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SUBJECT: Forwards fire protection review, Vols I & II.
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FPL
FLORIDA POWER & LIGHT COMPANY

July 1, 1982
L-82-266

Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555



Dear Mr. Eisenhut:

Re: Turkey Point Plant, Unit Nos. 3 and 4
Docket Nos. 50-250 and 50-251
Fire Protection Rule Submittal

The enclosed fire protection report for Turkey Point Plant, Unit Nos. 3 and 4, is submitted by Florida Power & Light Company (FPL) in response to the requirements set forth in 10 CFR Part 50.48, Appendix R to 10 CFR Part 50, and the exemption, including the associated letter, granted to FPL for the facility, dated May 10, 1982.

On November 19, 1980, the Commission published a revised 10 CFR Part 50.48 and a new Appendix R to 10 CFR Part 50 regarding the fire protection features of nuclear power plants (45 Fed. Reg. 76,602). In Appendix R, the Commission set forth fire protection features which it determined to be necessary to satisfy Criterion 3 of Appendix A to 10 CFR Part 50. Section 50.48(c) contained schedules for compliance with Appendix R requirements.

By letter dated March 19, 1981, FPL requested exemption from certain requirements of this Fire Protection Rule. In responding to that exemption request, the Commission provided, among other things, an extension of the date for submittal of plans, schedules and/or design descriptions for any modifications necessary to achieve compliance with, and/or request exemption from, certain sections of Appendix R. This submittal is being made pursuant to the terms of that exemption.

As you are aware, complex problems of interpretation and judgment are involved in achieving compliance with the Fire Protection Rule. Additional difficulties have also arisen as a result of the NRC's May 1982 advancement of the expected submittal date from November 9, 1982, to July 1, 1982. Nevertheless, the contents of this submittal represent a good faith effort to overcome those problems and difficulties. Necessarily, the report is based not only upon the language of the rule itself and the guidance documents issued by the NRC Staff, but also upon discussion with the Staff, including discussions with the Nuclear Utility Fire Protection Group during the period December 1981 to March 1982, and reflected in the Group's letter of March 16, 1982, to Richard H. Vollmer of the NRC.

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Except as set forth in connection with exemption requests, Turkey Point Plant, Unit Nos. 3 and 4, is in full compliance with the specific requirements of the Fire Protection Rule. In accordance with the Rule, requests in the enclosed document for exemptions from specific requirements are based on analyses indicating that physical plant modifications otherwise required under the specific provisions of the Rule would not enhance fire protection safety in the facility.

As provided in Commission regulations, requests for additional time for the completion of modifications are justified on the basis that exemption from the schedular requirements of the Rule are authorized by law and, for reasons detailed in the report itself, will not endanger life or property or the common defense and security, and are in the public interest. The schedules are based on current design and engineering studies and are believed to be reasonable. However, these schedules may be subject to revision as detailed design implementation progresses.

Further, an effort has been made to provide estimates of backfit costs and worker doses. The dose estimates, however, do not include standard ALARA practices. Shielding and out-of-area prefabrication techniques would likely reduce the quoted worker doses. Hence, dose estimates and backfit costs have not been refined to the point of employing ALARA/cost optimization techniques.

FPL is committed to a thorough and complete resolution of the fire protection issue. Accordingly, work is continuing and this submittal may be further refined and supplemented as a result. In any event, FPL stands ready to cooperate with the Staff to facilitate its review. If there are any questions, please let us know.

Respectfully submitted,

J. A. DeMastry
for

Robert E. Uhrig
Vice President
Advanced Systems & Technology

REU/JNB/rlb

Enclosure

cc: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

## 5.2.1 FIRE AREA 4, 5, 9 AND 10

### a.- AREA DESCRIPTION

Areas 4, 5, 9 and 10 consist of the Auxiliary Building main corridor at the 4' Elevation, the Chemical Drain Tank, Laundry, and Hot Shower Tank areas, and the Auxiliary Building main pipeway at Elevation 10'-0". Provided below is a brief description of these areas.

#### Fire Area 4

Area 4 is a hallway located in the Auxiliary Building at the 4' Elevation immediately outside the holdup tank rooms. This area does not contain any safe shutdown related components, but has safety related cable functions routed therein. Cables are located in trays and conduit exiting the trays at Elevation 14'-6" along the west wall of the area. A and B train cable trays are separated by a distance of approximately 1 foot. Non-shutdown related components in this area consist of the holdup tank recirculation pump and the three Gas Stripper Feed pumps located at the east end of the hallway. This area is accessible from the Auxiliary Building Pipeway and Area 5.

#### Fire Area 5

Area 5 located at the 4' Elevation contains miscellaneous components, e.g., Chemical Drain Tank, Laundry and Hot Shower Tanks, etc. (see Figure 5-1). This area does not contain any safe shutdown related components, but has safety related cable functions routed therein. Cables are located in trays and conduit exiting the trays at Elevations 13'-9" and 12'-9" along the north wall of the area. In addition, two Auxiliary Steam Condensate Pumps, the Laundry Tank Pump, and the Chemical Drain Tank Pump are located at the east side of the area. This area is accessible from the Main Auxiliary Building hallway, Area 58, via a stairway at the west side of Area 5.

#### Fire Area 9

Area 9 located at the 2' Elevation contains a floor drain sump, its associated pumps, and a waste evaporator feed pump. This area does not contain any safe shutdown related components, but has safety related cable functions therein. Cables are routed in trays and conduit exiting the trays at elevations 13'-9" and 12'-9" along the south wall of the area. This area is accessible from Fire Area 5.

#### Fire Area 10

Fire Area 10 is the Auxiliary Building main pipeway located at the 10'-0" Elevation. This is a locked gate high radiation area. There is no safe shutdown related equipment located within the fire area boundary, but safe shutdown related cables are routed through the area. All cable trays in this area are sprayed with Flamemastic 71A. This area is bounded by concrete walls, floor and ceiling. The area is accessible from three separate stairwells at Elevation 18'-0" in the main Auxiliary Building hallway (Fire Area 58); one stairwell from Unit 4's pipe and valve room (Fire Area 30); and one stairwell from Unit 3's pipe and valve room

(Fire Area 40). Cables routed through the area are located in trays or conduit exiting from the trays. Trays are at Elevations 11'-9" and 12'-9" rising to 13'-6" and 14'-6" respectively. A one foot separation is maintained between trays. Pertinent fire area details are provided below:

| | Area 4 | Area 5 |
|---|---|---|
| Floor Surface Area, | 595 $ft^2$ | 690 $ft^2$ |
| Wall and Ceiling Surface Area | 2650 $ft^2$ | 2870 $ft^2$ |
| Free Volume Excluding Components, | 6837 $ft^3$ | 7938 $ft^3$ |
| Ceiling Height, | 11'-6" | 11'-6" |
| Floor Composition,<br>Floor Thickness, | Concrete<br>2'-0" | Concrete<br>2'-0" |
| Wall Composition,<br>Wall Thickness, | Concrete<br>N 2'-6"<br>S, W, & E<br>1' to 1'-6" | Concrete<br>N 1' to 1'-6"<br>S 2'<br>E & W 1',<br>1'6" & 2'-6" |
| Ceiling Composition,<br>Ceiling Thickness, | Concrete<br>3'-6" | Concrete<br>3'-6" |
| Fire Detectors in Area,<br>Detector No./Type, | Yes<br>8-1, 8-2, 8-16/<br>Ionization | Yes<br>8-2, 8-3/<br>Ionization |
| Automatic Suppression,<br>Type of Automatic Supression | No<br>N/A | No<br>N/A |
| Installed Communications Near Fire Area, | Telephone<br>Handset T-335<br>Pax M-335 | Telephone<br>Handset T-335<br>Pax M-335 |
| Hose Station Available to Area, | #1 | #1 |
| Fire Extinguishers Immediately Available to Area, | 3.0.9, 3.4.3,<br>3.4.4, 3.4.5,<br>3.4.6 | 3.4.3, 3.4.4,<br>3.4.5, 3.4.6 |
| Number of Floor Drains | 1 | 2 |
| Drain(s) Size,<br>Drain(s) Flow To | 3"<br>Waste Holdup Room Sump | 3"<br>Waste Holdup Room Sump |

| | Area 4 | Area 5 |
|---|---|---|
| Normal Forced Draft Ventilation, | No | No |
| Normal Ventilation Flow Rate, | N/A | N/A |

| | Area 9 | Area 10 |
|---|---|---|
| Floor Surface Area, | 245 $ft^2$ | 3200 $ft^2$ |
| Wall and Ceiling Surface Area | 1460 $ft^2$ | 9300 $ft^2$ |
| Free Volume Excluding Components, | 3308 $ft^2$ | 19,200 $ft^3$ |
| Ceiling Height, | 13'-6" | 6' |
| Floor Composition, Floor Thickness, | Concrete 2'-0" | Concrete 18" |
| Wall Composition, Wall Thickness, | Concrete N 6" to 1' to 1'-6" S 1'-0" E 1'-0" W 1'-0" to 1'-6" | Concrete 12" |
| Ceiling Composition, Ceiling Thickness, | Concrete 3'-6" | Concrete 24" |
| Fire Detectors in Area, Detector No./Type, | Yes 8-4/ Ionization | Yes 8-15, 8-14, 8-13, 8-12, 8-11, 8-10, 8-9, 8-8, 8-7, 8-6, 8-5/ Ionization |
| Automatic Suppression, Type of Automatic Suppression | No N/A | No N/A |
| Installed Communications Near Fire Area, | Telephone Handset T-335 Pax M-335 | Telephone Handset T-335 Pax M-335 |
| Hose Station Available to Area, | #1 | #1 |
| Fire Extinguishers Immediately Available to Area, | 3.0.9, 3.4.3, 3.4.4, 3.4.5, 3.4.6 | 3.4.3, 3.4.4, 3.4.5, 3.4.6, 3.4.7 3.4.8, 3.4.10 |

| | Area 9 | Area 10 |
|---|---|---|
| Number of Floor Drains | Sump Pump | 10 |
| Drain(s) Size, | N/A | 3" |
| Drain(s) Flow To | Waste Holdup Room Sump | Waste Holdup Room Sump |
| Normal Forced Draft Ventilation, | No | Yes/Fan |
| Normal Ventilation Flow Rate, | N/A | 1000 CFM (Supply & Exhaust) |

Fire Area Penetrations: Area 4

| | |
|---|---|
| North-South Hallway | |
| East Wall | 5'x6' opening to Area 5 |
| South Wall | 5'x6' opening to Area 10 |

Fire Area Penetrations: Area 5

| | |
|---|---|
| Stairway Hall | |
| South Wall | 4'x6' opening to Area 10 |
| West Wall | 5'x6' opening to Area 4 |
| East End | 3'x6' doorway to Area 9 |
| Interior Walls | 2'-6" x 6' doorway to Area 6<br>2'-6" x 6' doorway to Area 7 |

Fire Area Penetrations: Area 9

| | |
|---|---|
| West Wall | 3'x6' doorway to Area 5 |

Fire Area Penetrations: Area 10

| | |
|---|---|
| East-West Hallway | |
| North Wall | 5'x 6' opening (West End) to Area 4<br>4'x 6' opening (West End) to Area 5<br>3'x 6' opening to Area 18 |
| North-South Hallway | |
| South End | 13' x 6' opening to Area 15<br>12' x 6' and 8'x 6' opening to Area 16<br>4'x 6' opening to Area 14 |
| North End | 12' x 6' and a 6' x 6' opening to Area 13<br>6' x 6' opening to Area 12 |

## b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

### 1. Safe Shutdown Equipment/Cables; For Area 4

#### Hot Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| BA Transfer Pump 3A | C |
| AFW Pump Steam Supply Valve S/G 3C MOV-3-1405 | P,C |
| CCW Rtn. Valve for Norm. Contain. Cool. 3-1418 | P,C |
| Emer. Contain. Cool. 3B | P |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |

#### Cold Shutdown Equipment/Cables

| Cables | Power (P),Control (C) |
|---|---|
| RWST Isolation Valve from RHR Header MOV-3-862B | P,C |
| RHR Inlet Isolation Valve from RCS MOV-3-750 | C |
| RHR Flow Control Valve HCV-3-758 | C |

#### Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P),Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3B SV-3-6275B | C |

### 2. Safe Shutdown Equipment/Cables; for Area 5

#### Hot Shutdown Equipment/Cables

| Cables | Power (P),Control (C) |
|---|---|
| BA Transfer Pump 3 A | C |
| AFW Pump Steam Supply Valve S/G 3C MOV-3-1405 | P,C |
| CCW Rtn. Valve for Norm. Contain. Cool. 3-1418 | P,C |

Cold Shutdown Equipment/Cables

| Cables | Power (P),Control (C) |
|---|---|
| RWST Isolation Valve from RHR Header MOV-3-862B | P,C |
| RHR Inlet Isolation Valve from RCS MOV-3-750 | C |
| RHR Flow Control Valve HCV-3-758 | C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3B SV-3-6275B | C |

3. Safe Shutdown Equipment/Cables; for Area 9

Hot Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| BA Transfer Pump 3A | C |
| AFW Pump Steam Supply Valve S/G 3C MOV-3-1405 | P,C |
| CCW Rtn. Valve for Norm. Contain. Cool. 3-1418 | P,C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| RWST Isolation Valve from RHR Header MOV-3-862B | P,C |
| RHR Inlet Isolation Valve from RCS MOV-3-750 | C |
| RHR Flow Control Valve HCV-3-758 | C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3B SV-3-6275B | C |

4. Safe Shutdown Equipment/Cables; For Area 10

Hot Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
| --- | --- |
| BA Transfer Pump 3A | C |
| AFW Pump Steam Supply Valve S/G 3C MOV-3-1405 | P,C |
| AFW Pump Steam Supply Valve S/G 4C MOV-4-1405 | P,C |
| Norm. Contain. Cool. | |
| 3B | C |
| 3C | C |
| 3D | P,C |
| 4A | P,C |
| 4B | C |
| Emer. Contain. Cool. | |
| 3B | P |
| 4A | P |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
| --- | --- |
| RHR Ht. Exch. Valve Cooling Water Isolation MOV-4-749A | P,C |
| RHR Ht. Exch. Valve Cooling Water Isolation MOV-4-749B | P,C |
| RWST Isolation Valve from RHR Header MOV-3-862A | P,C |
| RWST Isolation Valve from RHR Header MOV-3-862B | P,C |
| RWST Isolation Valve from RHR Header MOV-4-862A | P,C |
| RWST Isolation Valve from RHR Header MOV-4-862B | P,C |
| RCS Inlet Isolation Valve from RHR MOV-4-744A | C |
| RHR Inlet Isolation Valve from RCS MOV-4-750 | C |

| Cables | Power (P), Control (C) |
|---|---|
| RHR Inlet Isolation Valve from RCS MOV-3-750 | C |
| RHR Inlet Isolation Valve from RCS MOV-3-751 | C |
| RHR Inlet Isolation Valve from RCS MOV-4-751 | C |
| Accumulator Stop Valve MOV-4-865A | C |
| RWST Isolation Valve from RHR Header MOV-4-863A | P |
| RWST Isolation Valve from RHR Header MOV-4-863B | P,C |
| RHR Flow Control Valve HCV-3-758 | C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3B SV-3-6275B | C |
| Blowdown Isolation Valve S/G 4B MOV-4-1411 | P,C |
| High Contain. Pressure | |
| PS-4-2007 | C |
| PS-4-2009 | C |
| High-High Contain. Pressure | |
| PS-4-2056 | C |
| PS-4-2057 | C |
| PORV Block Valve 4-536 | C |

5. Nuclear Safety Evaluation

As indicated by the preceding safe shutdown equipment and cable listing, Areas 4, 5, 9 and 10 contain A and B safe shutdown related cables. Cables routed through these areas are located in trays, or conduit exiting from the trays. Separation of redundant cable trays is complicated by the relatively short distance between trays and congestion due to the existing piping in the area. Based on the anticipated difficulties to be encountered in providing separation of

A and B safe shutdown related cable trays, a concept of total cable protection was deemed to be the most viable approach for ensuring the capability to achieve and maintain hot/cold shutdown conditions. The fire hazards analysis and evaluation contained herein quantifies the level of protection to be provided by a combination of Flamemastic coatings on cables, baffles beneath cable trays, and the use of a thermal insulating material to protect conduit.

## c. FIRE HAZARDS ANALYSIS

### 1. Fire Area Combustibles

The potential combustibles inventory for Areas 4, 5, and 9 consists primarily of the oil and grease associated with the various pumps and valves located in these areas. This lubricating oil and grease is contained within the steel structure of the respective equipment, is limited to small quantities, and would not be expected to contribute to the design basis fires postulated in the fire hazards analysis. Other potential combustibles sources in Areas 4, 5, 9 and 10 consist of the numerous cables routed in cable trays throughout the areas. (Please note that Area 10 contains cable trays only.) All cable trays are sprayed with Flamemastic and can only be considered a combustible if exposure fires of sufficient intensity are postulated such that auto ignition or piloted ignition of the cables occurs. As previously mentioned, Area 10 contains only cable trays and is a locked gate high radiation area with controlled access. For these reasons, design basis fire calculations were not conducted for Area 10.

With regard to Areas 4, 5, and 9, three transient combustibles were considered in the analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at Turkey Point Plants. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Areas 4, 5, and 9, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when the plant is in all operating modes. In addition, these liquids will be transported only in approved safety containers. The transient combustibles control program will allow no flammable or combustible liquids in the Auxiliary Building main pipeway El. 10'-0" (Fire Area 10).

2. Design Basis Fire Calculations

These fire areas are considered to be a single fire sector. Fire Sector L is located in the laundry tank room and sump pump area in the Reactor Auxiliary Building on the 4'-0" level. It is bounded on the south by the Units #3 and #4 waste gas compressor rooms on the east by the Waste Holdup Tank Room, on the north by the Boric Acid Holdup Tank Room, and on the west by the stairwell connecting the 4'-0" and the 18'-0" levels. (Ref. Turkey Point Nuclear Plant Units 3 and 4 Drawings: 5610-E-66, Rev. 8, dated September 4, 1981 and 5610-E-67, Rev. 7, dated January 17, 1972). Fire Sector L can accommodate an effective spill diameter of 6 feet.

Fires involving three different fuels are postulated in this sector: acetone, lubricating oil, and heptane. In considering the effects of such fires, two levels of passive protection are considered.

The first involves only that protection which is associated with the existing separation and use of flame retardant coatings. The second adds the protection afforded by baffles and radiant energy shields to the existing level of protection. Assuming these protective measures, a "back" calculation analysis is utilized. A "back" calculation is directed towards determining the minimum quantities of the three fuels which, if ignited, may exceed the damage criterion of the most limiting cable.

The results of the "back" calculation are presented in Tables 5.2.1 and 5.2.2. In terms of piloted ignition of a cable, the results indicate that the most limiting fuel quantity involves the combustion of 6.5 gallons of lubricating oil in Fire Sector L. This fire size and location is considered to be the fire area's design basis fire. Since areas below the 18 ft. level are radiation areas, routine access is restricted by health physics requirements. This factor must be considered as a supplemental protective measure for fire protection as well. It is, therefore, considered unlikely that an exposure fire involving transient combustibles would occur in these areas, much less one involving the quantities indicated by this analysis.

Based on these considerations, it is concluded that the proposed modifications will adequately protect the cables from the effects of exposure fires and that further modifications to comply with the specific provisions of Appendix R would not enhance fire protection safety.

TABLE 5.2.1. FIRE SECTOR L, EXISTING CONFIGURATION

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | ($kW/m^2$) | ($BTU/Hr{\cdot}ft^2$) |
| Jacket Degradation | Acetone | 2.6 | 55.7 | 17660.0 |
| | Lubricating Oil | 2.5 | 58.3 | 18484.4 |
| | Heptane | 4.8 | 63.2 | 20037.9 |
| Piloted Ignition | Acetone | 3.4 | 55.7 | 17660.0 |
| | Lubricating Oil | 3.2 | 58.3 | 18484.4 |
| | Heptane | 6.1 | 63.2 | 20037.9 |
| Electrical Failure | Acetone | 11.2 | 55.7 | 17660.0 |
| | Lubricating Oil | 10.7 | 58.3 | 18484.4 |
| | Heptane | 17.0 | 104.9 | 33275.0 |
| Auto Ignition | | Not Achieved | | |

## TABLE 5.2.2. FIRE SECTOR L, PROPOSED CONFIGURATION

| Damage Criterion | Fuel: Type | Fuel: Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux ($kW/m^2$) | Maximum Heat Flux ($BTU/Hr \cdot ft^2$) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 6.0 | 36.0 | 11407.7 |
| | Lubricating Oil | 5.5 | 57.3 | 18173.6 |
| | Heptane | 7.5 | 83.8 | 26578.8 |
| Piloted Ignition | Acetone | 7.0 | 36.0 | 11407.7 |
| | Lubricating Oil | 6.5 | 59.4 | 18820.4 |
| | Heptane | 8.5 | 93.8 | 29749.4 |
| Electrical Failure | Acetone | 19.5 | 36.0 | 11407.7 |
| | Lubricating Oil | 13.5 | 59.4 | 18820.4 |
| | Heptane | 17.0 | 104.9 | 33275.0 |
| Auto Ignition | | Not Achieved | | |

## 3. Fire Hazards Evaluation

The fire area hazards evaluation was separated into four categories, viz., fire area structural ratings evaluations, fire area adjacent effects evaluations, available fire suppression capabilities determination, and a fire area summary.

Fire Area Structural Ratings Evaluation Data for Areas 4, 5, 9, and 10 Is As Follows:

Area boundary structural fire rating estimates based on standardized curves for solid concrete walls (See Section 5.2 for details);

| | Area 4 | Area 5 |
|---|---|---|
| Walls | 4 | 4 |
| Floor | 4 | 4 |
| Ceiling | 4 | 4 |

| | Area 9 | Area 10 |
|---|---|---|
| Walls | 4 | 4 |
| Floor | 4 | 4 |
| Ceiling | 4 | 4 |

Fire area structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to or from adjacent areas, hot gas radiation, or burning liquid spread. No fire spread hazard was found to exist. There are no significant ignition sources near these penetrations. Any burning liquid entering the drain system would not be expected to have an effect on adjacent areas. In spite of this evaluation, FPL proposes to upgrade the perimeter walls of combined Areas 4, 5, 9, and 10 to 3 hour fire rated barriers.

Available Fire Suppression Capabilities Determination

Area 4

Fire Area 4 is accessible from the Auxiliary Building Pipeway and Area 5. Hose Station 1 is available for fighting a fire in this area in addition to portable extinguishers 3.0.9, 3.4.3, 3.4.4, 3.4.5 and 3.4.6.

Area 5

Fire Area 5 is accessible from the Auxiliary Building Pipeway (Area 10) and Hallway (Area 58). Hose Station 1 is available for fighting a fire in this area in addition to portable extinguishers 3.4.3, 3.4.4, 3.4.5, and 3.4.6.

Area 9

Fire Area 9 is accessible through Fire Area 5. Hose Station 1 is available for fighting a fire in this area in addition to portable extinguishers 3.0.9, 3.4.3, 3.4.4, 3.4.5, and 3.4.6.

Area 10

Fire Area 10 is accessible from the Auxiliary Building Hallway (Area 58). Fire Hose Stations 1 and 3 are available for fighting a fire in this area, as well as portable extinguishers 3.4.3, 3.4.4, 3.4.5, 3.4.6, 3.4.8, 3.4.10, and 3.0.9. Areas 4, 5, 9 and 10 fire suppression equipment ratings are as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.0.9 | 10 A:40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.3 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.4.4 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.4.5 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.4.6 | 4 A:40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.8 | 12 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.4.10 | 10 A:40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| HS-1 | 100 GPM @ 50% Eff. | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-3 | 100 GPM @ 50% Eff. | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

| | Area 4 | Area 5 | Area 9 | Area 10 |
|---|---|---|---|---|
| Available fire-suppression heat removal rate | 420,000 $\frac{Btu}{min}$ | 420,000 $\frac{Btu}{min}$ | 420,000 $\frac{Btu}{min}$ | 420,000 $\frac{Btu}{min}$ |
| Total type "B" Capability available | 275 $ft^2$ | 175 $ft^2$ | 275 $ft^2$ | 400 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment cables in Areas 4, 5, and 9. Areas 4, 5, 9 and 10 do not contain any safe shutdown equipment. Fire Area 10 is a locked high radiation area and thus the probability of a fire is low. FPL proposes to provide baffles on cable trays routed through Areas 4, 5, and 9 to protect the trays from potential fires. Although no credit is given for existing fire detection and suppression equipment, the potential for a large fire in this area is considered acceptably small. Thus based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Protect all electrical cable trays located in Areas 4, 5, and 9 by installation of fire resistant baffles under these trays. Baffles are to span the width of the lowest cable tray in a stack and are to be located within 4 inches of the bottom of the lowest tray. These baffles will be constructed of 1/2 inch thick marinite or equivalent. See Appendix D.

2. Protect one train of conduit in Areas 4, 5, and 9 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

3. Upgrade perimeter walls for combined Areas 4, 5, 9 & 10 to 3 hour barriers by sealing all piping and other penetrations and by installing 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. See Appendix D.

e. EXEMPTION REQUEST

FPL requests exemption for Areas 4, 5, 9 and 10 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50*. Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with these areas supplemented by the specific modifications identified, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications, coupled with a strict combustible control program based on Appendix C of this report, provide reasonable assurance that the safe

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*Specifically, FPL requests exemption from those provisions that require the separation of redundant safe shutdown related cables by a 1 hour fire rated barrier, and the installation of an automatic fire suppression system for these areas.

shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Areas 4, 5, 9 and 10 based on implementation of the specific requirements of subsection (c), is estimated to be $1,177,460 versus the cost for the proposed modifications of $14,000. In addition, the estimated man-rem exposure for full implementation is 2,170 man-rem as opposed to 23 man-rem for the proposed modifications.

f. <u>SCHEDULE EXEMPTION</u>

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are three types of backfit activities necessary to support our exemption requests which do not require a unit outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There is one type of backfit activity necessary to support our exemption request which requires an outage on both Units #3 and #4 because construction work is required on the ventilation system and modifications will impact equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) or Fall 1983 refueling outage and that NRC approval of this exemption request is required prior to November 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G. of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1) There are two types of backfit activities necessary to implement the III.G.2 criteria which do not require a unit outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2) There is one type of backfit activity necessary to implement III.G.2 criteria which requires an outage on both Units #3 and #4 because the modifications may require cutting and welding of the Fire System water supply piping. This activity would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) or Fall 1983 refueling outage and that NRC approval of this exemption request is required prior to June 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.2 FIRE AREA 11, 12, AND 13

### a. AREA DESCRIPTION

Fire Areas 11, 12, and 13 consist of the Unit 3 residual heat removal (RHR) pump and heat exchanger areas located in the Auxiliary Building at elevation - 4'-6". (See figure 5-1). Provided below is a brief description of these areas:

**Fire Areas 12 and 13**

Areas 12 and 13 are the 3A and 3B RHR Pump Rooms. Each area is bounded by three concrete walls, floor, and ceiling, and is separated by a common 16' high reinforced concrete part height wall. In addition, a checker plate steel decking provides a walkway over each pump at elevation +10'. Both areas are accessible from the Auxiliary Building pipeway at elevation 10'-0" via stairways on the east side of each area. Fire Area 12 houses the RHR Pump 3A and associated valves and instrumentation. Safe shutdown related motor operated valve MOV-3-862B is located at elevation 0'-3" at the east end of the area. Non-shutdown related equipment consist of duplex sump pumps 25A and 25B located in the southwest corner of this area. Fire Area 13 houses the RHR pump 3B and associated valves and instrumentation. A safe shutdown related motor operated valve MOV-3-862A is located at elevation 2'-9" by the south wall of the area. Other equipment in the area consists of the duplex sump pumps 26A and 26B.

The RHR pumps are separated by an approximate distance of 12'-6" (center to center) not taking into consideration the intervening part height wall.

**Fire Area 11**

Area 11 is the RHR heat exchanger area located at the north end of the Auxiliary Building adjacent to the RHR Pump Rooms. It houses the 3A and 3B RHR heat exchangers and associated valves and piping. These heat exchangers are separated by a distance of 5'-6" center to center. Safe shutdown related motor operated valves consist of MOV-3-863A and B located at the east end of the area, approximately 5 feet apart and RHR flow control valve HCV-3-758 is also located in this area. In addition, safe shutdown related cables are routed in conduit through this area. Other equipment in the area consists of the duplex sump pumps 24A and 24B. This area is accessible from the Auxiliary Building pipeway at elevation 10'-0" via a stairway at the east end of the area.

Pertinent fire area details are provided below:

| | Area 11 | Area 12 | Area 13 |
|---|---|---|---|
| Floor Surface Area, | 410 $ft^2$ | 275 $ft^2$ | 275 $ft^2$ |
| Wall and Ceiling Surface Area, | 3777 $ft^2$ | 1187 $ft^2$ | 1187 $ft^2$ |

| | Area 11 | Area 12 | Area 13 |
|---|---|---|---|
| Free Volume Excluding Components, | 14485 $ft^3$ | 3713 $ft^3$ | 3713 $ft^3$ |
| Ceiling Height, | 36'-6" | 20'-9" | 20'-9" |
| Floor Composition, | Concrete | Concrete | Concrete |
| Floor Thickness, | 2' | 2' | 2' |
| Wall Composition, | Concrete | Concrete | Concrete |
| Wall Thickness, | 2' | 2' | 2' |
| Ceiling Composition, | Concrete | Metal Decking at 10' Elev. Concrete at 18' Elev. | Metal Decking at 10' Elev. Concrete at 18' Elev. |
| Ceiling Thickness, | 18 in | 1'-9" thick | 1'-9" thick |
| Fire Detectors in Area, | No | No | No |
| Detector No./Type, | N/A | N/A | N/A |
| Automatic Suppression, | No | No | No |
| Type of Automatic Suppression, | N/A | N/A | N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T-318A | Telephone Handset X-325 | Telephone Handset T-318A X-325 |
| Hose Station Available to Area, | #3 | #3 | #3 |
| Fire Extinguishers Immediately Available to Area, | 3.4.8<br>3.4.7<br>3.4.10 | 3.4.8<br>3.4.7<br>3.4.10 | 3.4.8<br>3.4.7<br>3.4.10 |
| Number of Floor Drains, | Duplex Sump Pump | Duplex Sump Pump | Duplex Sump Pump |
| Drain(s) Size, | N/A | N/A | N/A |
| Pump(s) Flow To, | Waste Holdup Tank | Waste Holdup Tank | Waste Holdup Tank |
| Normal Forced Draft Ventilation, Normal Ventilation Flow Rate, | Yes/Fan 1045 cfm (exhaust) | Yes/Fan 150 cfm (supply & exhaust) | Yes/Fan 150 cfm (supply & exhaust) |

Fire Area Penetrations: Area 11

| | |
|---|---|
| South Wall | 2 - 2" holes at floor level |
| | 5' x 8' stairway opening (approx. 14½' above the floor) which leads to Area 13 |
| North Wall | 2 - 6" pipes through 2 -8" pipe sleeves at the roof line |

Fire Area Penetrations: Area 12

| | |
|---|---|
| Ceiling | 2' x 5' stairway opening to Area 10 |
| North Wall | 1 - 2" hole at floor level |
| South Wall | 5' x 6' opening (approx. 14½' above the floor) to Area 10 |
| East Wall | Part height wall connecting to Area 13. 16' height 22' length |

Fire Area Penetrations: Area 13

| | |
|---|---|
| Ceiling | 2' x 5' stairway opening to Area 10 |
| North Wall | 1 - 2" hole at floor level |
| East Wall | 7' x 6' opening (approx. 14½' above the floor) to Area 10 |
| South Wall | 12' x 6' opening (approx. 14½' above the floor) to Area 10 |
| West Wall | Part height wall connecting to Area 12. 16' height 22' length |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables; for Area 11

Hot Shutdown Equipment/Cables

| Cables | Power (P),Control (C) |
|---|---|
| BA Transfer Pumps | |
| 3A | P,C |
| 3B | C |
| 4B | P,C |

Cold Shutdown Equipment/Cables

Equipment

RHR Flow Control Valve
HCV-3-758

RWST Isolation Valve from RHR
Header MOV-3-863A

RWST Isolation Valve from RHR
Header MOV-3-863B

| Cables | Power (P), Control (C) |
|---|---|
| RHR Flow Control Valve HCV-3-758 | C |
| RWST Isolation Valve from RHR Header MOV-3-863A | P |
| RWST Isolation Valve from RHR Header MOV-3-863B | P,C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| BA Transfer Pump Flow Control Valve HCV-105 | C |

2. Safe Shutdown Equipment/Cables; for Area 12

Hot Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| BA Transfer Pump 3A | P,C |

Cold Shutdown Equipment/Cables

Equipment

RHR Pump 3A

RWST Isolation Valve from RHR
Header MOV-3-862B

| Cables | Power (P),Control (C) |
|---|---|
| RHR Pump 3A | P,C |
| RWST Isolation Valve from RHR Header MOV-3-862B | P,C |
| RHR Inlet Isolation Valve from RCS MOV-3-751 | C |

3. Safe Shutdown Equipment/Cables; for Area 13

Cold Shutdown Equipment/Cables

Equipment

RHR Pump 3B

RWST Isolation Valve from RHR Header MOV-3-862A

| Cables | Power (P),Control (C) |
|---|---|
| RHR Pump 3A | P,C |
| RHR Pump 3B | P |
| RWST Isolation Valve from RHR Header MOV-3-862A | P,C |
| RHR Inlet Isolation Valve from RCS MOV-3-750 | C |
| RHR Flow Control Valve HCV-3-758 | C |
| RWST Stop Valve to RHR Header MOV-3-863A | P |

4. Nuclear Safety Evaluation

As indicated in the preceding equipment/cable list, the equipment located in Fire Areas 11, 12, and 13 is not required for hot shutdown. Per Section 3.3 of this report, only one residual heat removal (RHR) pump and heat exchanger per unit is required to maintain cold shutdown conditions. Therefore, the loss of one RHR pump and heat exchanger due to fire would not impact achieving cold shutdown. Refueling water storage tank (RWST)/RHR pump suction header isolation valves, MOV-3-862A and MOV-3-862B, provide a redundant isolation function, thus the loss of one valve would not impact achieving cold shutdown. Based on this evaluation, the fire hazards

analysis contained herein must provide assurance that a design basis fire in Area 12 or 13 will not render the redundant equipment in the adjacent fire area inoperable.

Area 11 contains valves MOV-3-863A and MOV-3-863B which are RWST/RHR pump discharge header isolation valves and RHR flow control valve HCV-3-758. Valves MOV-3-863A and MOV-3-863B are in parallel and have no redundant counterpart for isolation. Also, there is no redundant flow path around valve HCV-3-758. Based on this evaluation, the fire hazards analysis contained herein must provide assurance that valves MOV-3-863A, MOV-3-863B, and HCV-3-758 and their associated cables will remain functional in the event of a design basis fire in Area 11, or protection of these valves and their associated cables must be provided.

In addition to the equipment and its associated cables located in Areas 12 and 13, a number of other safe shutdown related cables routed in conduit through these areas must also be evaluated or protected. The required cable functions are listed below:

Fire Area 12 - Cables to be protected.

| | |
|---|---|
| MOV-3-751 | RHR Inlet from RCS Isolation Valve |
| BA Transfer Pump 3A | |

Fire Area 13 - Cables to be protected.

| | |
|---|---|
| MOV-3-750 | RHR Inlet from RCS Isolation Valve |
| HCV-3-758 | RHR Flow Control Valve |
| MOV-3-863A | RWST/RHR Isolation Valve from RHR Header |
| RHR Pump 3A | |

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The combustibles inventory for Areas 11, 12, and 13 consists primarily of the oil and grease associated with the various pumps and motor operated valves located in the areas. There is approximately two pounds of grease per motor operator for each of the motor operators in each area and one gallon of oil per residual heat removal pump. These combustibles are contained within the respective equipment, and are of insignificant quantities when compared to the transient combustibles assumed in the following fire hazards analysis.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plants. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels are modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Areas 11, 12, and 13, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 3 is in all operating modes except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

The design basis fire calculations for Area 11 consist of design basis fire heat release rate calculations, burn duration calculations, and effective spill area calculations. Three transient combustibles were considered in the analysis. These combustibles are acetone (5 gal.), heptane (5 gal.), and lubricating oil (10 gal.). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential impact on essential cold shutdown equipment/cables in the area (refer to Nuclear Safety Evaluation for specific equipment to be evaluated). The results of the design basis fire calculations are provided below: (Appendix A of this report provides a detailed discussion and development of the design basis fire methodology.)

Area 11

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$) | 251.5 | 251.5 | 251.5 |
| Design Basis Fire Heat Release Rate ($\frac{Btu}{Min}$) | $1.2 \times 10^6$ | $3.6 \times 10^6$ | $2.1 \times 10^6$ |
| Design Basis Fire Burn Duration (sec) | 15.9 | 7.9 | 31.8 |

The RHR flow control valve HCV-3-758 is located at elevation 12'-0". The RWST/RHR pump discharge header isolation valves MOV-3-863A and MOV-3-863B are located at elevation - 3'-0". At their closest point, the three essential valves are separated by a horizontal distance of approximately 5 feet. Based on the design basis fire effective spill areas and heat release rates it is evident that a single fire could potentially damage all three valves and their associated cables. In order to protect these valves, FPL proposes to provide an enclosure or thermal barrier constructed of ½" thick marinite or equivalent around the valve operators. In addition, the associated cables will be protected by utilizing a thermal insulating material to provide the equivalent protection of a one hour fire rated barrier. These modifications are deemed to provide an adequate level of protection from the design basis fires postulated herein.

As indicated in the Area Description, the part height wall between Areas 12 and 13 leaves a relatively large opening between these two fire areas. Therefore, a fire in either area would cause hot gases to enter into the other fire area. The design basis fire calculations for Areas 12 and 13 encompass three major categories, namely design basis fire heat release rate calculations, burn duration calculations, and effective heat flux calculations. The calculated values for heat flux provided herein are the average values to be expected for an RHR pump or valve operator should a design basis fire exist in the adjacent RHR Pump Room. Three transient combustibles were considered in the analysis. These combustibles are acetone (5 gal.), heptane (5 gal.), and lubricating oil (10 gal.). Each combustible was situated in the compartment so as to maximize its energy release rate and the most severe ventilation case was considered for each combustible, i.e., no ventilation available. The results of the design basis fire calculations are provided below: (Appendix A of this report provides a detailed discussion and development of the design basis fire methodology.)

<u>Area 12 & 13</u>

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Heat Release Rate ($\frac{Btu}{Min}$) | $1.28 \times 10^6$ | $3.74 \times 10^6$ | $2.11 \times 10^6$ |
| Burn Duration (sec) | 16 | 8 | 31 |

Postulating any of the above fires in Area 12 will yield the following expected values of heat flux for the RHR Pump 3B and MOV-3-862A:

Area 13

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Calculated Heat Flux at the RHR Pump 3B $(\frac{Kw}{m^2})$ | 4.7 | 4.7 | 8.5 |
| Calculated Heat Flux at the MOV-3-862A $(\frac{Kw}{m^2})$ | 10.1 | 10.1 | 18.1 |

These results are applicable to the RHR Pump 3A should the design basis fire be postulated in Area 13. However the following are expected values of heat flux for the MOV-3-862B:

Area 12

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Calculated Heat Flux at the MOV-3-862B $(\frac{Kw}{m^2})$ | 7.1 | 7.2 | 12.8 |

The average calculated heat flux values are relatively low, are based on the assumption that all normal ventilation flow has tripped, and would not be expected to result in excessive equipment temperatures. For the case where ventilation is available, the ventilation flow path forces supply air into the RHR pump cubicles and exhausts it; hence the combustion product gases would be directed away from the pumps and out of the area which would result in only a nominal equipment temperature increase inside the RHR Pump Room. Since no credit is taken for ventilation, and the average calculated heat flux for MOV-3-862A exceeds the critical heat flux for coated cables, some additional level of protection is deemed necessary. FPL proposes to provide an enclosure or thermal barrier constructed of ½" thick marinite around the motor operator of this valve. In addition, its associated cables will be sprayed with a thermal insulating material to provide the equivalent of 1 hour rated barrier protection. Likewise, FPL proposes to provide 1 hour rated barrier protection for safe shutdown related cables routed through Areas 12 and 13 as identified by the Nuclear Safety Evaluation.

## 3. Fire Hazards Evaluation

The fire area hazards evaluation was separated into four categories, viz., fire area structural ratings evaluations, fire area adjacent effects evaluations, available fire suppression capabilities determination, and a fire area summary.

Fire Area Structural Ratings Evaluation Data For Areas 11, 12, And 13 Is As Follows:

Area boundary structural fire rating estimates based on standarized curves for solid concrete walls (See Section 5.2 for details);

| | Area 11 | Area 12 | Area 13 |
|---|---|---|---|
| Walls | 4 | 4 | 4 |
| Floor | 4 | 4 | 4 |
| Ceiling | 4 | 4 | 4 |

Fire Area structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to adjacent areas, hot gas radiation, or burning liquid spread. No fire spread hazard was found to exist. There are no significant ignition sources near these penetrations. Any burning liquid entering the drain system would not be expected to have an effect on adjacent areas. In spite of this determination FPL proposes upgrading the perimeter walls, floors, and ceiling for Fire Areas 11, 12, and 13 by sealing all piping penetrations and installation of 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. In addition, FPL proposes to upgrade the part-height walls separating these areas by sealing all piping penetrations.

Available Fire Suppression Capabilities Determination

Fire Areas 11, 12, and 13 are accessible from the Auxiliary Building pipeway, Area 10. Fire hose station 3 is available for fighting a fire in these areas, as well as portable extinguishers 3.4.7, 3.4.8, and 3.4.10. Area fire suppression equipment ratings are as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.4.7 | 4A:40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.8 | 12 BC | Minimal | 25 $ft^2$ | Acceptable |

| | | | | |
|---|---|---|---|---|
| 3.4.10 | 10A:40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| HS-3 | 100 GPM @ 50% Eff | 420,000 Btu/min | | "E" Rated Nozzle |

| | |
|---|---|
| Available fire suppression heat removal rate (One hose station @ 50% Eff) | 420,000 Btu/min |
| Total Type "B" Capability available | 225 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards' analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables in Area 11. FPL proposes to provide an enclosure or thermal barrier (½" thick marinite or equivalent) to protect the valve operators in Area 11, and to protect their associated cables by utilizing a thermal insulating material. The design basis fire calculations for Areas 12 and 13 demonstrate that the relatively low effective heat fluxes resulting from postulated fires would not be expected to result in redundant equipment damage. In spite of this, FPL proposes to protect MOV-3-862A and essential shutdown equipment cables in these areas in a similar manner. Fire spread from adjacent areas is prevented by upgrading the perimeter walls and ceiling. In addition, by sealing all piping penetrations in the part-height walls separating these areas, the possibility of redundant RHR pumps being enveloped by a single fire is removed. Although no credit is given for existing fire fighting equipment available in the area, the potential for a large fire in this area is considered acceptably small. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Upgrade perimeter walls, floors, and ceiling for combined Areas 11, 12, and 13 to 3 hour rated barriers by sealing all piping and other penetrations and installation of 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. See Appendix D.

2. Upgrade part height wall separating Areas 11 and 13, 12 and 13, and upgrade full height wall separating Areas 11 and 12 by sealing all piping and other penetrations in the existing walls. See Appendix D.

3. Provide a fire barrier or enclosure of non-combustible material, ½" thick marinite, or equivalent around valve operators for

valves HCV-3-758, MOV-3-863A, MOV-3-863B, and MOV-3-862A.

4. Provide the equivalent of a 1 hour rated barrier for the electrical conduit associated with valves HCV-3-758, MOV-3-863A, MOV-3-863B, and MOV-3-862A by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

5. Protect one train of conduit in Areas 11, 12, and 13 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

e. <u>EXEMPTION REQUEST</u>

FPL requests exemption for Areas 11, 12, and 13 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50*. Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with these areas supplemented by the specific modifications identified, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications coupled with a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Areas 11, 12, and 13 based on implementation of the specific requirements of a combination of subsections (a) and (c), is estimated to be $609,003 versus the cost for the proposed modifications of $233,250. In addition, the estimated man-rem exposure for full implementation is 1383 man-rem as opposed to 582 man-rem for the proposed modifications.

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*Specifically, FPL requests exemption from the total enclosure of one RHR Pump Room by 3 hour rated fire barriers and protection of essential equipment conduit located in each RHR Pump Room by 3 hour rated barriers. In addition, FPL requests exemption from the installation of 1 hour rated fire barriers in the RHR Heat Exchanger Room for the protection of the valve operators of HCV-3-758, MOV-3-863A, and MOV-3-863B, and the installation of a fire detection and automatic suppression system for this area.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are four types of backfit activities necessary to support our exemption requests which do not require a Unit #3 outage. FPL requests extension from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There is one type of backfit activity necessary to support our exemption request which requires a Unit #3 outage because construction work is required on the ventilation system and modifications will impact equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Fall 1983 refueling outage and that NRC approval of this exemption request is required prior to April 1, 1984 in order to assure installation during the Spring 1985 refueling outage.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G. of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1) There are four types of backfit activities necessary to implement the III.G.2 criteria which do not require a Unit #3 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2) There are two types of backfit activities necessary to implement III.G.2 criteria which requires a Unit #3 outage because the modifications may require cutting and welding of the Fire System water supply piping and the Ventilation System. These activities would render the Fire and Ventilation Systems inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical

Specifications. Consistent with the Section 5.2.19 schedules for these modifications, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities is not possible during the Fall 1983 refueling outage and that NRC action is required prior to November 1, 1983 in order to assure installation during the Spring 1985 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.3 FIRE AREAS 14, 15 and 16

### a. AREA DESCRIPTION

Fire Areas 14, 15, and 16 consist of the Unit 4 residual heat removal (RHR) pump areas and the RHR heat exchanger area located in the Auxiliary Building at elevation - 4'-6". (see fig. 5-1). Provided below is a brief description of these areas.

#### Fire Areas 15 and 16

Areas 15 and 16 are the 4A and 4B RHR pump rooms. Each area is bounded by three concrete walls, a concrete floor, and a concrete ceiling and is separated by a common 16' high reinforced concrete part height wall. In addition, checker plate steel decking provides a walkway over each pump at elevation + 10'-0". Both areas are accessible from the Auxiliary Building pipeway at the 10' elevation via stairways on the east side of each area. Fire Area 15 houses RHR pump 4A and its associated valves and instrumentation. Safe shutdown related motor operated valve MOV-4-862B is located at elevation 0' at the east end of the area. Non-shutdown related equipment consists of duplex sump pumps 25A and B located in the northeast corner of this area. Fire Area 16 houses the RHR pump 4B and its associated valves and instrumentation. Safe shutdown related motor operated valve MOV-4-862A is located at elevation 2'-9" by the north wall of the area. Other equipment in the area consists of duplex sump pumps 26A and B.

The RHR pumps are approximately 12'-6" apart (center to center) and are separated by a part height concrete wall.

#### Fire Area 14

Area 14 is the RHR heat exchanger area located at the south end of the Auxiliary Building, adjacent to the RHR pump rooms. It houses the 4A and 4B RHR heat exchangers and associated valves and piping. These heat exchangers are separated by a distance of 5'-6" center to center. Safe shutdown related valves consist of MOV-4-863A and B located in the east end of the area, approximately 5'-0" apart and RHR flow control valve HCV-4-758 is also located in this area. In addition safe shutdown related cables are routed in conduit through this area. Other equipment in the area consists of duplex sump pumps 24A and B. This area is accessible from the Auxiliary Building pipeway at elevation 10'-0" via a stairway at the east end of the area.

Pertinent fire area details are provided below:

| | Area 14 | Area 15 | Area 16 |
|---|---|---|---|
| Floor Surface Area, | 410 $ft^2$ | 275 $ft^2$ | 275 $ft^2$ |
| Wall and Ceiling Surface Area, | 3777 $ft^2$ | 1186.5 $ft^2$ | 1186.5 $ft^2$ |

| | Area 14 | Area 15 | Area 16 |
|---|---|---|---|
| Free Volume Excluding Components, | 14485 $ft^3$ | 3712 $ft^3$ | 3712 $ft^3$ |
| Ceiling Height, | 36' - 6" | 20' - 9" | 20' - 9" |
| Floor Composition, | Concrete | Concrete | Concrete |
| Floor Thickness, | 2' | 2' | 2' |
| Wall Composition, | Concrete | Concrete | Concrete |
| Wall Thickness, | 2' | 2' | 2' |
| Ceiling Composition, | Concrete | Metal Decking at 10' elev. Concrete at 18' elev. | Metal Decking at 10' elev. Concrete at 18' elev. |
| Ceiling Thickness, | 18" | 1' - 9" thick | 1' - 9" thick |
| Fire Detectors in Area, | No | No | No |
| Detector No./Type, | N/A | N/A | N/A |
| Automatic Suppression, | No | No | No |
| Type of Automatic Suppression, | N/A | N/A | N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T-418A | Telephone Handset T-418B | Telephone Handset T-418A |
| Hose Station Available to Area, | #2 | #2 | #2 |
| Fire Extinguishers Immediately Available to Area, | 3.4.10<br>3.4.7<br>3.4.8 | 3.4.10<br>3.4.7<br>3.4.8 | 3.4.10<br>3.4.7<br>3.4.8 |
| Number of Floor Drains, | Duplex Sump Pump | Duplex Sump Pump | Duplex Sump Pump |
| Drain(s) Size, | N/A | N/A | N/A |
| Pump(s) Flow To, | Waste Holdup Tank | Waste Holdup Tank | Waste Holdup Tank |
| Normal Forced Draft Ventilation, | Yes/Fan | Yes/Fan | Yes/Fan |
| Normal Ventilation Flow Rate, | 1045 cfm (exhaust) | 150 cfm (supply & exhaust) | 150 cfm (supply & exhaust) |

Fire Area Penetrations: Area 14

| | |
|---|---|
| North Wall | 5' x 8' stairway opening which leads to Area 16 |
| | 4' x 6' opening (approx. 14½' above floor) which leads to area 10 |
| | 2 - 2" holes at floor level. |

Fire Area Penetrations: Area 15

| | |
|---|---|
| Ceiling | 2' x 5' stairway opening |
| South Wall | 1 - 2" hole at floor level |
| North Wall to Area 10 | 13' x 6' opening (approx. 14½' above the floor) |
| East Wall | Part height wall connecting to Area 16 (15'-9" height, 23' length) |

Fire Area Penetrations: Area 16

| | |
|---|---|
| Ceiling | 2' x 5' opening |
| South Wall | 1 - 2" hole at floor level |
| North Wall | 12' x 6' opening to Area 10 |
| East Wall | 8' x 6' opening to Area 10 |
| West Wall | Part height wall connecting to Area 15 (15'-9" height, 23' length) |

b. <u>SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION</u>

1. <u>Safe Shutdown Equipment/Cables; For Area 14</u>

<u>Cold Shutdown Equipment/Cables</u>

<u>Equipment</u>

RWST Isolation Valve from RHR
Header MOV-4-863A

RWST Isolation Valve from RHR
Header MOV-4-863B

RHR Flow Control Valve
HCV-4-758

| Cables | Power (P),Control (C) |
|---|---|
| RWST Isolation Valve from RHR Header MOV-4-863A | P |
| RWST Isolation Valve from RHR Header MOV-4-863B | P,C |
| RHR Flow Control Valve HCV-4-758 | C |

2. Safe Shutdown Equipment/Cables; For Area 15

Cold Shutdown Equipment/Cables

Equipment

RHR Pump 4A

RWST Isolation Valve from RHR Header MOV-4-862B

| Cables | Power (P),Control (C) |
|---|---|
| RHR Pump 4A | P,C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-4-749B | P,C |
| RWST Isolation Valve from RHR Header MOV-4-862A | P,C |
| RWST Isolation Valve from RHR Header MOV-4-862B | P,C |
| RHR Inlet Isolation Valve from RCS MOV-4-750 | C |
| RHR Inlet Isolation Valve from RCS MOV-4-751 | C |
| RWST Isolation Valve from RHR Header MOV-4-863A | P |

3. Safe Shutdown Equipment/Cables; for Area 16

Cold Shutdown Equipment/Cables

Equipment

RHR Pump 4B

RWST Isolation Valve from RHR
Header MOV-4-862A

| Cables | Power (P), Control (C) |
|---|---|
| RHR Pump 4B | P,C |
| RWST Isolation Valve from RHR Header MOV-4-862A | P,C |
| RHR Inlet Isolation Valve from RCS MOV-4-750 | C |

4. Nuclear Safety Evaluation

As indicated by the preceding equipment/cable list, the equipment located in Fire Areas 14, 15, and 16 is not required for hot shutdown. Per Section 3.3 of this report, only one residual heat removal (RHR) pump and heat exchanger is required per unit to maintain cold shutdown conditions. Therefore, the loss of one RHR pump and heat exchanger due to fire would not impact achieving cold shutdown. Refueling water storage tank (RWST)/RHR pump suction header isolation valves, MOV-4-862A and MOV-4-862B provide a redundant isolation function, thus the loss of one valve would not impact achieving cold shutdown. Based on this evaluation, the fire hazards analysis contained herein must provide assurance that a design basis fire in Area 15 or Area 16 will not render the redundant equipment in the adjacent fire area inoperable.

Area 14 contains valves MOV-4-863A and MOV-4-863B which are RWST/RHR pump discharge header isolation valves, and RHR flow control valve HCV-4-758. Valves MOV-4-863A and MOV-4-863B are in parallel and have no redundant counterpart for isolation. Also, there is no redundant flow path around valve HCV-4-758. Based on this evaluation, the fire hazards analysis contained herein must provide assurance that valves MOV-4-863A, MOV-4-863B, and HCV-4-758 will remain functional in the event of a design basis fire in Area 14, or protection of these valves and their associated cables must be provided.

In addition to the equipment and its associated cables located in Areas 15 and 16, a number of other safe shutdown related cables routed in conduit through these areas must be evaluated or protected. The required cable functions are listed below:

Fire Area 15 - Cables to be protected.

| | |
|---|---|
| MOV-4-863A | RWST Isolation Valve from RHR Header |
| MOV-4-749B | RHR Ht. Exchanger B Cooling Water Isolation Valve |
| MOV-4-862A | RWST Isolation Valve from RHR Header |
| MOV-4-750 | RHR Inlet from RCS Isolation Valve |
| MOV-4-751 | RHR Inlet from RCS Isolation Valve |

Fire Area 16 - Cables to be protected.

| | |
|---|---|
| MOV-4-750 | RHR Inlet Isolation Valve |

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The combustibles inventory for Areas 14, 15, and 16 consists primarily of the oil and grease associated with the various pumps and motor operated valves located in the areas. There are approximately two pounds of grease per motor operator and one gallon of oil per residual heat removal pump. These combustibles are contained within the respective equipment, and are of insignificant quantities when compared to the transient combustibles assumed in the following fire hazards analysis.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plants. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6), transient combustibles will be strictly limited. In Fire Areas 14, 15, and 16, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 4 is in all operating modes except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

The design basis fire calculations for Area 14 consist of design basis fire heat release rate calculations, burn duration calculations, and effective spill area calculations. Three transient combustibles were considered in the analysis. These combustibles are acetone (5 gal), heptane (5 gal), and lubricating oil (10 gal). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential impact on essential cold shutdown equipment/cables in the area (refer to Nuclear Safety Evaluation for specific equipment to be evaluated). The results of the design basis fire calculations are provided below: (Appendix A of this report provides a detailed discussion and development of the design basis fire methodology.)

Area 14

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$) | 251.5 | 251.5 | 251.5 |
| Design Basis Fire Heat Release Rate (Btu/min) | $1.2x10^6$ | $3.6x10^6$ | $2.1x10^6$ |
| Design Basis Fire Burn Duration (sec) | 15.9 | 7.9 | 31.8 |

The RHR flow control valve HCV-4-758 is located at elevation 12'-0". The RWST/RHR pump discharge header isolation valves MOV-4-863A and MOV-4-863B are located at elevation -3'-0". At their closest point the three essential valves are separated by a horizontal distance of approximately 5 feet. Based on the design basis fire effective spill areas and heat release rates it is evident that a single fire could potentially damage all three valves and their associated cables. In order to protect these valves, FPL proposes to provide an enclosure or thermal barrier constructed of ½" thick marinite or equivalent around the valve operators. In addition, the associated cables will be protected by utilizing a thermal insulating material to provide the equivalent protection of a one hour fire rated barrier. These modifications are deemed to provide an adequate level of protection from the design basis fires postulated herein.

As indicated in the Area Description the part height wall between Areas 15 and 16 leaves a relatively large opening between these two fire areas. Therefore, a fire in either area would cause hot gases to enter into the other fire area. The design basis fire calculations for Areas 15 and 16 encompass three major categories, namely design basis fire heat release rate calculations, burn duration calculations, and effective heat flux calculations.

The calculated values for heat flux provided herein are the average values to be expected for an RHR pump or valve operator should a design basis fire exist in the adjacent RHR Pump Room. Three transient combustibles were considered in the analysis. These combustibles are acetone (5 gal.), heptane (5 gal.), and lubricating oil (10 gal.). Each combustible was situated in the compartment so as to maximize its energy release rate and the most severe ventilation case was considered for each combustible, i.e. no ventilation available. The results of the design basis fire calculations are provided below: (Appendix A of this report provides a detailed discussion and development of the design basis fire methodology.)

Area 15 & 16

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Heat Release Rate $(\frac{Btu}{Min})$ | $1.34 \times 10^6$ | $3.91 \times 10^6$ | $2.21 \times 10^6$ |
| Burn Duration (sec) | 15 | 7 | 30 |

Postulating any of the above fires in Area 15 will yield the following expected values of heat flux for the RHR pump 4B and MOV-4-862A:

Area 16

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Calculated Heat Flux at the RHR Pump 4B $(\frac{Kw}{m^2})$ | 4.9 | 5.3 | 8.6 |
| Calculated Heat Flux at the MOV-4-862A $(\frac{Kw}{m^2})$ | 10.4 | 11.3 | 18.2 |

These results are applicable to the RHR pump 4A should the design basis fire be postulated in Area 16. However the following are expected values of heat flux for the MOV-4-862B:

Area 15

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Calculated Heat Flux at the MOV-4-862B $(\frac{Kw}{m^2})$ | 7.4 | 8.0 | 12.9 |

..The average calculated heat flux values are relatively low, are based on the assumption that all normal ventilation flow has tripped, and would not be expected to result in excessive equipment temperatures. For the case where ventilation is available, the ventilation flow path forces supply air into the RHR pump cubicles and exhausts it; hence the combustion product gases would be directed away from the pumps and out of the area, which would result in only a nominal equipment temperature increase inside the RHR pump room. Since no credit is taken for ventilation, and the average calculated heat flux for MOV-4-862A exceeds the critical heat flux for coated cables, some additional level of protection is deemed necessary. FPL proposes to provide an enclosure or thermal barrier constructed of ½" thick marinite around the motor operator of this valve. In addition, its associated cables will be sprayed with a thermal insulating material to provide the equivalent of 1 hour fire barrier protection. Likewise, FPL proposes to provide 1 hour rated barrier protection for shutdown related cables in Areas 15 and 16 as identified in the Nuclear Safety Evaluation.

1. Fire Hazards Evaluation

The fire area hazards evaluation was separated into four categories, viz., fire area structural ratings evaluations, fire area adjacent effects evaluations, available fire suppression capabilities determination, and a fire area summary.

Fire Area Structural Ratings Evaluation Data For Areas 14, 15, And 16 Is As Follows:

Area boundary structural fire rating estimates based on standardized curves for solid concrete walls (See Section 5.2 for details);

| | Area 14 | Area 15 | Area 16 |
|---|---|---|---|
| Walls | 4 | 4 | 4 |
| Floor | 4 | 4 | 4 |
| Ceiling | 4 | 4 | 4 |

Fire Area structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to adjacent areas, hot gas radiation, or burning liquid spread. No fire spread hazard was found to exist. There are no significant ignition sources near these penetrations. Any burning liquid entering the drain system would not be expected to have an effect on adjacent areas. In spite of this determination FPL proposes upgrading the perimeter walls, floors, and ceiling for Fire Areas 14, 15, and 16 by sealing all piping penetrations and installation of 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. In addition, FPL proposed to upgrade the part-height walls separating these areas by sealing all piping penetrations.

Available Fire Suppression Capabilities Determination

Fire Areas 14, 15, and 16 are accessible from the auxiliary building pipeway, Area 10. Fire Hose Station 2 is available for fighting a fire in these areas, as well as portable extinguishers 3.4.8, 3.4.7, and 3.4.10. Area fire suppression equipment ratings are as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.4.7 | 4A:40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.8 | 12 BC | | 25 $ft^2$ | Acceptable |
| 3.4.10 | 10A:40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| HS-2 | 75 GPM @ 50% Eff. | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

| | |
|---|---|
| Available fire suppression heat removal rate (One hose station @ 50% Eff.) | 315,000 $\frac{Btu}{min}$ |
| Total Type "B" Capability Available | 225 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables in Area 14. FPL proposes to provide an enclosure or thermal barrier (½" thick marinite or equivalent) to protect the valve operators in Area 14 and to protect their associated cables by utilizing a thermal insulating material. The design basis fire calculations for Areas 15 and 16 demonstrated that the relatively low effective heat fluxes resulting from postulated fires would not be expected to result in redundant equipment damage. In spite of this, FPL proposes to protect the motor operator and associated cables of MOV-4-862A in a similar manner. Fire spread from adjacent areas is prevented by upgrading the perimeter walls and ceiling. In addition, by sealing all piping penetrations in the part height walls separating these areas, the possibility of redundant RHR pumps being enveloped by a single fire is removed. Although no credit is given for existing fire fighting equipment available in the area, the potential for a large fire in this area is considered acceptably small. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Upgrade perimeter walls, floors, and ceiling for combined Areas 14, 15, and 16 to 3 hour rated barrier by sealing all piping and other penetrations and installation of 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. See Appendix D.

2. Upgrade part height wall separating Areas 14 and 16, 15 and 16, and upgrade full height wall separating Areas 14 and 15 by sealing all piping and other penetrations in the existing walls. See Appendix D.

3. Provide a fire barrier or enclosure of non-combustible material, ½" thick marinite or equivalent, around valve operators for valves HCV-4-758, MOV-4-863A, MOV-4-863B, and MOV-4-862A.

4. Provide the equivalent of a 1 hour rated barrier for the electrical conduit associated with valves HCV-4-758, MOV-4-863A, MOV-4-863B, and MOV-4-862A by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

5. Protect one train of conduit in Areas 14, 15, and 16 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

e. <u>EXEMPTION REQUEST</u>

FPL requests exemption for Areas 14, 15, and 16 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50*. Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with these areas supplemented by the specific modifications identified, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications coupled with a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Areas 14, 15, and 16 based on implementation of the specific requirements of subsections (a) and (c) is estimated to be $609,000 versus the cost for the proposed modifications of $255,250. In addition, the estimated man-rem exposure for full implementation is 1383 man-rem as opposed to 598 man-rem for the proposed modifications.

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*Specifically, FPL requests exemption from the total enclosure of one RHR Pump Room by 3 hour rated fire barriers and protection of essential equipment conduit located in each RHR Pump Room by 3 hour rated barriers. In addition, FPL requests exemption from the installation of 1 hour rated fire barriers in the RHR Heat Exchanger Room for the protection of the valve operators of HCV-4-758, MOV-4-863A, and MOV-4-863B, and the installation of a fire detection and automatic suppression system for this area.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are four types of backfit activities necessary to support our exemption requests which do not require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There is one type of backfit activity necessary to support our exemption request which requires a Unit 4 outage because major construction work is required on the Ventilation System and modifications will impact equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) and that NRC approval of this exemption request is required prior to November 1, 1983 in order to assure installation during the Fall 1984 refueling outage.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1. There are four types of backfit activities necessary to implement the III.G.2 criteria which do not require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2. There are two types of backfit activities necessary to implement III.G.2 criteria which require a Unit 4 outage because the modifications may require cutting and welding of the Fire System water supply piping and the Ventilation System. These activities would render the Fire and Ventilation Systems inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities is not possible during the

Steam Generator Repair outage (Winter 1982) and that NRC action is required prior to June 1, 1983 in order to assure installation during the Spring 1985 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.4 FIRE AREA 30

### a. AREA DESCRIPTION

Fire Area 30 is the Pipe and Valve Room for Unit 4. This area is located at the southwest end of the Reactor Auxiliary Building at elevation +18'-0" and is immediately adjacent to the Unit 4 Reactor Containment Building. The Pipe and Valve Room is accessible from the north-south hallway of the Reactor Auxiliary Building via an 8' x 3' doorway.

The Pipe and Valve Room contains the piping and associated valves for numerous systems that penetrate into the Reactor Containment Building. This area is bounded by concrete walls, floor and ceiling. The north wall has an 18" x 12" ventilation register, and the east wall has an 8' x 3' doorway which opens into the main auxiliary building north-south hallway at the 18' elevation. The floor has approximately 35 piping penetrations and a 2' x 5' stairway opening. The west wall is the Unit 4 Reactor Containment Building with 45 sealed piping penetrations.

Safe shutdown equipment in the area consists of the charging supply control valve, HCV-4-121 (el. 19'-6"); the component cooling water supply and discharge valves for the containment coolers, CV-4-2903 through CV-4-2905 (el. 22'-5"), CV-4-2906 through CV-4-2908 (el. 26'-10"), and MOV-4-1417 and MOV-4-1418 (el. 19'-6" and 19'-3"); the residual heat exchanger cooling water isolation valves, MOV-4-749A and B (el. 19'-9" separated by a distance of 5'-5¼"); and the letdown isolation valve, CV-4-204. Safe shutdown related cables are routed through this area at a tray elevation of approximately +27'-0". Cables in this tray are sprayed with Flamemastic 71A or Flamemastic 77. Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 800 $ft^2$ |
| Wall and Ceiling Surface Area, | 2650 $ft^2$ |
| Free Volume Excluding Components, | 11,680 $ft^2$ |
| Ceiling Height | 14'-6" |
| Ceiling Composition, | Concrete |
| Ceiling Thickness, | 1'-6" |
| Floor Composition, | Concrete |
| Floor Thickness, | 1'/1'-9" |
| Wall Composition, | Concrete |
| Wall Thickness, | South: 1', West: 3'-9"<br>North & East: 2' |
| Fire detector(s) in Area, | None |
| Detector No./Type, | N/A |

| | |
|---|---|
| Automatic Suppression in Area, | No |
| Type of Automatic Suppression, | N/A |
| Installed Communications Near Fire Area, | T-417, PA M-417 |
| Hose Station(s) Available To Area, | FH #2 |
| Fire Extinguisher(s) Immediately Available To Area, | 3.4.7, 3.4.8, 3.4.10 |
| Number of Floor Drains, | 1 |
| Drain(s) Size/Capacity, | 3"/160 gpm |
| Drain(s) Flow To, | Waste Holdup Tank |
| Normal Forced Draft/ Type Ventilation, | Yes/Fan |
| Normal Ventilation Flow Rate, | 960 CFM |

Fire Area Penetrations:

| | |
|---|---|
| Floor | Piping sleeves openings not sealed<br>Stairway opening<br>1 drain |
| North Wall | Exhaust vent duct 18" x 12"<br>12" piping penetration, |
| East Wall | Supply vent 14" x 24"<br>doorway 3' x 8' |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

Chg. Control Valve HCV-4-121

CCW Sup. Valve for Emer. Contain. Cool. 4A 4-2903

CCW Sup. Valve for Emer. Contain. Cool. 4B 4-2904

CCW Sup. Valve for Emer. Contain. Cool. 4C 4-2905

CCW Rtn. Valve for Emer. Contain. Cool. 4A 4-2906

CCW Rtn. Valve for Emer. Contain. Cool. 4B 4-2907

CCW Rtn. Valve for Emer. Contain. Cool. 4C 4-2908

CCW Sup. Valve for Norm. Contain. Cool. 4-1417

CCW Rtn. Valve for Norm. Contain. Cool. 4-1418

| Cables | Power (P), Control (C) |
|---|---|
| CCW Sup. Valve for Norm. Contain. Cool. 4-1417 | P, C |
| CCW Sup. Valves for Emer. Contain. Cool. | |
| 4A 4-2903 | C |
| 4B 4-2904 | C |
| 4C 4-2905 | C |
| CCW Rtn. Valves for Emer. Contain. Cool. | |
| 4A 4-2906 | C |
| 4A 4-2907 | C |
| 4A 4-2908 | C |
| Chg. Control Valve HCV-4-121 | C |
| CCW Rtn. Valve for Norm. Contain. Cool. 4-1418 | P, C |

Cold Shutdown Equipment/Cables

Equipment

RHR Ht. Exch. Cooling Water Isolation
Loop A MOV-4-749A
Loop B MOV-4-749B

| Cables | Power (P), Control (C) |
|---|---|
| RHR Ht. Exch. Cooling Water Isolation MOV-4-749A | P, C |
| RHR Ht. Exch. Cooling Water Isolation MOV-4-749B | P, C |

Equipment/Cables to Mitigate the Consequences of a Fire

Equipment

Letdown Isolation Valve 4-204

| Cables | Power (P), Control (C) |
|---|---|
| Letdown Isolation Valve 4-204 | C |

2. **Nuclear Safety Evaluation**

As indicated by the preceding equipment/cable list, Fire Area 30 contains various safe shutdown related components and cables which perform both hot and cold shutdown functions.

Included in the hot shutdown equipment/cable list are the four component cooling water supply and return valves for the normal and emergency containment coolers. For the purposes of analysis, one containment cooler is deemed adequate for containment cooling. In lieu of this, MOV-4-1417 and MOV-4-1418, the normal containment coolers supply and return valves and their associated cables must be evaluated.

In addition, Fire Area 30 contains the charging supply control valve HCV-4-121. This valve is utilized for RCS makeup during hot and cold shutdown conditions. Although RCS makeup during hot shutdown can be accomplished by reactor coolant pump seal injection, this valve is categorized as a hot shutdown valve and must therefore also be evaluated.

MOV-4-749A and MOV-4-749B are the component cooling water return valves from the residual heat removal (RHR) heat exchangers. As indicated in section 3.2, only one RHR heat exchanger is required for maintaining cold shutdown conditions. Therefore, either MOV-4-749A or MOV-4-749B will satisfy the RHR heat exchanger component cooling water requirements.

Letdown isolation valve CV-4-204 is of concern from a spurious actuation aspect. However, due to the capability to isolate letdown utilizing redundant isolation valves 4-200A, 4-200B, 4-200C and LCV-4-460 located inside containment, further analysis of this valve is not required.

In summary, the fire analysis contained herein must demonstrate the functionality of valves MOV-4-1417, MOV-4-1418, HCV-4-121 and either MOV-4-749A or B in the event of a design basis fire or adequate protection of these valves and their associated cables must be provided.

It should be noted that MOV's have the capability of being hand operated in the event of control power cable damage.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The combustibles inventory for Fire Area 30 consists primarily of the grease contained within each of the motor operated valves (MOV's) in the area and the cables routed in the cable trays. Since there are 14 MOV's in the area, with 1 lb. of grease per valve, this amounts to about 14 lbs. of grease total. This grease is contained within the respective steel enclosure of each valve motor operator, and is not considered to contribute to the design basis fires postulated herein. As previously stated, the cable trays are sprayed with Flamemastic 71A or Flamemastic 77 and therefore can only be considered a combustible if exposure fires of sufficient intensity are postulated such that piloted or auto ignition of the cables occurs. Based on these considerations, only transient combustibles were utilized in the design basis fire calculations.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plants. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all on site. Thus, while fires involving substantial quantities of these fuels are modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 30, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 4 is in all operating modes except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calulations

The design basis fire calculations for Area 30 consist of design basis fire heat release rate calculations, design basis fire burn duration calculations, and effective spill area calculations. Three transient

combustibles were considered in this analysis. These combustibles are acetone (5 gal.), heptane (5 gal.), and lubricating oil (10 gal.). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential impact on redundant safe shutdown equipment in the area. The results of the design basis fire calculations are provided below:

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$) | 800 | 800 | 543.3 |
| Design Basis Fire Heat Release Rate (Btu)/(min) | $3.9x10^6$ | $11.5x10^6$ | $4.4x10^6$ |
| Burn Duration (sec) | 5.0 | 2.5 | 14.9 |

It is evident from the effective spill areas of the three design basis fires and the separation distances of redundant cold shutdown valves that protection must be provided for one set of valves. FPL proposes to provide an enclosure or thermal barrier ½" thick marinite or equivalent to protect the motor operators of one set of redundant valves. These valves are HCV-4-121, MOV-4-1417, MOV-4-1418, and MOV-4-749A. In addition, the associated cables for these valves routed in conduit will be sprayed with a thermal insulating material to provide the equivalent protection of a 1 hour barrier. Likewise, one train of cable trays in this area will be provided 1 hour rated barrier protection by use of a thermal insulating wrap. This level of protection is deemed adequate for the design basis fires postulated herein.

3. <u>Fire Hazards Evaluation</u>

The fire hazards evaluation was separated into four categories, viz., fire area structural ratings evaluation, fire area adjacent effects evaluation, available fire suppression capabilities determination, and a fire area summary.

<u>Fire Area Structural Ratings Evaluation</u>

Area boundary structural fire ratings are estimates based on standardized curves for solid concrete walls (see Section 5.2 for details);

| | |
|---|---|
| Walls | 4 hours |
| Floor | 4 hours |

Fire and structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to adjacent areas, hot gas radiation, or burning liquid spread. There are no significant ignition sources near these penetrations. Any burning liquid entering the drain system would not be expected to have an effect on adjacent areas. Piping penetrations in the floor, and all other penetrations in the floor or walls, will be sealed and upgraded, as proposed by FPL.

Available Fire Suppression Capabilities Determination

Fire Area 30 is accessible from the Auxiliary Building hallway (Area 58) and the RHR Pump Room for Unit 4 (Areas 15 and 16). Portable extinguishers 3.4.7, 3.4.8, and 3.4.10 are available for use in Area 30 as well as Fire Hose Station #2.

Area 30 fire suppression equipment ratings are summarized as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.4.7 | 4A: 40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.8 | 12BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.4.10 | 10A:40BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| FH#2 | 75 gpm @ 50% eff | 315,000 Btu/min | | "E" Rated Nozzle |

Available fire suppression heat removal rate (one hose station @ 50% eff) — 315,000 Btu/min

Total type "B" Capability available — 225 $ft^2$

Fire Area Summary

As demonstrated by the fire hazards analysis contained herein, protection from the direct flame impingement or radiation of a fire must be provided for one train of redundant hot and cold shutdown equipment/cables located in Area 30. FPL proposes to provide such protection by the utilization of an enclosure or thermal barrier around the motor operators of required valves, and protection of their associated cables by the use of a thermal insulating material. In addition, fire spread from Area 30 to other redundant equipment areas is prevented by upgrading the perimeter walls to a 3 hour barrier. Although no credit is given for the existing fire suppression

equipment available in the area, the potential for a large fire in Area 30 is considered acceptably small. It should be emphasized that the fires postulated in the preceding fire methodology are not considered credible fires, and in reality the existing fire fighting equipment provides more than adequate fire suppression capability. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Protect one train of cable trays in Area 30 utilizing a thermal insulating wrap to provide the equivalent protection of a 1 hour rated barrier.

2. Upgrade perimeter walls and floor for Area 30 to 3 hour rated barrier by sealing all piping and other penetrations and installation of 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. See appendix D.

3. Provide a fire barrier or enclosure of non-combustible material 1/2" thick marinite or equivalent around valve operators for valves HCV-4-121, 4-1417, 4-1418 and MOV-4-749A.

4. Provide the equivalent of a 1 hour fire rated barrier for the electrical conduit associated with valves HCV-4-121, 4-1417, 4-1418 and MOV-4-749A by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

5. Protect one train of conduit in Area 30 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

e. EXEMPTION REQUEST

FPL requests exemption for Area 30 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features

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* Specifically, FPL requests exemption from the installation of 1 hour rated fire barriers in the Unit #4 Pipe and Valve Room for the protection of the valve operators of MOV-4-1417, MOV-4-1418, HCV-4-121, and MOV-4-749A. In addition, FPL requests exemption from the installation of fire detection and suppression system in this area.

associated with this area supplemented by the specific modifications identified, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications, coupled with a strict combustible control program based on Appendix C of this report, provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 30 based on implementation of the specific requirements of subsection (c), is estimated to be $316,517 versus the cost for the proposed modifications of $218,517. In addition, the estimated minimum exposure for full implementation is 209 man-rem as opposed to 69 man-rem for the proposed modifications.

f. <u>SCHEDULE EXEMPTION</u>

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are four types of backfit activities necessary to support our exemption requests which do not require a Unit #4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There is one type of backfit activity necessary to support our exemption request which requires a Unit 4 outage because major construction work is required on the ventilation system and modifications will impact equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) and that NRC approval of this exemption request is required prior to November 1, 1983 in order to assure installation during the Fall 1984 refueling outage.

Should the above requested exemption be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1) There are four types of backfit activities necessary to implement the III.G.2. criteria which do not require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation

phases during an outage period as defined by 10CFR50.48(c)(3)(i),(ii) or (iii).

2) There are two types of backfit activities necessary to implement III.G.2 criteria which require a Unit 4 outage because the modifications may require cutting and welding of the Fire System water supply piping and the ventilation system. These activities would render the Fire and Ventilation Systems inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities is not possible during the Steam Generator Repair outage (Winter 1982) and that NRC action is required prior to June 1, 1983 in order to assure installation during the fall 1984 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.5 FIRE AREA 40

### a. AREA DESCRIPTION

Fire Area 40 is the Pipe and Valve Room for Unit 3. This area is located at the northwest end of the Reactor Auxiliary Building at elevation +18'-0" and is immediately adjacent to the Unit 3 Reactor Containment Building. The pipe and valve room is accessible from the north-south hallway of the Reactor Auxiliary Building via an 8' x 3' doorway.

The Pipe and Valve Room contains the piping and associated valves for numerous sytems that penetrate into the Reactor Containment Building. This area is bounded by concrete walls, floor, and ceiling. The south wall has an 18" x 12" ventilation register and the east wall has an 8' x 3' doorway which opens into the Reactor Auxiliary Building hallway at the 18' elevation The floor has approximately 35 piping penetrations and a 2' x 5' stairway opening. The west wall is the Unit 3 Reactor Containment Building with 45 sealed piping penetrations.

Safe shutdown equipment in the area consists of the charging supply control valve, HCV-3-121 (el. 19'-6"); the component cooling water supply and discharge valves for the containment coolers, CV-3-2903 through CV-3-2905 (el. 22'-5"), CV-3-2906 through CV-3-2908 (el. 26'-10"), and MOV-3-1417 and MOV-3-1418 (el. 19'-6" and 19'-3"); the residual heat exchanger cooling water isolation valves, MOV-3-749A and B (el. 19'-9" separated by a distance of 5'-5"); and the letdown isolation valve, CV-3-204. Safe shutdown related cables are routed through this area at a tray elevation of approximately +27'-0". Cables in this tray are sprayed with Flamemastic 71A or Flamemastic 77. Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 800 $ft^2$ |
| Wall and Ceiling Surface Area, | 2650 $ft^2$ |
| Free Volume Excluding Components, | 11,680 $ft^2$ |
| Ceiling Height,<br>Ceiling Composition,<br>Ceiling Thickness, | 14'-6"<br>Concrete<br>1'-6" |
| Floor Composition,<br>Floor Thickness, | Concrete<br>1' |
| Wall Composition,<br>Wall Thickness, | Concrete<br>North: 1'<br>West: 3'-9"<br>South & east: 2' |
| Fire detector(s) in Area,<br>Detector No./Type, | None<br>N/A |

| | |
|---|---|
| Automatic Suppression in Area, | None |
| Type of Automatic Suppression, | N/A |
| Installed Communications Near Fire Area, | T-317, PA M-317 |
| Hose Station(s) Available To Area, | FH#3 |
| Fire Extinguisher(s) Immediately Available To Area, | 3.4.7, 3.4.8, 3.4.10 |
| Number of Floor Drains, | 1 |
| Drain(s) Size/Capacity, | 3"/140 gpm |
| Drain(s) Flow To, | Waste Holdup Tank |
| Normal Forced Draft/ Type Ventilation, | Yes/Fan |
| Normal Ventilation Flow Rate, | 960 CFM |
| Fire Area Penetrations: | |
| Floor | 1 drain, Stairway opening, 25 pipe penetrations w/3" high sleeves |
| South Wall | 12" x 14" A/C grating |
| East Wall | Doorway 40" x 84" no curb |
| West Wall | Sealed penetrations to Containment |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

Chg. Control Valve HCV-3-121

CCW Sup. Valve for Emer. Contain. Cool. 3A 3-2903

CCW Sup. Valve for Emer. Contain. Cool. 3B 3-2904

CCW Sup. Valve for Emer. Contain. Cool. 3C 3-2905

CCW Rtn. Valve for Emer. Contain. Cool. 3A 3-2906

CCW Rtn. Valve for Emer. Contain. Cool. 3B 3-2907

CCW Rtn. Valve for Emer. Contain. Cool. 3C 3-2908

CCW Sup. Valve for Norm. Contain. Cool. 3-1417

CCW Rtn. Valve for Norm. Contain. Cool. 3-1418

| Cables | Power (P), Control (C) |
|---|---|
| CCW Sup. Valve for Emer. Contain. Cool. | |
| 3A 3-2903 | C |
| 3B 3-2904 | C |
| 3C 3-2905 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. | |
| 3A 3-2906 | C |
| 3B 3-2907 | C |
| 3C 3-2908 | C |
| Chg. Control Valve HCV-3-121 | C |
| CCW Sup. Valve for Norm. Contain. Cool. 3-1417 | P, C |
| CCW Rtn. Valve for Norm. Contain. Cool. 3-1418 | P, C |

Cold Shutdown Equipment/Cables

Equipment

RHR Ht. Exch. Cooling Water Isolation Valves
MOV-3-749A
MOV-3-749B

| Cables | Power (P), Control (C) |
|---|---|
| RHR Ht. Exch. Cooling Water Isolation Valves MOV-3-749A | P, C |
| RHR Ht. Exch. Cooling Water Isolation Valves MOV-3-749B | P, C |

Equipment/Cables to Mitigate the Consequences of a Fire

Equipment

Letdown Isolation Valve 3-204

| Cables | Power (P), Control (C) |
|---|---|
| BA Transfer Pump Recirculation Valve HCV-105 | C |
| Letdown Isolation Valve 3-204 | C |

2. Nuclear Safety Evaluation

As indicated by the preceding equipment/cable list, Fire Area 40 contains various safe shutdown related components and cables which perform both hot and cold shutdown functions.

Included in the hot shutdown equipment/cable list are the four component cooling water supply and return valves for the normal and emergency containment coolers. For the purposes of analysis, one containment cooler is deemed adequate for containment cooling. In lieu of this, MOV-3-1417 and MOV-3-1418, the normal containment coolers supply and return valves and their associated cables must be evaluated.

In addition, Fire Area 40 contains the charging supply control valve HCV-3-121. This valve is utilized for RCS makeup during hot and cold shutdown conditions. Although RCS makeup during hot shutdown can be accomplished by reactor coolant pump seal injection, this valve is categorized as a hot shutdown valve and must therefore also be evaluated.

MOV-3-749A and MOV-3-749B are the component cooling water return valves from the residual heat removal (RHR) heat exchangers. As indicated in section 3.2, only one RHR heat exchanger is required for maintaining cold shutdown conditions. Therefore, either MOV-3-749A or MOV-3-749B will satisfy the RHR heat exchanger component cooling water requirements.

Letdown isolation valve CV-3-204 is of concern from a spurious actuation aspect. However, due to the capability to isolate letdown utilizing redundant isolation valves 3-200A, 3-200B, 3-200C, and LCV-3-460 located inside containment, further analysis of this valve is not required.

In summary, the fire analysis contained herein must demonstrate the functionality of valves MOV-3-1417, MOV-3-1418, HCV-3-121 and either MOV-3-749A or B in the event of a design basis fire or adequate protection of these valves and their associated cables must be provided.

It should be noted that MOV's have the capability of being hand operated in the event of control power cable damage.

c. <u>FIRE HAZARDS ANALYSIS</u>

1. <u>Fire Area Combustibles</u>

The combustibles inventory for Fire Area 40 consists primarily of the grease contained within each of the motor operated valves (MOV's) and cables routed in cable trays in the area. There are 14 MOV's in the area, with 1 lb. of grease per valve, which amounts to about 14 lbs. of grease total. Since this grease is contained within the respective steel enclosure of each valve motor operator, it is not considered to contribute to the design basis fires postulated herein. As previously stated, the cable trays are sprayed with Flamemastic 71A or Flamemastic 77 and therefore can only be considered a combustible if exposure fires of sufficient intensity are postulated such that piloted or auto ignition of the cables occurs. Based on these considerations, only transient combustibles were utilized in the design basis fire calculations.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point Plant. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels are modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 40, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 3 is in all operating modes except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

The design basis fire calculations for Area 40 consist of design basis fire heat release rate calculations, design basis fire burn duration calculations, and effective spill area calculations. Three transient combustibles were considered in this analysis. These combustibles are acetone (5 gal.), heptane (5 gal.) and lubricating oil (10 gal.). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential impact on redundant safe shutdown equipment in the area. The results of the design basis fire calculations are provided below:

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$) | 800 | 800 | 543.3 |
| Design Basis Fire Heat Release Rate (Btu/min) | $3.9x10^6$ | $11.5x10^6$ | $4.4x10^6$ |
| Burn Duration (sec) | 5.0 | 2.5 | 14.9 |

It is evident from the effective spill areas of the three design basis fires and the separation distances of redundant cold shutdown valves that protection must be provided for one set of valves. FPL proposes to provide an enclosure or thermal barrier constructed of ½" thick marinite or equivalent to protect the motor operators of one set of redundant valves. These valves are HCV-3-121, MOV-3-1417, MOV-3-1418, and MOV-3-749A. In addition, the associated cables for these valves routed in conduit will be sprayed with a thermal insulating material to provide the equivalent protection of a 1 hour barrier. Likewise, one train of cable trays in this area will be provided 1 hour rated barrier protection by use of a thermal insulating wrap. This level of protection is deemed adequate for the design basis fires postulated herein.

3. Fire Hazards Evaluation

The fire hazards evaluation was separated into four categories, viz., fire area structural ratings evaluation, fire area adjacent effects evaluation, available fire suppression capabilities determination, and a fire area summary.

Fire Area Structural Ratings Evaluation

Area boundary structural fire ratings are estimates based on standardized curves for solid concrete walls (see Section 5.2 for details);

| | |
|---|---|
| Walls | 4 hours |
| Floor | 4 hours |

Fire and structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to adjacent areas, hot gas radiation, or burning liquid spread. There are no significant ignition sources near these penetrations. Any burning liquid entering the drain system would not be expected to have an effect on adjacent areas. Piping penetrations in the floor, and all other penetrations in the floor or walls, will be sealed and upgraded, as proposed by FPL.

Available Fire Suppression Capabilities Determination

Fire Area 40 is accessible from the Auxiliary Building hallway (Area 58) and the RHR Pump Room for Unit 3 (Areas 12 & 13). Portable extinguishers 3.4.7, 3.4.8, and 3.4.10 are available for use in Area 40, as well as fire hose station #3.

Area 40 fire suppression equipment ratings are summarized as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.4.7 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.8 | 12 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.4.10 | 10A: 40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| FH #3 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

| | |
|---|---|
| Available fire suppression heat removal rate (one hose station @ 50% eff) | 420,000 $\frac{Btu}{min}$ |
| Total type "B" Capability available | 225 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis contained herein, protection from the direct flame impingement or radiation of a fire must be provided for one train of redundant hot and cold shutdown equipment/cables located in Area 40. FPL proposes to provide such protection by the utilization of an enclosure or thermal barrier around the motor operators of required valves, and protection of their associated cables by the use of a thermal insulating material. In addition, fire spread from Area 40 to other redundant equipment areas is prevented by upgrading the perimeter walls to a 3 hour barrier. Although no credit is given for the existing fire suppression equipment available in the area, the possibility of a large fire in Area 40 is considered acceptably small. It should be emphasized that the fires postulated in the preceding fire methodology are not considered credible fires, and in reality the existing fire fighting equipment provides more than adequate fire suppression capability. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Protect one train of cable trays in Area 40 utilizing a thermal insulating wrap to provide the equivalent protection of a 1 hour rated barrier.

2. Upgrade perimeter walls and floor for Area 40 to 3 hour rated barrier by sealing all piping and other penetrations and installing of 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. See Appendix D.

3. Provide a fire barrier or enclosure of noncombustible material 1/2" thick marinite or equivalent around valve operators for valves HCV-3-121, 3-1417, 3-1418 and MOV-3-749A.

4. Provide the equivalent of a 1 hour rated barrier for the electrical conduit associated with valves HCV-3-121, 3-1417, 3-1418 and MOV-3-749A by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

5. Protect one train of conduit in Area 40 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

6 e. EXEMPTION REQUEST

FPL requests exemption for Area 40 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with this area supplemented by the specific modification identified provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications, coupled with a strict combustible control program based on Appendix C of this report, provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 40 based on implementation of the specific requirements of subsection (c), is estimated to be $320,820 versus the cost for the proposed modifications of $199,000. In addition, the estimated man-rem exposure for full implementation is 180 man-rem as opposed to 102 man-rem for the proposed modifications.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are four types of backfit activities necessary to support our exemption requests which do not require a Unit 3 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a Unit 3 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There is one type of backfit activity necessary to support our exemption request which requires a Unit 3 outage because major construction work is required on the ventilation system and modifications will impact equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this

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*Specifically, FPL requests exemption from the installation of 1 hour rated fire barriers in the Unit #3 Pipe and Valve Room for the protection of the valve operators of MOV-3-1417, MOV-3-1418, HCV-3-121, and MOV-3-749A. In addition, FPL requests exemption from the installation of a fire detection and suppression system in this area.

activity is not possible during the Fall 1983 refueling outage and that NRC approval of this exemption request is required prior to April 1, 1984 in order to assure installation during the Spring 1985 refueling outage.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1. There are four types of backfit activities necessary to implement the III.G2 criteria which do not require a Unit 3 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a Unit 3 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i),(ii) or (iii).

2. There are two types of backfit activities necessary to implement III.G.2 criteria which require a Unit 3 outage because the modifications may require cutting and welding of the Fire System water supply piping and the ventilation system. These activities would render the fire and ventilation system inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemptions from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i),(ii) and (iii). It is noted that completion of these activities is not possible during the Fall 1983 refueling outage and that NRC action is required prior to November 1, 1983 in order to assure installation during the Spring 1985 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.6 FIRE AREA 47

### a. AREA DESCRIPTION

Fire Area 47 is the component cooling water area for Unit 4. This area is located at the southeast corner of the Reactor Auxiliary Building at elevation +18'-0". The component cooling water area is accessible from the east end of the main Reactor Auxiliary Building east-west hallway, the Safety Injection Pump Room, the Laundry Room, and outside from Fire Area 123. The component cooling water area contains the pumps, heat exchangers, piping, valves and instrumentation associated with the component cooling water system. The area also contains safe shutdown related cables which are routed in cable trays through the area. The area is bounded by concrete walls and floor. The ceiling of this area is open to the atmosphere and contains a walking surface constructed of steel grating. The north wall of the area has an 8' x 4' doorway and electrical and mechanical penetrations into the Safety Injection Pump Room (Fire Area 52). The east wall has a 10' x 10' doorway into outside Area 123. The west wall has an 8' x 8' doorway to the Reactor Auxiliary Building main hallway and a 7' x 4' doorway to the Laundry Room. The floor contains a 5' wide trench covered with steel grating running through the area from the main pipeway 10'-0" elevation under the east wall into the Raw Water Storage Tank area (Fire Area 123). Safe shutdown equipment in the area consists of the component cooling water pumps, 4A, 4B, and 4C, which are separated by approximately 12'-0" center to center. Safe shutdown related cables are routed through this area at tray elevations of 26'-6" and 27'-6". These trays then enter manholes MH408 and MH410 respectively which are also located in Fire Area 47. Cables in these trays are coated with Flamemastic 71A or 77. Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 3000 ft$^2$ |
| Wall and Ceiling Surface Area, | 6800 ft$^2$ |
| Free Volume Excluding Components, | 48,000 ft$^3$ |
| Ceiling Height, | 16' |
| Floor Composition,<br>Floor Thickness, | Concrete<br>(ground level) |
| Wall Composition,<br>Wall Thickness, | Concrete<br>West: 1'-6",<br>North, South, East: 1' |
| Ceiling Composition,<br>Ceiling Thickness, | Metal grating<br>N/A |
| Fire detector(s) in Area,<br>Detector No./Type, | None<br>N/A |

| | |
|---|---|
| Automatic Suppression in Area, | None |
| Type of Automatic Suppression, | N/A |
| Installed Communications Near Fire Area, | T-312, M-321 |
| Hose Station(s) Available To Area, | #2, #5 |
| Fire Extinguisher(s) Immediately Available To Area, | 3.4.7, 3.4.9, 3.4.10 |
| Number of Floor Drains, | 6 |
| Drain(s) Size/Capacity, | 2½"/230 gpm |
| Drain(s) Flow To, | Waste Holdup Tank |
| Normal Forced Draft/ | None |
| Type Ventilation, | N/A |
| Normal Ventilation Flow Rate, | N/A |

Fire Area Penetrations:

| | |
|---|---|
| Floor | Trench under east & west walls:<br>18' wide (west)<br>5' wide (east) |
| Ceiling | Steel grating |
| North Wall | Aluminum door 4' x 8' on 12" curb - electrical & mechanical penetrations into Area 52 (not sealed, 6' high) |
| West Wall | 8' x 8' door to Aux. Bldg.<br>7' x 4' doorway to laundry room |
| East Wall | 10' doorway |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

CCW Pump 4A

CCW Pump 4B

CCW Pump 4C

| Cables | Power (P), Control (C) |
|---|---|
| Chg. Pump 3A | C |
| Chg. Pump 3B | C |
| Chg. Pump 3C | C |
| CCW Pump 4A | P, C |
| CCW Pump 4B | P, C |
| CCW Pump 4C | P, C |
| ICW Pump 4A | C |
| ICW Pump 4B | C |
| ICW Pump 4C | C |
| Emer. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3A | C |
| Norm. Contain. Cool. 3B | C |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |

2. Nuclear Safety Evaluation

As indicated in the preceding equipment/cable list, this area contains equipment and cables required for both hot and cold shutdown.

Hot shutdown equipment in this area consists of three 100% capacity component cooling water pumps, and their associated heat exchangers. At least one CCW pump is required for both hot and cold shutdown. The CCW system is designed such that either A, B, or C pump can be used in conjunction with A, B, or C heat exchanger. Therefore, FPL proposes to protect one CCW pump by use of 3 hour fire rated barriers.

In addition, Fire Area 47 contains various hot and cold shutdown related cables which are routed in cable trays located in this area. Redundant cable tray separation is complicated by the relatively short distances between trays. Based on the anticipated difficulties encountered in providing redundant cable separation, a concept of total cable protection was deemed to be the most viable approach for ensuring the capability to achieve and maintain hot/cold shutdown conditions. The fire hazards analysis and evaluation contained herein quantifies the level of protection to be provided by a combination of Flamemastic coatings on cables, baffles beneath cable trays, and the use of a thermal insulating coating to protect conduit.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The combustible inventory for the Unit 4 component cooling water area consists of one gallon of lube oil per pump, approximately one pound of grease per valve, and the electrical cables routed in trays through the area. As stated previously, those cables are coated with Flamemastic 71A or Flamemastic 77. Lubricating oil can only be considered a combustible if sprayed upon a hot surface which raises the temperature to above its flash point, i.e., above approximately 450°F. The lubricating systems for the component cooling water pumps are not pressurized, therefore the potential for oil spray is unlikely. In addition, ignition sources such as hot piping, etc., are not present in the area. Likewise, the lubricating oil and grease contained within valves would not be expected to contribute to a postulated fire in the area since these combustibles are confined within the steel structure of the valve operators.

Electrical cables routed in cable trays in the area can only be considered a combustible if exposure fires of sufficient intensity are postulated such that piloted ignition or auto ignition of the cables occurs. In addition, these cables are coated with Flamemastic.

In summary, the design basis fire calculations provided herein do not consider the oil and grease contained within the pumps and valves as a combustible source for the previously stated reasons. Lubricating oil is considered in the analysis, however, as a transient combustible. Two other transient combustibles considered are acetone and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at Turkey Point Units 3 and 4. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than 1 gallon at any time, while heptane has no use at all on site. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 47, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 4 is in all operating modes except cold shutdown or refueling. In addition, these liquids will be transported only in approved safety containers.

2. <u>Design Basis Fire Calculations</u>

Fire Area 47 is considered to be a single fire sector. Fire Sector B is described in Section 5.2.7. Fires involving three different fuels are postulated in this sector: acetone, lubricating oil, and heptane. In considering the effects of such fires, two levels of passive protection are considered.

The first involves only that protection which is associated with the existing separation and use of flame retardant coatings. The second adds the protection afforded by baffles and radiant energy shields to the existing level of protection. Assuming these protective measures a "back" calculation analysis is utilized. A "back" calculation is directed towards determining the minimum quantities of the three fuels which, if ignited, may exceed the damage criterion of the most limiting cable.

The results of the "back" calculation are presented in Tables 5.2.3 and 5.2.4. In terms of piloted ignition of a cable, the results indicate that the most limiting fuel quantity involves the combustion of 12.5 gallons of lubricating oil in Fire Sector B. This fire size and location is considered to be well in excess of that quantity which may realistically be introduced into the plant as a result of a breakdown of administrative controls.

Table 5.2.3 Fire Sector B, Existing Configuration

| Damage Criterion | Fuel Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux (kW/m²) | Maximum Heat Flux (BTU/Hr · ft²) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 6.5 | 62.4 | 19784.3 |
| | Lubricating Oil | 6.2 | 65.4 | 20735.5 |
| | Heptane | 11.8 | 70.9 | 22479.3 |
| Piloted Ignition | Acetone | 8.4 | 62.4 | 19784.3 |
| | Lubricating Oil | 8.0 | 65.4 | 20735.5 |
| | Heptane | 15.2 | 70.9 | 22479.3 |
| Electrical Failure | Acetone | 27.8 | 62.4 | 19784.3 |
| | Lubricating Oil | 25.0 | 97.0 | 30748.1 |
| | Heptane | 32.4 | 171.5 | 54368.8 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.4 Fire Sector B, Proposed Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m$^2$) | (BTU/Hr · ft$^2$) |
| Jacket Degradation | Acetone | 11.0 | 58.8 | 18639.7 |
| | Lubricating Oil | 10.5 | 73.6 | 23338.5 |
| | Heptane | 15.0 | 112.2 | 35586.4 |
| Piloted Ignition | Acetone | 13.0 | 58.8 | 18639.7 |
| | Lubricating Oil | 12.5 | 86.1 | 27301.7 |
| | Heptane | 17.0 | 125.6 | 39831.7 |
| Electrical Failure | Acetone | 33.5 | 58.8 | 18639.7 |
| | Lubricating Oil | 25.0 | 97.0 | 30748.1 |
| | Heptane | 32.4 | 171.5 | 54368.8 |
| Auto Ignition | | Not Achieved | | |

Based on these considerations, it is concluded that the proposed modifications will adequately protect the cables from the effects of exposure fires and that further modifications to comply with the specific provisions of Appendix R would not enhance fire protection safety.

3. **Fire Hazards Evaluation**

The fire hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

Available Fire Suppression Capabilities Determination

Fire Area 47 is accessible from the Auxiliary Building hallway (Area 58) and outdoors from the Refueling Water Storage Area (Area 123). The area is also accessible from the Laundry Room (Area 46) and the Safety Injection Pump Room (Area 52). Fire hose stations 2 and 5 are available for fighting a fire in this area, as well as portable extinguishers 3.4.7, 3.4.9, and 3.4.10. Area 47 fire suppression equipment ratings are as follows:

| I.D. NO. | Extinguisher Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.4.7 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.9 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.10 | 10A: 40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| F.H. #2 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| F.H. #5 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% eff): 630,000 $\frac{Btu}{min}$

Total type "B" capability available: 300 $ft^2$

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables in Area 47. FPL proposes to install fire resistant baffles under all cable trays in the area, as well as a fire resistant partial enclosure around all vertical cable trays penetrating the floor of the area. In addition, one component cooling water pump will be enclosed in a three hour fire rated wall. Although no credit is given for existing fire suppression equipment available in the area, the potential for a large fire in this area is considered acceptably small.

d. **SUMMARY OF PROPOSED MODIFICATIONS**

1. Protect electrical cable trays located in Area 47 by installation of fire resistant baffles under these trays. Baffles are to span the width of the lowest cable tray in a stack and are to be located within 4 inches of the bottom of the lowest tray. These baffles will be constructed of ½ inch thick marinite or equivalent. See Appendix D.

2. Protect all vertical cable trays penetrating the floor of Area 47 by the installation of a fire resistant partial enclosure or heat shield around the trays. This enclosure will be constructed of ½ inch thick marinite or equivalent, and will extend from the floor up to the lowest horizontal tray in a stack. See Appendix D.

3. Protect one CCW pump with a three hour fire rated wall (no roof). See Appendix D.

e. **EXEMPTION REQUEST**

FPL requests exemption for Area 47 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2 Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with this area supplemented by the specific modifications identified provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications coupled with a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant

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*Specifically, FPL requests exemption from those provisions that require the separation of redundant safe shutdown related cables by a 1 hour rated fire barrier and the installation of a fire detection and automatic suppression system in this area.

is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment ismaintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 47 based on implementation of the specific requirements of subsection (c), is estimated to be $354,238 versus the cost for the proposed modifications of $236,000.

f. <u>SCHEDULE EXEMPTION</u>

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There is one type of backfit activity necessary to support our exemption requests which does not require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that this backfit installation phase will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phase during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There are two types of backfit activities necessary to support our exemption request which require a Unit 4 outage to construct equipment fire barriers which will not be seismically qualified until completed. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities are not possible during the Steam Generator Repair outage (Winter 1982) and that NRC approval of this exemption request is required prior to March 1, 1983 in order to assure installation during the Fall 1984 refueling outage.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1. There is one type of backfit activity necessary to implement the III.G.2 criteria which does not require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for this activity from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that this backfit installation phase will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phase during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2. There are two types of backfit activities necessary to implement III.G.2 criteria which require a Unit 4 outage. One activity may require cutting and welding of the Fire System water supply piping. This activity would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. The other activity

requires fire barriers to be constructed. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities is not possible during the Steam Generator Repair outage (Winter 1982) and that NRC action is required prior to March 1, 1983 in order to assure installation during the Fall 1984 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.7 FIRE AREA 58

### a. AREA DESCRIPTION

Fire Area 58 is the Main Auxiliary Building hallway at the 18'-0" elevation. The boric acid heat tracing transformers, 480 V MCC's 3C, 4C and D, and the emergency lighting panels are located in this area. Cables required for normal plant shutdown are also routed through this area. Cables are located in trays, wireways and conduit exiting the trays and wireways. Trays are located at elevations 26'-6", 27'-6", and 28'-6". All cable trays in this area are sprayed with Flamemastic 71A or Flamemastic 77. The walls, floor, and ceiling are concrete. This area is the main access route to all rooms of the Auxiliary Building at this level, thus there are doorways to those areas from the hallway. The fire area is accessible from outdoors via five separate entrances. Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 2100 $ft^2$ |
| Wall and Ceiling Surface Area, | 13300 $ft^2$ |
| Free Volume Excluding Components, | 33600 $ft^3$ |
| Ceiling Height, | 11' |
| Floor Composition,<br>Floor Thickness, | Concrete<br>2' |
| Wall Composition,<br>Wall Thickness, | Concrete<br>Varied range of thickness between 1' to 2' with average thickness of 18". |
| Ceiling Composition,<br>Ceiling Thickness, | Concrete<br>1' |
| Fire Detectors in Area,<br>Detectors No./Type, | Yes<br>7-1,7-2,7-3,7-4,7-9,7-10,7-11,7-12, 7-13,7-14,7-15,7-16,7-24,7-25,7-26 7-27,7-28,7-29,7-30,7-31,7-32/Ionization. |
| Automatic Suppression,<br>Type of Automatic Suppression, | No<br>N/A |
| Installed Comm. Near Fire Area, | #3 CCW HT EX Room NW Corner |
| Hose Station Available to Area, | #1<br>#3 |

| | |
|---|---|
| Fire Extinguishers Immediately Available to Area, | 3.4.2<br>3.4.3<br>3.4.4<br>3.4.5<br>3.4.9 |
| Number of Floor Drains, | 9 |
| Drain(s) Size, | 3" |
| Drain(s) Flow To, | Waste Holdup Tank |
| Normal Forced Draft Ventilation, | Yes/Fan |
| Normal Ventilation Flow Rate, | 26400 CFM (Supply) |

Fire Area Penetrations:

| | |
|---|---|
| Floor | 30" x 4' Stairway on North End Down to Area 10<br>30" x 4' Stairway on South End Down to Area 10<br>1" Wide x 60' Crack Around Hatchway to 10' - 0" Level Pipeway Located at Intersection of E/W and N/S Halls. |
| Walls: | |
| South End, East Side | 4' x 7' Door to Drumming Area<br>8' x 7' Door to #4 Charging Pump Room |
| South End, West Side | 4' x 7' Door to #4 Pipe and Valve Room<br>4' x 7' Door to #4 Cont. Spray Pump Room<br>4' x 7' Door to Sample Room<br>5' x 8' Door to Waste Evap. Package Room |
| West End | 8' x 8' Doorway to Outside |
| West End, North Side | 30" x 6'-8" Door to Cold Lab<br>30" x 6'-8" Door to Hot Lab<br>48" x 7' Door to Steps Downstairs<br>30" x 7' Opening to Gas Decay Valve Gallery |

| | |
|---|---|
| West End, South Side | 48" x 6'-8" Door to Hot Machine Shop<br>48" x 6'-8" Door to Fan Room |
| North End, West Side | 4' x 7' Door to Boric Acid Evaporator<br>4' x 7' Door to Boric Acid Evaporator<br>4' x 7' Door to Sample Room<br>4' x 7' Door to #3 Cont. Spray Pump Room<br>4' x 7' Door to #3 Pipe and Valve Room |
| North End, East Side | 8' x 7' Door to #3 Charging Pump Room<br>4' x 7' Door to Monitor Tank Room<br>30" x 7' Door to Base and Cation Demineralizer Room |
| East End | 10' x 8' Door to Outside |
| East End, North Side | 4' x 7' Door to Deborating Demineralizer Room |

b. <u>SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION</u>

1. <u>Safe Shutdown Equipment/Cables</u>

<u>Hot Shutdown Equipment/Cables</u>

<u>Equipment</u>

480V MCC 3C
480V MCC 4C
480V MCC D

| Cables | Power(P),Control(C) |
|---|---|
| AFW Pump Steam Supply Valve S/G 3C MOV-3-1405 | P,C |
| AFW Pump Steam Supply Valve S/G 4C MOV-4-1405 | P,C |
| BA Injection Stop Valve MOV-3-350 | P |
| BA Injection Stop Valve MOV-4-350 | P |
| VCT Lo-Level Isolation Valve LCV-3-115C | P,C |
| VCT Lo-Level Isolation Valve LCV-4-115C | P,C |
| AB Exhaust Fan A | P,C |

| Cables (Cont'd) | Power(P),Control(C) |
|---|---|
| AB Exhaust Fan B | P,C |
| AB Supply Fan B | P,C |
| Chg. Control Valve HCV-4-121 | C |
| Chg. Control Valve HCV-3-121 | C |
| CCW Sup. Valve for Emer. Contain. Cool. | |
| 3A 3-2903 | C |
| 3B 3-2904 | C |
| 3C 3-2905 | C |
| AB Supply Fan A | P,C |
| Pressurizer Level | |
| LI/LT-4-460 | C |
| LI/LT-4-459 | C |
| CCW Sup. Valve for Emer. Contain. Cool. | |
| 4A 4-2903 | C |
| 4B 4-2904 | C |
| 4C 4-2905 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. | |
| 3A 3-2906 | C |
| 3B 3-2907 | C |
| 3C 3-2908 | C |
| Chg. Pumps | |
| 3A | C |
| 3B | C |
| 3C | C |
| CCW Pump 4C | C |
| BA Transfer Pumps | |
| 3A | P,C |
| 3B | P,C |
| 4A | P,C |
| 4B | P,C |
| S/G 4A Level LI/LT-4-476 | C |
| S/G 4B Level LI/LT-4-486 | C |
| Emer. Contain. Cool. | |
| 3B | P,C |
| 3C | P,C |
| 4A | C |

| Cables (Cont'd) | Power(P),Control(C) |
|---|---|
| Norm. Contain. Cool. | |
| 3A | C |
| 3B | C |
| 3C | P,C |
| 3D | P,C |
| Norm. Contain. Cool. | |
| 4A | P,C |
| 4B | P,C |
| 4C | C |
| 4D | C |
| CCW Rtn. Valve for Emer. Contain. Cool. | |
| 4A 4-2906 | C |
| 4B 4-2907 | C |
| 4C 4-2908 | C |
| Control Rm. A/C C | P |
| Control Rm. A/C B | P |
| Steam Generator Level S/G 4A LI/LT-4-474 | C |
| Pressurizer Level Transmitter | |
| LI/LT-3-460 | C |
| LI/LT-3-459 | C |
| CCW SUP. Valve for Norm. Contain. Cool. | |
| 3-1417 | P,C |
| 4-1417 | P,C |

Cold Shutdown Equipment/Cables

| Cables | Power(P),Control(C) |
|---|---|
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749A | P,C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749B | P |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-4-749A | P,C |

| Cables (Cont'd) | Power(P),Control(C) |
|---|---|
| RHR Ht. Exch.<br>Cooling Water Isolation Valve<br>MOV-4-749B | P |
| RWST Isolation Valve<br>From RHR Header<br>MOV-3-862A | P,C |
| RCS Inlet Isolation Valve<br>from RHR<br>MOV-3-744A | P,C |
| RCS Inlet Isolation Valve<br>from RHR<br>MOV-4-744A | P,C |
| RHR Inlet Isolation Valve<br>from RCS<br>MOV-3-751 | P,C |
| RHR Inlet Isolation Valve<br>from RCS<br>MOV-4-751 | P,C |
| RWST Isolation Valve from<br>RHR Header<br>MOV-4-863A | P,C |
| RHR Flow Control Valve<br>HCV-3-758 | C |
| RHR Flow Control Valve<br>HCV-4-758 | C |
| RWST Isolation Valve from<br>RHR Header<br>MOV-3-863A | C |
| RWST Isolation Valve from<br>RHR Header<br>MOV-3-863B | P,C |
| RHR Pumps | |
| 3A | C |
| 3B | C |
| 4A | C |
| 4B | C |
| Accumulator Stop Valves | |
| MOV-3-865C | P,C |
| MOV-4-865A | P,C |

| Cables (Cont'd) | Power(P),Control(C) |
|---|---|
| RWST Isolation Valve from RHR Header MOV-4-862A | P,C |
| RWST Supply Valve to Charging Header LCV-3-115B | P,C |
| RWST Supply Valve to Charging Header LCV-4-115B | P,C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power(P),Control(C) |
|---|---|
| Blowdown Isolation Valve S/G 3B SV-3-6275B | C |
| Blowdown Isolation Valve S/G 4B MOV-4-1411 | C |
| BA Transfer Pump Recirculation Valve HCV-105 | C |
| Letdown Isolation Valve 4-204 | C |
| PORV Block Valve MOV-4-536 | P,C |
| Letdown Isolation Valve 3-204 | C |

2. Nuclear Safety Evaluation

As indicated in the preceding hot/cold shutdown equipment and cable listing, the main Auxiliary Building Hallway (el. 18') and its adjacent areas contain numerous A and B train safe shutdown related cables. Redundant cable tray separation is complicated by the relatively short distance between adjacent trays and congestion due to existing piping, ventilation ducting and other fixtures. Based on anticipated difficulties to be encountered in providing redundant cable tray separation, a concept of total cable protection was deemed to be the most viable approach for ensuring the capability to achieve and maintain hot/cold shutdown conditions. The fire hazard analysis and evaluation contained herein quantifies the level of protection to be provided by a combination of Flamemastic coatings on cables, baffles beneath cable trays and the use of a thermal insulating material to protect conduit.

In addition, 480 V MCC feeder breakers 3C, 4C and D are in Area 58. Several safe shutdown related valves with no redundant counterpart receive power through these breakers. Therefore, the valves as listed below must be provided an alternate power source or, under fire conditions, manual operation of these valves may be required.

| | |
|---|---|
| MOV-3-1417 | Norm. Contain. Cool. Sup. Valve |
| MOV-3-751 | RHR Inlet from RCS Isolation Valve |
| MOV-3-865C | Accumulator Stop Valve |
| MOV-3-863A | RWST Stop Valve to RHR Header |
| MOV-4-751 | RHR Inlet from RCS Isolation Valve |
| MOV-4-865A | Accumulator Stop Valve |
| MOV-4-863A | RWST Stop Valve to RHR Header |

One boric acid transfer pump and one Auxiliary Building supply or exhaust fan is required for maintaining hot shutdown conditions for both units. All four boric acid transfer pumps and all four Auxiliary Building supply and exhaust fans receive power through feeder breakers 3C, 4C or D in Fire Area 58. Therefore, at least one boric acid transfer pump and one Auxiliary Building supply or exhaust fan must be provided power through a feeder breaker independent of Fire Area 58.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The major potential combustible sources of concern in the 18' Main Auxiliary Building hallway are the 3C, 4C, and D motor control centers, lighting panels and heat tracing transformers, and the numerous cable trays routed throughout the area. It should be emphasized that these cable trays are sprayed with Flamemastic and can only be considered a combustible if exposure fires of sufficient intensity are postulated such that piloted ignition or auto ignition of the cables occurs. In addition, the motor control centers, heat tracing transformers, and lighting panels in Area 58 are totally enclosed thus reducing their possibility of adding to the combustible inventory.

Based on these considerations, only transient combustibles were considered in the design basis fire calculations. These combustibles are acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at Turkey Point Units 3 and 4. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition.

Acetone is not expected to be found within the protected area in any quantity greater than a gallon at a time, while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels are modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 58, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

This fire area is divided into the following four sectors for the purpose of analysis:

| Fire Sector | Description |
|---|---|
| A | Located in the north end of the main hallway in the Auxiliary Building on the 18.0 foot level, Fire Sector A extends from the east-west hallway on the south to the pipe and valve room on the north. (Ref. Turkey Point Nuclear Plant Units 3 and 4, Drawing 5610-E-115, Rev. 10, dated February 14, 1971) This fire sector can accommodate an effective spill diameter of 6 feet, 3 inches. |
| B | Located in the main east-west hallway of the Auxiliary Building on the 18.0 foot level. It extends west as far as the Counting Room and east as far as the component cooling pump area. (Ref. Turkey Point Nuclear Plant Units 3 and 4, Drawing 5610-E-119, Rev. 8 dated August 31, 1977, Drawing 5610-E-123, Rev 10, dated January 10, 1972, and Drawing 5610-E-124, Rev 12, dated August 31, 1977). This fire sector can accommodate an effective spill diameter of 10 feet. |
| C | Located in the main east-west hallway of the Auxiliary Building on the 18.0 foot level. It extends east as far as the Counting Room and Fire Sector B, and west to the breezeway (Fire Sector E) next to the Instrument Shop. (Ref. Turkey Point Nuclear Plant Units 3 and 4 Drawing 5610-E-119, Rev 8, dated August 31, 1977) This fire sector can accomodate an effective spill diameter of 10 feet. |
| D | Located in the main hallway in the south end of the Auxiliary Building on the 18.0 foot level. It extends south as far as the Charging Pump Room and north to the intersection of the main east-west corridor (Fire Sector B). (Ref. Turkey Point Nuclear Plant |

Unit 3 and 4 Drawing 5610-E-123, Rev 10, dated January 10, 1972). This fire sector can accommodate an effective spill diameter of 10 feet.

Fires involving three different fuels are postulated in these fire sectors: acetone, lubricating oil, and heptane. In evaluating the effects of such fires two levels of passive protection are considered.

The first involves only that protection which is associated with the existing separation and use of flame retardant coatings. The second adds the protection afforded by baffles and radiant energy shields to the existing level of protection. Assuming these protective measures, a "back" calculation analysis is utilized. A "back" calculation is directed towards determining the minimum quantities of the three fuels which, if ignited, may exceed the damage criterion of the most limiting cable.

The results of the "back" calculation for Fire Area 58 are presented in Tables 5.2.5 through 5.2.12. For the case of piloted ignition of a cable, the results indicated that the most limiting fuel quantity involves the combustion of 7.5 gallons of either lubricating oil or acetone in Fire Sector C. This fire size and location is considered to be the fire area's design basis fire.

Table 5.2.5 Fire Sector A, Existing Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m²) | (BTU/Hr·ft²) |
| Jacket Degradation | Acetone | 2.8 | 56.2 | 17818.5 |
| | Lubricating Oil | 2.7 | 58.9 | 18674.6 |
| | Heptane | 5.1 | 63.8 | 20228.2 |
| Piloted Ignition | Acetone | 3.6 | 56.2 | 17818.5 |
| | Lubricating Oil | 3.5 | 58.9 | 18674.6 |
| | Heptane | 6.6 | 63.8 | 20228.2 |
| Electrical Failure | Acetone | 12.0 | 56.2 | 17818.5 |
| | Lubricating Oil | 11.5 | 58.9 | 18674.6 |
| | Heptane | 21.7 | 63.8 | 20228.2 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.6 Fire Sector A, Proposed Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m$^2$) | (BTU/Hr·ft$^2$) |
| Jacket Degradation | Acetone | 10.0 | 23.0 | 7282.8 |
| | Lubricating Oil | 9.0 | 35.5 | 11258.7 |
| | Heptane | 11.0 | 62.6 | 19831.8 |
| Piloted Ignition | Acetone | 12.0 | 23.0 | 7282.8 |
| | Lubricating Oil | 10.5 | 35.5 | 11258.7 |
| | Heptane | 12.5 | 67.0 | 21236.4 |
| Electrical Failure | Acetone | 32.5 | 23.0 | 7282.8 |
| | Lubricating Oil | 23.5 | 35.5 | 11258.7 |
| | Heptane | 27.0 | 67.0 | 21236.4 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.7 Fire Sector B, Existing Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m$^2$) | (BTU/Hr·ft$^2$) |
| Jacket Degradation | Acetone | 6.5 | 62.4 | 19784.3 |
| | Lubricating Oil | 6.2 | 65.4 | 20735.5 |
| | Heptane | 11.8 | 70.9 | 22479.3 |
| Piloted Ignition | Acetone | 8.4 | 62.4 | 19784.3 |
| | Lubricating Oil | 8.0 | 65.4 | 20735.5 |
| | Heptane | 15.2 | 70.9 | 22479.3 |
| Electrical Failure | Acetone | 27.8 | 62.4 | 19784.3 |
| | Lubricating Oil | 25.0 | 97.0 | 30748.1 |
| | Heptane | 32.4 | 171.5 | 54368.8 |
| Auto Ignition | | Not Achieved | | |

## Table 5.2.8 Fire Sector B, Proposed Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | ($kW/m^2$) | ($BTU/Hr{\cdot}ft^2$) |
| | Acetone | 11.0 | 58.8 | 18639.7 |
| Jacket Degradation | Lubricating Oil | 10.5 | 73.6 | 23338.5 |
| | Heptane | 15.0 | 112.2 | 35586.4 |
| | Acetone | 13.0 | 58.8 | 18639.7 |
| Piloted Ignition | Lubricating Oil | 12.5 | 86.1 | 27301.7 |
| | Heptane | 17.0 | 125.6 | 39831.7 |
| | Acetone | 33.5 | 58.8 | 18639.7 |
| Electrical Failure | Lubricating Oil | 25.0 | 97.0 | 30748.1 |
| | Heptane | 32.4 | 171.5 | 54368.8 |
| Auto Ignition | Not Achieved | | | |

Table 5.2.9 Fire Sector C, Existing Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m2) | (BTU/Hr·ft2) |
| Jacket Degradation | Acetone | 5.5 | 152.0 | 48198.0 |
| | Lubricating Oil | 6.0 | 153.5 | 48661.7 |
| | Heptane | 8.0 | 219.9 | 69736.5 |
| Piloted Ignition | Acetone | 6.5 | 165.8 | 52555.2 |
| | Lubricating Oil | 6.5 | 164.9 | 52295.2 |
| | Heptane | 9.0 | 244.5 | 77536.0 |
| Electrical Failure | Acetone | 13.5 | 165.8 | 52555.2 |
| | Lubricating Oil | 12.0 | 273.4 | 86692.6 |
| | Heptane | 16.5 | 422.0 | 133788.1 |
| Auto Ignition | Not Achieved | | | |

Table 5.2.10 Fire Sector C, Proposed Configuration

| Damage Criterion | Fuel Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux (kW/m$^2$) | Maximum Heat Flux (BTU/Hr·ft$^2$) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 6.5 | 133.9 | 42457.0 |
| | Lubricating Oil | 6.5 | 125.3 | 39714.4 |
| | Heptane | 9.0 | 185.7 | 58880.5 |
| Piloted Ignition | Acetone | 7.5 | 133.9 | 42457.0 |
| | Lubricating Oil | 7.5 | 142.5 | 45171.0 |
| | Heptane | 10.5 | 213.3 | 67643.9 |
| Electrical Failure | Acetone | 16.5 | 133.9 | 42457.0 |
| | Lubricating Oil | 14.0 | 220.9 | 70034.5 |
| | Heptane | 19.0 | 363.8 | 115354.5 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.11 Fire Sector D, Existing Configuration

| Damage Criterion | Fuel Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux (kW/m$^2$) | Maximum Heat Flux (BTU/Hr·ft$^2$) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 6.5 | 62.4 | 19784.3 |
| | Lubricating Oil | 6.2 | 65.4 | 20735.5 |
| | Heptane | 11.5 | 146.7 | 46518.5 |
| Piloted Ignition | Acetone | 8.4 | 62.4 | 19784.3 |
| | Lubricating Oil | 8.0 | 65.4 | 20735.5 |
| | Heptane | 13.0 | 163.8 | 51943.3 |
| Electrical Failure | Acetone | 24.5 | 82.6 | 26204.7 |
| | Lubricating Oil | 18.5 | 136.3 | 43214.7 |
| | Heptane | 24.5 | 241.1 | 76432.7 |
| Auto Ignition | | Not Achieved | | |

**Table 5.2.12 Fire Sector D, Proposed Configuration**

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m$^2$) | (BTU/Hr·ft$^2$) |
| Jacket Degradation | Acetone | 8.5 | 82.6 | 26204.7 |
| | Lubricating Oil | 8.5 | 101.0 | 32035.3 |
| | Heptane | 11.5 | 146.7 | 46518.5 |
| Piloted Ignition | Acetone | 9.5 | 82.6 | 26204.7 |
| | Lubricating Oil | 9.5 | 111.7 | 35408.8 |
| | Heptane | 13.0 | 163.8 | 51943.3 |
| Electrical Failure | Acetone | 24.5 | 82.6 | 26204.7 |
| | Lubricating Oil | 18.5 | 136.3 | 43214.7 |
| | Heptane | 24.5 | 241.1 | 76432.7 |
| Auto Ignition | | Not Achieved | | |

3. Fire Hazards Evaluation

The fire area hazards evaluation was separated into four categories, viz., fire area structural ratings evaluation, fire area adjacent effects evaluation, available fire suppression capabilities determination and a fire area summary.

Fire Area Structural Ratings Evaluation

Area boundary structural fire rating estimates based on standardized curves for solid concrete walls (See Section 5.2 for details);

| | |
|---|---|
| Walls | 4 hours |
| Floor | 4 hours |
| Ceiling | 4 hours |

Fire area structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to adjacent areas, hot gas radiation, or burning liquid spread. No fire spread hazard was found to exist. There are no significant ignition sources near these penetrations. Any burning liquid entering the drain system would not be expected to have an effect on adjacent areas. In spite of this determination, FPL proposes upgrading the walls and floor of Area 58, by sealing all penetrations and installing fire rated doors and ventilation dampers.

Available Fire Suppression Capabilities Determination

Fire Area 58 is accessible from outdoors via five separate entrances. Hose Stations 1 and 3 are available for fighting a fire in this area, in addition to portable extinguishers 3.4.2, 3.4.3, 3.4.4, 3.4.5 and 3.4.9. Furthermore, it should be noted that self-contained emergency lighting units have been installed in the area to enhance fire fighting capabilities. Area 58 fire suppression equipment is as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.4.2 | 10A:40BC | 105000 Btu | 100 $ft^2$ | Acceptable |
| 3.4.3 | 10 BC | Minimal | 25 $ft^2$ | " |
| 3.4.4 | 10 BC | Minimal | 25 $ft^2$ | " |
| 3.4.5 | 10 BC | Minimal | 25 $ft^2$ | " |
| 3.4.9 | 4A:40BC | 42000 Btu | 100 $ft^2$ | " |
| HS-1 | 100 GPM@50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-3 | 100 GPM@ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

| | |
|---|---|
| Available Fire Suppression Heat Removal Rate (Two Hose Stations @ 50% eff) | 840,000 $\frac{Btu}{Min}$ |
| Total type "B" Capability available | 275 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment cables in Area 58. Fire spread from adjacent areas is prevented by sealing all wall and floor penetrations. FPL proposes to provide protection by use of cable tray baffles and spraying conduit. Although no credit is given for existing fire detection and suppression equipment, the potential for a large fire in this area is considered acceptably small. A fire in this area would be detected promptly and it is expected that immediate use of portable fire fighting equipment would be employed before significant fire development could occur. Based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Protect all electrical cable trays located in Area 58 by installation of fire resistant baffles under these trays. Baffles are to span the width of the lowest cable tray in a stack and are to be located within 4 inches of the bottom of the lowest tray. These baffles will be constructed of ½ inch thick marinite or equivalent. See Appendix D.

2. Protect one train of conduit in Area 58 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

3. Protect one train of wireways in Area 58 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

4. Rewire the power supplies to one Auxiliary Building exhaust fan and one boric acid transfer pump to an MCC outside of Area 58. This equipment is presently powered by MCC D.

5. Upgrade perimeter walls for combined areas 31, 32, 33, 34, 35, 36, 37, 38, 39, 48, 49, 50, 51 and 58 to 3-hour rated barrier by sealing all piping and other penetrations and installation of 3-hour rated fire dampers and doors on all ventilation duct penetrations and doorways. See Appendix D.

6. Provide emergency operating procedures for a fire in Area 58 to ensure that the following off-normal operator actions are conducted if required:

a.) Manual operation of the RWST isolation (from RHR header) valves, MOV-4-863A and MOV-3-863A.

b.) Manual operation of the RHR inlet isolation (from RCS) valves, MOV-4-751 and MOV-3-751.

c.) Manual operation of the accumulator stop valves, MOV-3-865C and MOV-4-865A.

Note: These are cold shutdown valves.

7. Provide self-contained emergency lighting units in the Unit 3 and 4 RHR Heat Exchanger Rooms (Fire Areas 11 and 14) to facilitate the manual operation of MOV-3-863A and MOV-4-863A.

e. <u>EXEMPTION REQUEST</u>

FPL requests exemption for Area 58 from those specific provisions of Section III.G.3/III.L of Appendix R to 10CFR Part 50.*. Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.3/III.L. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with this area, supplemented by the specific modifications identified, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications coupled with a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.3/III.L in Area 58 is estimated to be $2,742,000 versus the cost for the proposed modifications of $517,000. In addition, the estimated man-rem exposure for full implementation is 66 man-rem as opposed to 14 man-rem for the proposed modifications.

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* Specifically, FPL requests exemption from the installation of an alternate shutdown system consisting of centrally located panels housing instrumentation, modulating control devices, and transfer devices. These local panels containing equipment on/off control and transfer devices would be provided in Switchgear and motor control center areas. Locations of the panels would, in all cases, be independent of Fire Area 58. Assignment of equipment power sources and routing of cables would also ensure that neither the distribution equipment nor the cabling is exposed to Fire Area 58. In addition, FPL requests exemption from the installation of an automatic fire suppression system in Area 58.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are five types of backfit activities necessary to support our exemption requests which do not require a unit outage. FPL requests exemption from 10 CFR 50.48(c)(1&2) to extend the allowed completion schedule for these activities from 1 month and 9 months, respectively, (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There are two types of backfit activities necessary to support our exemption request which require a unit outage on both units because major construction work is required on the ventilation system and cable disconnections will also be made. These modifications will impact equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities are not possible during the Steam Generator Repair (Winter 1982), Fall 1983, or Fall 1984 refueling outages and that NRC approval of this exemption request is required prior to March 1, 1983 in order to assure installation during the Spring 1985 and Spring 1986 refueling outages.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10 CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1) There are three types of backfits necessary to implement III.G.3 criteria that can only be completed during an outage on both units because of the impact on safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications, FPL requests exemption from 10CFR50.48(c)(5) to extend from 30 days to 6 months the time period for submitting detailed designs containing the informational requirements necessary for NRC review.

2) Additionally, for the three types of backfits necessary to implement III.G.3 criteria that can only be completed during the outages, consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(4) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii) to 10 CFR 50.48(c)(3). It is noted that completion of these activities is not possible during the Steam Generator Repair (Winter 1982), Fall 1983, or Fall 1984 refueling outages and that NRC action and approval of the detailed designs would be required prior to November 1, 1982 in order to assure installation during the Spring 1985 and Spring 1986 refueling outages.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.8 FIRE AREA 59

### a. AREA DESCRIPTION

Fire Area 59 encompasses the Unit 4 Containment Building. Floor elevations are at 14', 30'-6" and 58' and fire fighting accessibility is available through the personnel air lock, emergency air lock and the access hatch.

Numerous safe shutdown related components and cables are located within containment. Cables are routed in SA and SB trays that usually run outside the secondary shield wall at tray elevations ranging from 18'-7" to 80'. These cable trays are not typically separated by a barrier, however, they are sprayed with Flamemastic and are vertically separated by a minimum distance of 4' and horizontally separated by 1'-6". A list of safe shutdown equipment and their locations is provided below:

| EQUIPMENT | ELEVATION | DISTANCE FROM REACTOR VESSEL CENTERLINE | |
|---|---|---|---|
| Normal Containment Coolers; | | | |
| 4A | 58'-0" | 21' N | 46' E |
| 4B | 58'-0" | 14' S | 47' E |
| 4C | 58'-0" | 33' N | 34' W |
| 4D | 58'-0" | 17' S | 46' W |
| Emergency Containment Coolers; | | | |
| 4A | 69'-6" | 32' S | 37' E |
| 4B | 59'-0" | 49' N | 8' E |
| 4C | 69'-6" | 26' S | 40' W |
| Accumulator Discharge Valves; | | | |
| MOV-4-865A | 21'-4" | 17'-6" S | 46'-6" E |
| MOV-4-865B | 21'-4" | 51' N | 9'-6" W |
| MOV-4-865C | 18'-0" | 3' S | 50' W |
| Letdown Isolation Valves; | | | |
| LCV-4-460 | 14'-6" | 22'-6" N | 29' W |
| CV-4-200A | 16'-6" | 36'-6" N | 29'-6" W |
| CV-4-200B | 15'-9" | 35' N | 31' W |
| CV-4-200C | 15'-0" | 33'-6" N | 32'-6" W |
| Excess Letdown Isolation Valves; | | | |
| CV-4-387 | | | |
| HCV-4-137 | 14'-0" | 50'-6" | 16' W |

| EQUIPMENT(Cont'd) | ELEVATION | DISTANCE FROM REACTOR VESSEL CENTERLINE | |
|---|---|---|---|
| -RHR Inlet Isolation Valves; | | | |
| MOV-4-750 | 20'-3" | 12' S | 21' E |
| MOV-4-751 | 19'-3" | 21' S | 45' E |
| Pressurizer Heaters; | 36'-0" | 27'-6" N | 11'-6" W |
| Pressurizer Sprays; | | | |
| PCV-4-455A | 73'-0" | 9' N | 26' E |
| PCV-4-455B | 73'-0" | 10'-6" N | 25' E |
| Auxiliary Spray; | | | |
| CV-4-311 | 17'-0" | 29' N | 32'-6" W |
| PORV's; | | | |
| PCV-4-455C | 71'-6 3/8" | 10' N | 31' E |
| PCV-4-456 | 71'-6 3/8" | 10'-6" N | 33' E |
| PORV Block Valves; | | | |
| MOV-4-535 | 71'-9 3/16" | 12'-6" N | 33' E |
| MOV-4-536 | 71'-9 3/16" | 12' N | 31' E |
| Charging Line Isolation Valves; | | | |
| CV-4-310A | 15'-6" | 27' N | 34'-6" W |
| CV-4-310B | 18'-6" | 31' N | 30'-6" W |
| RHR to Cold Legs RCS; | | | |
| MOV-4-744A | 21'-0" | 8'-6" S | 49'-6" E |
| MOV-4-744B | 21'-0" | 8'-6" S | 54' E |
| RCS Temperature Hot Leg; | | | |
| TE-4-413 | above 14'-0" | 15' S | 18'-6" E |
| TE-4-423 | above 14'-0" | 23'-6" N | 4' E |
| TE-4-433 | above 14'-0" | 8'-6" S | 21'-6" W |

| EQUIPMENT(Cont'd) | ELEVATION | DISTANCE FROM REACTOR VESSEL CENTERLINE | |
|---|---|---|---|
| RCS Temperature Cold Leg; | | | |
| TE-4-410 | above 14'-0" | 1' S | 24' E |
| TE-4-420 | above 14'-0" | 21' N | 12' W |
| TE-4-430 | above 14'-0" | 21' S | 13' W |
| RCS Pressurizer Pressure Transmitters; | | | |
| PT-4-402 | above 14'-0" | 39' N | 19' E |
| PT-4-403 | above 14'-0" | 40' N | 16'-6" E |
| PT-4-444 | above 30'-6" | 16' N | 36' E |
| PT-4-445 | above 30'-6" | 16' N | 36' E |
| PT-4-455 | above 30'-6" | 16' N | 22' E |
| PT-4-456 | above 30'-6" | 19'-6" N | 27' E |
| PT-4-457 | above 30'-6" | 19'-6" N | 31' E |
| PT-4-458 | above 30'-6" | 16' N | 36' N |
| Pressurizer Level Transmitters; | | | |
| LT-4-459 | above 30'-6" | 16' N | 22' E |
| LT-4-460 | above 30'-6" | 19'-6" N | 27' E |
| LT-4-461 | above 30'6" | 19'-6" N | 31' E |
| LT-4-462 | above 30'-6" | 16' N | 36' E |
| Steam Generator Level Transmitters; | | | |
| LT-4-474 | above 30'-6" | 19'-6" S | 38' E |
| LT-4-475 | above 30'-6" | 31' S | 28' E |
| LT-4-476 | above 30'-6" | 35' S | 22'-6" E |
| LT-4-477 | above 30'-6" | 37' S | 18' E |
| LT-4-484 | above 30'-6" | 45' N | 1'-6" W |
| LT-4-485 | above 30'-6" | 45'-6" N | 8' E |
| LT-4-486 | above 30'-6" | 41' N | 13'-6"E |
| LT-4-487 | above 30'-6" | 43' N | 11' E |
| LT-4-494 | above 30'-6" | 11' S | 42' W |
| LT-4-495 | above 30'-6" | 22'-6" S | 35'-6" W |
| LT-4-496 | above 30'-6" | 30'-6" S | 28' W |
| LT-4-497 | above 30'-6" | 19' S | 39' W |

Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 10,600 $ft^2$ |
| Wall and Ceiling Surface Area, | 95,700 $ft^2$ |
| Free Volume Excluding Components, | $1.55 \times 10^6$ $ft^3$ |
| Ceiling Height, | Maximum height from 58' elevation = 126' |
| Floor Composition,<br>Floor Thickness, | Concrete<br>10'-6" plus containment mat |
| Wall Composition,<br>Wall Thickness, | Concrete<br>3'-9" |
| Ceiling Composition,<br>Ceiling Thickness, | Concrete<br>3'-9" |
| Fire detector(s) in Area,<br>Detector No./Type, | Yes<br>4-1 through 4-10/Ionization |
| Automatic Suppression in Area,<br>Type of Automatic Suppression, | None<br>N/A |
| Installed Communications Near Fire Area, | Telephone handset T-3146 |
| Hose Station(s) Available To Area, | None |
| Fire Extinguisher(s) Immediately Available To Area, | 4.5.1, 4.5.2, 4.5.3, 4.5.4 |
| Number of Floor Drains,<br>Drain(s) Size/Capacity,<br>Drain(s) Flow To, | (Numerous)<br>Total capacity = 330 gpm<br>Waste Holdup Tank/ CVCS Holdup Tank |
| Normal Forced Draft/ Type Ventilation, | Yes/Fan |
| Normal Ventilation Flow Rate, | 35,000 CFM |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

Norm. Contain. Cool. 4A

Norm. Contain. Cool. 4B

Norm. Contain. Cool. 4C

Norm. Contain. Cool. 4D

Emer. Contain. Cool. 4A

Emer. Contain. Cool. 4B

Emer. Contain. Cool. 4C

Chg. Line Isolation Valve 4-310A

Chg. Line Isolation Valve 4-310B

Pressurizer Heater Control Group 4A

Pressurizer Heater Backup Group 4A

Pressurizer Heater Backup Group 4B

Steam Generator Level
S/G 4A
LT-4-477
LT-4-474
LT-4-475
LT-4-476

S/G 4B
LT-4-487
LT-4-484
LT-4-485
LT-4-486

S/G 4C
LT-4-497
LT-4-494
LT-4-495
LT-4-496

Equipment(Cont'd)

Pressurizer Level
LT-4-459
LT-4-460
LT-4-461
LT-4-462

RCS/Pressurizer Pressure
PT-4-402
PT-4-403
PT-4-444
PT-4-445
PT-4-455
PT-4-456
PT-4-457
PT-4-458

| Cables | Power(P),Control(C) |
|---|---|
| RCS/Pressurizer Pressure | |
| PI/PT-4-402 | C |
| PI/PT-4-403 | C |
| PI/PT-4-444 | C |
| PI/PT-4-445 | C |
| PI/PT-4-455 | C |
| PI/PT-4-456 | C |
| PI/PT-4-457 | C |
| PI/PT-4-458 | C |
| RCS Temperature Hot Leg TE-4-413 | C |
| RCS Temperature Hot Leg TE-4-423 | C |

| Cables(Cont'd) | Power(P),Control(C) |
|---|---|
| RCS Temperature Hot Leg TE-4-433 | C |
| RCS Temperature Cold Leg TE-4-410 | C |
| RCS Temperature Cold Leg TE-4-420 | C |
| RCS Temperature Cold Leg TE-4-430 | C |
| Steam Generator Level | |
| S/G 4A | |
| LI/LT-4-497 | C |
| LI/LT-4-494 | C |
| LI/LT-4-495 | C |
| LI/LT-4-496 | C |
| S/G 4B | |
| LI/LT-4-487 | C |
| LI/LT-4-484 | C |
| LI/LT-4-485 | C |
| LI/LT-4-486 | C |
| S/G 4C | |
| LI/LT-4-477 | C |
| LI/LT-4-474 | C |
| LI/LT-4-475 | C |
| LI/LT-4-476 | C |
| Pressurizer Level | |
| LI/LT-4-459 | C |
| LI/LT-4-460 | C |
| LI/LT-4-461 | C |
| LI/LT-4-462 | C |
| Pressurizer Heater Control Group 4A | P,C |
| Pressurizer Heater Backup Group 4A | P,C |
| Pressurizer Heater Backup Group 4B | P,C |

| Cables(Cont'd) | Power(P),Control(C) |
|---|---|
| Chg. Line Isolation Valve 4-310A | C |
| Chg. Line Isolation Valve 4-310B | C |
| Norm. Contain. Cool. 4A | P,C |
| Norm. Contain. Cool. 4B | P,C |
| Norm. Contain. Cool. 4C | P,C |
| Norm. Contain. Cool. 4D | P,C |
| Emer. Contain. Cool. 4A | P |
| Emer. Contain. Cool. 4B | P |
| Emer. Contain. Cool. 4C | P |

Cold Shutdown Equipment/Cables

Equipment

RCS Inlet Isolation Valve from RHR
MOV-4-744A
MOV-4-744B

RHR Inlet Isolation Valve from RCS
MOV-4-750

RHR Inlet Isolation Valve from RCS
MOV-4-751

Accumulator Stop Valves
MOV-4-865A
MOV-4-865B
MOV-4-865C

| Cables | Power(P),Control(C) |
|---|---|
| Accumulator Stop Valve MOV-4-865A | P,C |
| Accumulator Stop Valve MOV-4-865B | P,C |

| Cables(Cont'd) | Power(P),Control(C) |
| --- | --- |
| Accumulator Stop Valve MOV-4-865C | P,C |
| RCS Inlet Isolation Valve from RHR MOV-4-744A | P,C |
| RCS Inlet Isolation Valve from RHR MOV-4-744B | P,C |
| RHR Inlet Isolation Valve from RCS MOV-4-750 | P,C |
| RHR Inlet Isolation Valve from RCS MOV-4-751 | P,C |
| Pressurizer Auxiliary Spray Valve 4-311 | C |

Equipment/Cables To Mitigate The Consequences Of A Fire

Equipment

Pressurizer Spray Valve PCV-4-455A

Pressurizer Spray Valve PCV-4-455B

PORV PCV-4-455C

PORV PCV-4-456

PORV Block Valve 4-536

PORV Block Valve 4-535

Equipment(Cont'd)

Letdown Isolation Valves
LCV-4-460
4-200A
4-200B
4-200C
4-204

Excess Letdown Isolation Valves
4-387
HCV-4-137

| Cables | Power(P),Control(C) |
|---|---|
| Excess Letdown Isolation Valve 4-387 | C |
| Letdown Isolation Valve 4-200A | C |
| Letdown Isolation Valve 4-200B | C |
| Letdown Isolation Valve 4-200C | C |
| Pressurizer Spray PCV-4-455A | C |
| Pressurizer Spray PCV-4-455B | C |
| Excess Letdown Isolation Valve HCV-4-137 | C |
| Letdown Isolation Valve LCV-4-460 | C |
| PORV PCV-4-456 | C |
| PORV Block Valve 4-536 | P,C |
| PORV Block Valve 4-535 | P,C |
| PORV PCV-4-455C | C |
| Letdown Isolation Valve 4-204 | C |

| Cables | Power(P),Control(C) |
|---|---|
| Steam Flow S/G 4A | |
| FT-4-474 | C |
| FT-4-475 | C |
| Steam Flow S/G 4B | |
| FT-4-484 | C |
| FT-4-485 | C |
| Steam Flow S/G 4C | |
| FT-4-494 | C |
| FT-4-495 | C |

2. Nuclear Safety Evaluation

As indicated in the preceding equipment/cable list, the Containment Building (Area 59) houses much of the equipment and associated cables required to achieve and maintain hot and cold shutdown conditions. This equipment consists mainly of instrumentation, however a number of shutdown related valves and the containment cooling fans are also included. The fire hazards analysis contained herein must evaluate the possible fire hazards associated with this area, the potential impact on safe shutdown related equipment/cables, and must provide reasonable assurance that the safe shutdown capability of the plant is maintained, or additional fire protection must be provided.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

Liquid Combustibles

Lubricating oil is contained within the following equipment:

Reactor Coolant Pumps (3)
Manipulator Crane Trolley
CRDM Cooler
Normal Containment Coolers (4)
Emergency Containment Coolers (3)
Hydraulic Snubbers
Sump Pumps (2)
Reactor Building Crane

The lubricating oil associated with the equipment listed above can only be considered a combustible if sprayed onto a hot surface which raises its temperature to above its flash point, i.e., above approximately 450°F. The only major ignition source of concern in containment is the RCS piping, and it is lagged for the most part, thus significantly reducing the probability of a lubricating oil fire.

The largest potential combustible source in containment is the lube oil associated with the reactor coolant pumps. This consists of approximately 200 gallons per pump. The reactor coolant pumps have an oil collection system meeting the requirements of Section III.O of Appendix R, thus precluding this potential combustible source from initiating a fire in containment. The second largest combustible source in containment is the lubricating oil associated with the Reactor Building crane and the manipulator crane trolley. Since the manipulator crane is stored during normal plant operation over the fuel assembly tipping machine in the fuel transfer area, the potential for the ignition of an oil spill from this equipment is considered extremely unlikely and does not warrant further evaluation. Likewise, the reactor building crane is parked over the refueling cavity and is not considered a potential fire hazard. The remaining liquid combustibles in containment consist of the small amounts of lubricating oil associated with the specific equipment identified in the above list. These potential combustible sources are localized, generally well separated, and confined within the steel structure of the specific equipment. The lubricating oil systems associated with the equipment are not pressurized, and therefore the potential for oil spray is unlikely. In addition, the lack of ignition sources in most areas further precludes the possibility of a fire, as previously stated. Transient combustibles were not considered in this evaluation due to the limited and controlled access to the Containment Building during power operation.

<u>Other Combustibles:</u>

Other potential combustible sources in containment consist primarily of the electrical cables routed in trays. As discussed in the Area Description, redundant safe shutdown cable trays are separated by a minimum of 4 feet vertical height and 1½ feet horizontal distance and are sprayed with Flamemastic. This fire retardant coating, although not a rated fire barrier, acts as a radiant energy shield to provide a substantial level of protection against any postulated equipment or exposure fires. Taking into consideration the preceding discussion on liquid combustibles in containment and the detailed test results (See Appendix B) of Factory Mutual's report, "Small Scale Testing of Flame-retardant Coated Cables", one can conclude that a fire involving the cable trays in containment is extremely unlikely.

In summary, taking into consideration the preceding discussion of the existing fire protection design features associated with the equipment in containment in addition to the containment's limited and controlled access during power operation, one can conclude that no significant potential fire hazards are associated with this area.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 59, no flammable liquids or combustible liquids will be allowed when Unit 4 is in all operating modes except cold shutdown and refueling. In addition these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

Design basis fire calculations were not conducted for Area 59 based on the preceding evaluation of in situ combustibles and the extremely limited access to the area during power operation. This evaluation demonstrated that no significant fire hazards exist in containment.

3. Fire Hazards Evaluation

The fire hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

Available Fire Suppression Capabilities Determination

Fire Area 59 is accessible through the personnel air lock, the emergency air lock and the access hatch. Portable extinguishers 4.5.1 through 4.5.4 are available to fight a fire in this area.

Area 59 fire suppression equipment ratings are summarized as follows:

| I.D. No. | Extinguisher Hose station rating | Type "A" capability | Type "B" capability | Type "C" capability |
|---|---|---|---|---|
| 4.5.1 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.5.2 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.5.3 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.5.4 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |

Total type "B" capability available, 400 $ft^2$

Fire Area Summary

As indicated by the preceding fire hazards analysis, the two major combustible sources in containment, i.e., the lubricating oil associated with the reactor coolant pumps and the containment building cranes, do not represent a potential fire hazard in containment. In addition, the remaining liquid combustible sources in containment are localized, well separated, and due to their small quantities are not considered to present a problem. The cable trays in containment are not separated by a fire rated barrier, however, the trays are generally well separated and are sprayed with a flame retardant coating which acts as a radiant energy shield to provide a substantial level of protection. Although no credit is given for the existing fire suppression equipment available in the area, the probability of a fire in containment is considered extremely unlikely.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Provide dedicated portable emergency lighting units for containment entry to facilitate manual operation of the following motor operated valves:

   MOV-4-865A, B, & C (Accumulator Stop Valves)
   MOV-4-750 & 751 (RHR Inlet Isolation Valves)

   Note: Refer to Section 5.2 (Fire Area 61) and Sections 5.2.7 & 5.2.10 of this report.

e. EXEMPTION REQUEST

FPL requests exemption for Area 59 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features and equipment layout in containment, in addition to the fire retardant coatings on cables, provide an adequate level of protection from any conceivable fire in the area. Flamemastic, although not a fire rated barrier, acts as a radiant energy shield to separate essential equipment cables.

FPL also requests exemption from those provisions of Section III.J. that would require the installation of emergency lighting units in containment (Area 59) to facilitate the manual operation of accumulator stop valves MOV-4-865 A, B, and C and RHR inlet isolation valves MOV-4-750 and 751. Such an exemption is authorized by law, will not endanger life or property or common defense and security and is in the public interest. Due to the harsh environmental conditions (i.e., temperature, humidity, etc.) existing in containment and their detrimental effect on battery power supplies, FPL contends that the existing lighting system in containment supplemented by the dedicated portable emergency lighting units proposed herein, would exceed in usefulness and reliability that of installed self-contained emergency lighting units. Based on this evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.J. in question.

In summary, it is FPL's position that the inherent design features associated with this area coupled with a strict combustible control program based on Appendix C of this report will provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire

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* Specifically, FPL requests exemption from that provision which requires the installation of a non-combustible radiant energy shield between redundant safe shutdown equipment and cables separated by a distance of less than 20'.

damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 59, based on implementation of the specific requirements of subsection (f), is estimated to be $1,660,000. In addition, the estimated man-rem exposure for full implementation is 1000 man-rem.

f. SCHEDULE EXEMPTIONS

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10 CFR Part 50 are provided in Section 5.2.19 and are discussed as follows.

There are two types of backfit activities necessary to implement III.G.2 criteria which require a Unit 4 outage because the modifications require construction inside Containment. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR 50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities is not possible during the Steam Generator Repair outage (Winter 1982) and that NRC action is required prior to June 1, 1983 in order to assure installation during the Fall 1984 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.9 FIRE AREA 60

### a. -AREA DESCRIPTION

Fire Area 60 encompasses the Unit 3 Containment Building. Floor elevations are at 14', 30'-6" and 58' and fire fighting accessiblity is available through the personnel air lock, emergency air lock, and the access hatch.

Numerous safe shutdown related components and cables are located within containment. Cables are routed in SA and SB trays that usually run outside the secondary shield wall at tray elevations ranging from 19'-5" to 80'. These cable trays are not typically separated by a barrier, however they are sprayed with Flamemastic and are vertically separated by a minimum distance of 4' and horizontally separated by 1'-6". A list of safe shutdown equipment and their locations is provided below:

| EQUIPMENT | ELEVATION | DISTANCE FROM REACTOR VESSEL CENTERLINE | |
|---|---|---|---|
| Normal Containment Coolers; | | | |
| 3A | 58'-0" | 35' N | 37' E |
| 3B | 58'-0" | 16' N | 47' E |
| 3C | 58'-0" | 17' N | 45' W |
| 3D | 58'-0" | 7' S | 51' W |
| Emergency Containment Coolers; | | | |
| 3A | 69'-6" | 28' S | 40' E |
| 3B | 59'-0" | 47' N | 9' W |
| 3C | 59'-0" | 25' S | 43' W |
| Accumulator Discharge Valves; | | | |
| MOV-3-865A | 21'-4" | 5'-6" | 52' E |
| MOV-3-865B | 21'-4" | 51'-6" | 8' E |
| MOV-3-865C | 22'-6" | 27' S | 46'-6" W |
| Letdown Isolation Valves; | | | |
| LCV-3-460 | 14'-6" | 22' N | 29'-6" W |
| CV-3-200A | 16'-6" | 13'-6" N | 45'-6" |
| CV-3-200B | 15'-6" | 11'-6" N | 46' W |
| CV-3-200C | 14'-9" | 9'-6" N | 46'-6" W |
| Excess Letdown Isolation Valves; | | | |
| CV-3-387 | | | |
| HCV-3-137 | 14'-0" | 49'-6" S | 16' W |

| EQUIPMENT(Cont'd) | ELEVATION | DISTANCE FROM REACTOR VESSEL CENTERLINE | |
|---|---|---|---|
| RHR Inlet Isolation Valves from RCS; | | | |
| MOV-3-750 | 15'-6" | 4' S | 34' W |
| MOV-3-751 | 15'-6" | 23'-6" S | 44'-6" W |
| Pressurizer Heaters; | 36'-0" | 27'-6" N | 11'-6" W |
| Pressurizer Sprays; | | | |
| PCV-3-455A | 73'-0" | 8'-6" N | 25'-6" E |
| PCV-3-455B | 73'-0" | 10'-6" N | 25' E |
| Auxiliary Spray; | | | |
| CV-3-311 | 17'-0" | 29' N | 32'-6" W |
| PORV'S; | | | |
| PCV-3-455C | 71'-6 3/8" | 10' N | 31' E |
| PCV-3-456 | 71'-6 3/8" | 10'-6" N | 33' E |
| PORV Block Valves; | | | |
| MOV-3-535 | 71'-9 3/16" | 12'-6" N | 32'-6" E |
| MOV-3-536 | 71'-9 3/16" | 12' N | 31' E |
| Charging Line Isolation Valves; | | | |
| CV-3-310A | 15'-6" | 27' N | 34'-6" W |
| CV-3-310B | 18'-6" | 31' N | 30'-6" W |
| RHR to Cold Legs RCS; | | | |
| MOV-3-744A | 21'-0" | 16' S | 52'-6" W |
| MOV-3-744B | 21'-0" | 16' S | 48' W |
| RCS Temperature Hot Leg; | | | |
| TE-3-413 | above 14'-0" | 15' S | 18'-6" E |
| TE-3-423 | above 14'-0" | 23' N | 3'-6" E |
| TE-3-433 | above 14'-0" | 8'-6" S | 21'-6" W |

| EQUIPMENT(Cont'd) | ELEVATION | DISTANCE FROM REACTOR VESSEL CENTERLINE | |
|---|---|---|---|
| RCS Temperature Cold Leg; | | | |
| TE-3-410 | above 14'-0" | 0'-6" S | 23' E |
| TE-3-420 | above 14'-0" | 21' N | 12' W |
| TE-3-430 | above 14'-0" | 21' S | 13' W |
| RCS/Pressurizer Pressure Transmitters; | | | |
| PT-3-402 | above 14'-0" | 46'-6" N | 14' E |
| PT-3-403 | above 14'-0" | 46' N | 16' E |
| PT-3-444 | above 30'-6" | 15'-6" N | 36' E |
| PT-3-445 | above 30'-6" | 15'-6" N | 36' E |
| PT-3-455 | above 30'-6" | 15'-6" N | 22' E |
| PT-3-456 | above 30'-6" | 19'-6" N | 27' E |
| PT-3-457 | above 30'-6" | 19'-6" N | 31'-6" E |
| PT-3-458 | above 30'-6" | 15'-6" N | 36' E |
| Pressurizer Level Transmitters; | | | |
| LT-3-459 | above 30'-6" | 15'-6" N | 22' E |
| LT-3-460 | above 30'-6" | 19'-6" N | 27' E |
| LT-3-461 | above 30'-6" | 19'-6" N | 31'-6" E |
| LT-3-462 | above 30'-6" | 15'-6" N | 36' E |
| Steam Generator Level Transmitters; | | | |
| LT-3-474 | above 30'-6" | 18'-6" S | 38' E |
| LT-3-475 | above 30'-6" | 31' S | 28' E |
| LT-3-476 | above 30'-6" | 36'-6" S | 19'-6" E |
| LT-3-477 | above 30'-6" | 38' S | 17' E |
| LT-3-484 | above 30'-6" | 43'-6" N | 3'-6" W |
| LT-3-485 | above 30'-6" | 43' N | 6' E |
| LT-3-486 | above 30'-6" | 41' N | 13'-6" E |
| LT-3-487 | above 30'-6" | 42' N | 11' E |
| LT-3-494 | above 30'-6" | 17'-6" S | 39'-6" W |
| LT-3-495 | above 30'-6" | 23'-6" S | 35'-6" W |
| LT-3-496 | above 30'-6" | 30' S | 29' W |
| LT-3-497 | above 30'-6" | 19'-6" S | 38'-6" W |

Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 10,600 $ft^2$ |
| Wall and Ceiling Surface Area, | 95,700 $ft^2$ |
| Free Volume Excluding Components, | $1.55 \times 10^6$ $ft^3$ |

| | |
|---|---|
| Floor Composition, | Concrete |
| Floor Thickness, | 10'-6" plus containment mat |
| Wall Composition, | Concrete |
| Wall Thickness, | 3'-9" |
| Ceiling Height, | Maximum height from 58' elevation = 126' |
| Ceiling Composition, | Concrete |
| Ceiling Thickness, | 3'-9" |
| Fire Detector(s) in Area, | Yes |
| Detector No./Type, | 3-1 through 3-16/ Ionization |
| Automatic Suppression in Area, | No |
| Type of Automatic Suppression, | N/A |
| Installed Communications Near Fire Area, | Telephone handset T-3146 |
| Hose Station(s) Available to Area, | None |
| Fire Extinguisher(s) Immediately Available to Area, | 3.5.1, 3.5.2, 3.5.3, 3.5.4 |
| Number of Floor Drains, | (Numerous) |
| Drain(s) Size/Capacity, | Total capacity = 330 gpm |
| Drain(s) Flow To, | Waste Holdup Tank/ CVCS Holdup Tank |
| Normal Forced Draft/ Type Ventilation, | Yes/Fan |
| Normal Ventilation Flow Rate, | 35,000 CFM |

b. SAFE SHUTDOWN EQUIPMENT/CABLES NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

Norm. Contain. Cool. 3A

Norm. Contain. Cool. 3B

Norm. Contain. Cool. 3C

Norm. Contain. Cool. 3D

Emer. Contain. Cool. 3A

Emer. Contain. Cool. 3B

Emer. Contain. Cool. 3C

Chg. Line Isolation Valve 3-310A

Chg. Line Isolation Valve 3-310B

Pressurizer Heater Control Group 3A

Pressurizer Heater Backup Group 3A

Pressurizer Heater Backup Group 3B

Steam Generator Level
S/G 3A
LT-3-477
LT-3-474
LT-3-475
LT-3-476

S/G 3B
LT-3-487
LT-3-484
LT-3-485
LT-3-486

S/G 3C
LT-3-497
LT-3-494
LT-3-495
LT-3-496

Equipment(Cont'd)

Pressurizer Level
LT-3-459
LT-3-460
LT-3-461
LT-3-462

RCS/Pressurizer Pressure
PT-3-402
PT-3-403
PT-3-444
PT-3-445
PT-3-455
PT-3-456
PT-3-457
PT-3-458

| Cables | Power(P),Control(C) |
|---|---|
| Pressurizer Heater Control Group 3A | P,C |
| Pressurizer Heater Backup Group 3A | P,C |
| Pressurizer Heater Backup Group 3B | P,C |
| RCS Temperature Hot Leg TE-3-413 | C |
| RCS Temperature Hot Leg TE-3-423 | C |
| RCS Temperature Hot Leg TE-3-433 | C |
| RCS Temperature Cold Leg TE-3-410 | C |
| RCS Temperature Cold Leg TE-3-420 | C |
| RCS Temperature Cold Leg TE-3-430 | C |

| Cables(Cont'd) | | Power(P),Control(C) |
|---|---|---|
| Steam Generator Level | | |
| S/G 3A | | |
| LI/LT-3-477 | | C |
| LI/LT-3-474 | | C |
| LI/LT-3-475 | | C |
| LI/LT-3-476 | | C |
| S/G 3B | | |
| LI/LT-3-487 | | C |
| LI/LT-3-484 | | C |
| LI/LT-3-485 | | C |
| LI/LT-3-486 | | C |
| S/G 3C | | |
| LI/LT-3-497 | | C |
| LI/LT-3-494 | | C |
| LI/LT-3-495 | | C |
| LI/LT-3-496 | | C |
| Pressurizer Level | LT-3-459 | C |
| | LT-3-460 | C |
| | LT-3-461 | C |
| | LT-3-462 | C |
| Chg. Line Isolation Valve 3-310A | | C |
| Chg. Line Isolation Valve 3-310B | | C |
| Emer. Contain. Cool. 3A | | P |
| Emer. Contain. Cool. 3B | | P |
| Emer. Contain. Cool. 3C | | P |
| Norm. Contain. Cool. 3A | | P,C |
| Norm. Contain. Cool. 3B | | P,C |
| Norm. Contain. Cool. 3C | | P,C |
| Norm. Contain. Cool. 3D | | P,C |
| RCS/Pressurizer Pressure | | |
| PI/PT-3-458 | | C |
| PI/PT-3-455 | | C |
| PI/PT-3-444 | | C |
| PI/PT-3-457 | | C |
| PI/PT-3-445 | | C |
| PI/PT-3-456 | | C |
| PI/PT-3-402 | | C |
| PI/PT-3-403 | | C |

Cold Shutdown Equipment/Cables

Equipment

RCS Inlet Isolation Valve from RHR
MOV-3-744A
MOV-3-744B

RHR Inlet Isolation Valve from RCS
MOV-3-750

RHR Inlet Isolation Valve from RCS
MOV-3-751

Accumulator Stop Valves
MOV-3-865A
MOV-3-865B
MOV-3-865C

Pressurizer Auxiliary Spray Valve
3-311

| Cables | Power(P),Control(C) |
|---|---|
| Accumulator Stop Valve MOV-3-865A | P,C |
| Accumulator Stop Valve MOV-3-865B | P,C |
| Accumulator Stop Valve MOV-3-865C | P,C |
| RCS Inlet Isolation Valve from RHR MOV-3-744A | P,C |
| RCS Inlet Isolation Valve from RHR MOV-3-744B | P,C |
| RHR Inlet Isolation Valve from RCS MOV-3-750 | P,C |
| RHR Inlet Isolation Valve from RCS MOV-3-751 | P,C |
| Pressurizer Auxiliary Spray Valve 3-311 | C |

## Equipment/Cables to Mitigate the Consequences of a Fire

### Equipment

Pressurizer Spray Valve PCV-3-455A

Pressurizer Spray Valve PCV-3-455B

PORV PCV-3-455C

PORV PCV-3-456

PORV Block Valve 3-536

PORV Block Valve 3-535

Letdown Isolation Valves
LCV-3-460
3-200A
3-200B
3-200C
3-204

Excess Letdown Isolation Valves
3-387
HCV-3-137

| Cables | Power(P),Control(C) |
|---|---|
| Excess Letdown Isolation Valve HCV-3-137 | C |
| Excess Letdown Isolation Valve 3-387 | C |
| Letdown Isolation Valve 3-200A | C |
| Letdown Isolation Valve 3-200B | C |
| Letdown Isolation Valve 3-200C | C |
| Letdown Isolation Valve LCV-3-460 | C |
| Letdown Isolation Valve 3-204 | C |

| Cables(Cont'd) | Power(P),Control(C) |
|---|---|
| Pressurizer Spray PCV-3-455A | C |
| Pressurizer Spray PCV-3-455B | C |
| PORV PCV-3-455C | C |
| PORV PCV-3-456 | C |
| PORV Block Valve 3-536 | P,C |
| PORV Block Valve 3-535 | P,C |
| 3A Steam Flow | |
| FT-3-474 | C |
| FT-3-475 | C |
| 3B Steam Flow | |
| FT-3-484 | C |
| FT-3-485 | C |
| 3C Steam Flow | |
| FT-3-494 | C |
| FT-3-495 | C |

2. Nuclear Safety Evaluation

As indicated in the preceding equipment/cable list, the containment building (Area 60) houses much of the equipment and associated cables required to achieve and maintain hot and cold shutdown conditions. This equipment consists mainly of instrumentation, however a number of shutdown related valves and the containment cooling fans are also included. The fire hazards analysis contained herein must evaluate the possible fire hazards associated with this area, the potential impact on safe shutdown related equipment/cables, and must provide reasonable assurance that the safe shutdown capability of the plant is maintained or additional protection must be provided.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

Liquid Combustibles

Lubricating oil is contained within the following equipment:

Reactor Coolant Pumps (3)
Manipulator Crane Trolley
CRDM Cooler
Normal Containment Coolers (4)
Emergency Containment Coolers (3)
Hydraulic Snubbers
Sump Pumps (2)
Reactor Building Crane

The lubricating oil associated with the equipment listed above can only be considered a combustible if sprayed onto a hot surface which raises its temperature to above its flash point, i.e., above approximately 450°F. The only major ignition source of concern in containment is the RCS piping and it is lagged for the most part, thus significantly reducing the probability of a lubricating oil fire.

The largest potential combustible source in Containment is the lube oil associated with the reactor coolant pumps. This consists of approximately 200 gallons per pump. The reactor coolant pumps have an oil collection system meeting the requirements of Section III.O of Appendix R, thus precluding this potential combustible source from initiating a fire in containment. The second largest combustible source in containment is the lubricating oil associated with the Reactor Building crane and the manipulator crane trolley. Since the manipulator crane is stored during normal plant operation over the fuel assembly tipping machine in the fuel transfer area, the potential for ignition of an oil spill from this equipment is considered extremely unlikely and does not warrant further evaluation. Likewise, the reactor building crane is parked over the refueling cavity and is not considered a potential fire hazard. The remaining liquid combustibles in containment consist of the small amounts of lubricating oil associated with the specific equipment identified in the above list. These potential combustible sources are localized, generally well separated and confined within the steel structure of the specific equipment. The lubricating oil systems associated with this equipment are not pressurized, and therefore the potential for oil spray is unlikely. In addition, the lack of ignition sources in most areas further precludes the possibility of a fire, as previously stated. Transient combustibles were not considered in this evaluation due to the limited and controlled access to the Containment Building during power operation.

Other Combustibles

Other potential combustible sources in containment consist primarily of the electrical cables routed in trays. As discussed in the Area Description, redundant safe shutdown cable trays are separated by a minimum of 4 feet vertical height and 1½ feet horizontal separation and are sprayed with Flamemastic. This fire retardant coating, although not a rated fire barrier, acts as a radiant energy shield to provide a substantial level of protection against any postulated equipment or exposure fires. Taking into consideration the preceding discussion on liquid combustibles in containment and the detailed test results (See Appendix B) of Factory Mutual's report, "Small Scale Testing of Flame-retardant Coated Cables", one can conclude that a fire involving the cable trays in containment is extremely unlikely.

In summary, taking into consideration the preceding discussion of the existing fire protection design features associated with the equipment in containment, in addition to the containment's limited and controlled access during power operation, one can conclude that no significant potential fire hazards are associated with this area.

In accordance with the proposed transient combustibles control program (see Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 60, no flammable liquids or combustible liquids will be allowed when Unit 3 is in all operating modes except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

Design basis fire calculations were not conducted for Area 60 based on the preceding evaluation of in situ combustibles and the extremely limited access to the area during power operation. This evaluation demonstrated that no significant fire hazards exist in containment.

3. Fire Hazards Evaluation

The fire area hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

Available Fire Suppression Capabilities Determination

Fire Area 60 is accessible through the personnel air lock, the emergency air lock and the access hatch. Portable extinguishers 3.5.1 through 3.5.4 are available to fight a fire in this area.

Area 60 fire suppression equipment ratings are summarized as follows:

| I.D. No. | Extinguisher Hose station rating | Type "A" capability | Type "B" capability | Type "C" capability |
|---|---|---|---|---|
| 3.5.1 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.5.2 | 10A:40BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| 3.5.3 | 10A:40BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| 3.5.4 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |

Total type "B" capability available 400 $ft^2$

Fire Area Summary

As indicated by the preceding fire hazards analysis, the two major combustible sources in containment, i.e., the lubricating oil associated with the reactor coolant pumps and the containment building cranes, do not represent a potential fire hazard in containment. In addition, the remaining liquid combustible sources in containment are localized, well separated, and due to their small quantities are not considered to present a problem. The cable trays in containment are not separated by a fire rated barrier, however, the trays are generally well separated and are sprayed with a flame retardant coating which acts as a radiant energy shield to provide a substantial level of protection. Although no credit is given for the existing fire suppression equipment available in the area, the probability of a fire in containment is considered extremely unlikely.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Provide dedicated portable emergency lighting units for containment entry to facilitate manual operation of the following motor operated valves:

   MOV-3-865A, B, and C (Accum. Stop Valves)
   MOV-3-750 and 751 (RHR Inlet Isolation Valves)

   Note: Refer to Section 5.2 (Fire Area 61) and Sections 5.2.7 and 5.2.10 of this report.

e. EXEMPTION REQUEST

FPL requests exemption for Area 60 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding

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*Specifically, FPL requests exemption from that provision which requires the installation of a non-combustible radiant energy shield between redundant safe shutdown equipment and cables separated by a distance of less than 20 ft.

fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features and equipment layout in containment, in addition to the fire retardant coatings on cables, provide an adequate level of protection from any conceivable fire in the area. Flamemastic, although not a fire rated barrier, acts as a radiant energy shield to separate essential equipment cables.

FPL also requests exemption from those provisions of Section III.J that would require the installation of emergency lighting units in containment (Area 60) to facilitate the manual operation of accumulator stop valves MOV-3-865A, B and C and RHR inlet isolation valves MOV-3-750 and 751. Such an exemption is authorized by law, will not endanger life or property or the common defense and security, and is in the public interest. Due to the harsh environmental conditions (i.e. temperature, humidity, etc.) existing in containment and their detrimental effect on battery power supplies, FPL contends that the existing lighting system inside containment supplemented by the dedicated portable emergency lighting units proposed herein, would exceed in usefulness and reliability that of installed self-contained emergency lighting units. Based on this evaulation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.J in question.

In summary, it is FPL's position that the inherent design features associated with this area combined with a strict combustible control program based on Appendix C of this report will provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 60 based on implementation of the specific requirements of subsection (f), is estimated to be $1,660,000. In addition, the estimated man-rem exposure for full implementation is 1000 man-rem.

f. SCHEDULE EXEMPTIONS

The schedules for full implementation of Section III.G of Appendix R to 10 CFR Part 50 are provided in Section 5.2.19 and are discussed as follows.

There are two types of backfit activities necessary to implement III.G.2 criteria which require a Unit 3 outage because the modifications require construction inside Containment. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10 CFR 50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities is not possible during the Fall 1983 refueling outage and that NRC action is required prior to November 1, 1983 in order to assure installation during the Spring 1985 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of

plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.10 FIRE AREAS 82, 87, 77, 89, 79, 88, 84,91 , 92, 105 and 117

### a. AREA DESCRIPTION

These areas are outside areas and provided below is a brief description of each.

Fire Areas 82 and 87

Fire Areas 82 and 87 are the auxiliary transformer areas for Units 4 and 3 respectively. These areas contain the turbine-generator auxiliaries for each unit at the 18' elevation. Fire Area 82 contains MCC 4A and Fire Area 87 contains MCC 3A, but neither contain safe shutdown related mechanical components. Safe shutdown related cable functions are routed through these areas in cable trays at elevations 31'-6" and 30'-6". Cables in these trays are sprayed with Flamemastic 71A or 77. Hydrogen seal oil units are located in the southwest corners of each area circumscribed by a 6-inch high concrete curb. The auxiliary transformers located in the areas are in closed bottom concrete basins approximately 2 feet below the 18 foot floor elevation. These areas are similar and are bounded on the north by 4160 V switchgear rooms and on the south by their respective condensers. Additionally, these areas are bounded on the west by the main transformers separated from the transformers by a concrete wall approximately 2 feet high. On the east side of the areas are each unit's three condensate pumps.

In addition, Areas 82 and 87 house the turbine generator hydrogen monitoring systems for Units 4 and 3, respectively, located in the southwest corner of each fire area. Each turbine generator hydrogen monitoring system includes valving and piping associated with the filling and venting of the turbine generator hydrogen cooling system, a hydrogen dryer, a hydrogen purity monitor, and a hydrogen control panel.

Fire Areas 77 and 89

Fire Area 77 is the Unit 4 laydown and condensate storage area. This area contains the Unit 4 condensate storage tank and condensate transfer pump. Fire Area 89 is the Unit 3 condensate storage area and contains identical equipment for Unit 3. Both areas are located at the 18 foot elevation. Safe shutdown related equipment located within these fire areas consists of both condensate storage tanks, the Unit 3 steam supply valves for the auxiliary feedwater pumps, the Unit 3 pneumatic steam generator pressure transmitters, and the Unit 3 and 4 steam generator blowdown isolation valves. Safe shutdown related cables are also routed through these areas and all are coated with Flamemastic 71A or 77. In addition, each unit's condensate recovery tank and pump are located in areas 77 and 89. The condensate transfer pumps are approximately 7 feet from their respective condensate storage tanks on the west side. The condensate recovery tank and pump are on the east side of their respective condensate storage tank, approximately 7 feet away.

Fire Areas 79 and 88

These areas are the ground floor vestibules at the 18'-0" elevation of the Units 3 and 4 Turbine Building. Safety related equipment in Area 79 consists of the Unit 4 steam supply valves for the auxiliary feedwater pumps and the pneumatic steam generator pressure transmitters for Unit 4. Area 88 contains no safety related equipment. In addition, safe shutdown related cables are routed through both areas. The areas are outside with no walls, and part of each area has an open roof. All cable trays located in the area are sprayed with Flamemastic 71A or 77.

Fire Area 84

This area is the auxiliary feedwater (AFW) pump area (see Figure 5-3). It houses auxiliary feedwater pumps A, B, and C, pump turbines and associated valves and piping (see Area 84 write up in Section 5.2 for III.G commitments with regard to the AFW pumps). Safe shutdown cables are routed though this area (see Table 5.1.3).

This area is bounded on the east by the Unit 3 containment. The remaining walls and the ceiling are constructed of chain link fencing.

Cable trays routed through the area are at least 13' above grade. The A and B auxiliary feedwater pumps are about 8 1/2' apart and the B and C pumps about 10' apart.

Fire Areas 91 and 92

Fire Area 91 contains the Unit 4 condensate pumps and Fire Area 92 contains the Unit 3 condensate pumps. Safe shutdown related cables are routed through the areas in cable trays located at elevations of 27'-2" and 28'-2". The condensate pumps are located in areas below the surrounding floor at elevation 2'8". Each unit has 3 pumps located on approximately 12 foot centers. These areas have no ceilings and are accessible from the 18 foot elevation via stairways on the west side of each area. All cables in trays are sprayed with Flamemastic 71A or 77.

Fire Area 105

This area is the turbine building mezzanine deck (30'-0"). There are no safe shutdown related components in the area, but safe shutdown cables are routed through the area. Cable trays are located in the area at elevations of 37'-2" and 38'-2" lowering to 36'-6" and 37'-6", respectively. All cables in trays are sprayed with Flamemastic 71A or 77.

Fire Area 117

This area is the turbine deck, elevation 42'-0". Fire Area 117 contains the safety related steam generator pressure transmitters for both Units 3 and 4. Additionally, safe shutdown related cables are routed through the area in conduit.

Pertinent fire area details are listed below:

| | Area 77 | Area 89 |
|---|---|---|
| Floor Surface Area, | 15450 $ft^2$ | 7450 $ft^2$ |
| Wall and Ceiling Surface Area, | N/A | N/A |
| Free Volume Excluding Components, | N/A | N/A |
| Ceiling Height, | N/A | N/A |
| Floor Composition, | Concrete | Concrete |
| Floor Thickness, | Typically 8" | Typically 8" Partial Gravel |
| Wall Composition, | N/A | N/A |
| Wall Thickness, | N/A | N/A |
| Ceiling Composition, | N/A | N/A |
| Ceiling Thickness, | N/A | N/A |
| Fire Detectors in Area, | No | No |
| Detectors - No./Type, | N/A | N/A |
| Automatic Suppression, | No | No |
| Type of Automatic Suppression, | N/A | N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T405 PAX M405 | Telephone Handset T305 PAX M305 |
| Hose Station Available Area,to | #14, #13 | #6, #7 |
| Fire Extinguishers Immediately Available to Area, | 4.1.2, 4.1.3, 4.1.6, 4.1.7 | 3.1.1, 3.1.2, 3.1.8 |
| Number of Floor Drains, | None | None |
| Drain(s) Size, | N/A | N/A |
| Drain(s) Flow To, | N/A | N/A |
| Normal Forced Draft Ventilation, | None | None |
| Normal Ventilation Flow Rate, | N/A | N/A |

| | Area 79 | Area 88 |
|---|---|---|
| Floor Surface Area, | 5600 $ft^2$ | 5600 $ft^2$ |
| Wall and Ceiling Surface Area, | N/A | N/A |
| Free Volume Excluding Components, | N/A | N/A |
| Ceiling Height, | 10' - 6" | 10' - 6" |
| Floor Composition, | Concrete | Concrete |
| Floor Thickness, | Typically 8" | Typically 8" |
| Wall Composition, | N/A | N/A |
| Wall Thickness, | N/A | N/A |
| Ceiling Composition, | Partial Concrete, Partial Open | Partial Concrete, Partial Open |
| Ceiling Thickness, | 18" | 18" |
| Fire Detectors in Area, | No | No |
| Detectors - No./Type, | N/A | N/A |
| Automatic Suppression, | No | No |
| Type of Automatic Suppression, | N/A | N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T405 PAX M405 | Telephone Handset T305 PAX M305 |
| Hose Station Available to Area, | #13, #14 | #7, #8 |
| Fire Extinguishers Immediately Available to Area, | 3.1.5, 3.4.3 3.4.4, 4.1.6 4.1.7 | 3.1.9, 3.1.4, 3.1.3 |
| Number of Floor Drains, | 2 | None |
| Drain(s) Size, | 30" | N/A |
| Drain(s) Flow To, | Sewage | N/A |
| Normal Forced Draft Ventilation, | None | None |
| Normal Ventilation Flow Rate, | N/A | N/A |

| | Area 84 |
| --- | --- |
| Floor Surface Area, | |
| Wall and Ceiling Surface Area, | N/A |
| Free Volume Excluding Components, | N/A |
| Ceiling Height, | N/A |
| Floor Composition,<br>Floor Thickness, | Concrete<br>Typically 8" |
| Wall Composition,<br>Wall Thickness, | N/A<br>N/A |
| Ceiling Composition,<br>Ceiling Thickness, | N/A |
| Fire Detectors in Area,<br>Detectors - No./Type | No<br>N/A |
| Automatic Suppression,<br>Type of Automatic Suppression, | No<br>N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T314b |
| Hose Station Available to Area, | #8, #15 |
| Fire Extinguishers Immediately Available to Area, | 3.6.1, 3.6.2, 3.6.3 |
| Number of Floor Drains, | N/A |
| Drain(s) Size,<br>Drain(s) Flow To, | N/A<br>Oily Waste Drain |
| Normal Forced Draft Ventilation,<br>Normal Ventilation Flow Rate, | None<br>N/A |

| | Area 91 | Area 92 |
|---|---|---|
| Floor Surface Area, | 960 $ft^2$ | 960 $ft^2$ |
| Wall and Ceiling Surface Area, | N/A | N/A |
| Free Volume Excluding Components, | N/A | N/A |
| Ceiling Height, | N/A | N/A |
| Floor Composition, | Concrete | Concrete |
| Floor Thickness, | 3' | 3' |
| Wall Composition, | Concrete | Concrete |
| Wall Thickness, | 18" | 18" |
| Ceiling Composition, | N/A | N/A |
| Ceiling Thickness, | N/A | N/A |
| Fire Detectors in Area, | No | No |
| Detectors - No./Type, | N/A | N/A |
| Automatic Suppression, | No | No |
| Type of Automatic Suppression, | N/A | N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T405 PAX M405 | Telephone Handset T305 PAX M305 |
| Hose Station Available to Area, | #13, #8 | #6, #7 |
| Fire Extinguishers Immediately Available to Area, | 4.1.3, 4.1.1, 4.1.2, 4.1.4 4.1.5 | 3.1.2, 3.1.1 3.1.4, 3.1.3 |
| Number of Floor Drains, | Sump Pumps | Sump Pumps |
| Drain(s) Size, | N/A | N/A |
| Drain(s) Flow To, | Oily Waste Drain | Oily Waste Drain |
| Normal Forced Draft Ventilation, | None | None |
| Normal Ventilation Flow Rate, | N/A | N/A |

| | Area 105 | Area 117 |
|---|---|---|
| Floor Surface Area, | 42000 $ft^2$ | 42000 $ft^2$ |
| Wall and Ceiling Surface Area, | N/A | N/A |
| Free Volume Excluding Components, | N/A | N/A |
| Ceiling Height, | 10' - 6" | N/A |
| Floor Composition, | Concrete | Concrete |
| Floor Thickness, | 18" | 18" |
| Wall Composition, | N/A | N/A |
| Wall Thickness, | N/A | N/A |
| Ceiling Composition, | Concrete | N/A |
| Ceiling Thickness, | 18" | N/A |
| Fire Detectors in Area, | No | No |
| Detectors - No./Type, | N/A | N/A |
| Automatic Suppression, | No | No |
| Type of Automatic Suppression, | N/A | N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T326, T426 PAX M326, M426 | Telephone Handset T326, T426 PAX M326, M426 |
| Hose Station Available to Area, | #9, #15, #20, #21 | #16, #10, #12, #18 #17, #11, #19 |
| Fire Extinguishers Immediately Available to Area, | 4.4.9, 3.2.1, 4.2.2 | 3.3.2, 4.3.3, 4.3.2 3.3.1, 4.3.1, 3.3.4, 4.3.4, 3.3.3, 4.3.6 |
| Number of Floor Drains, | None | None |
| Drain(s) Size, | N/A | N/A |
| Drain(s) Flow To, | N/A | N/A |
| Normal Forced Draft Ventilation, | None | None |
| Normal Ventilation Flow Rate, | N/A | N/A |

| | Area 82 | Area 87 |
|---|---|---|
| Floor Surface Area, | 2600 $ft^2$ | 2600 $ft^2$ |
| Wall and Ceiling Surface Area, | N/A | N/A |
| Free Volume Excluding Components, | N/A | N/A |
| Ceiling Height, | 22'-6" | 22'-6" |
| Floor Composition,<br>Floor Thickness, | Concrete<br>Typically 8 in | Concrete<br>Typically 8 in |
| Wall Composition,<br>Wall Thickness, | N/A<br>N/A | N/A<br>N/A |
| Ceiling Composition,<br>Ceiling Thickness, | Concrete<br>18" | Concrete<br>18" |
| Fire Detectors in Area,<br>Detectors - No./Type, | Yes<br>14-1/Thermal | Yes<br>13-1/Thermal |
| Automatic Suppression,<br>Type of Automatic Suppression, | Yes<br>Automatic Deluge | Yes<br>Automatic Deluge |
| Installed Comm. Near Fire Area, | Telephone<br>Handset T405<br>PAX M405 | Telephone<br>Handset T305<br>PAX M305 |
| Hose Station Available to Area, | #13, #5 | #7, #4 |
| Fire Extinguishers Immediately Available to Area, | 4.1.1, 4.1.2, 4.1.4<br>4.1.3, 4.1.5, 3.1.5 | 3.1.2, 3.1.3, 3.1.4<br>3.1.1, 3.1.5, 3.1.9 |
| Number of Floor Drains,<br>Drain(s) Size,<br>Drain(s) Flow To, | 1<br>3"<br>Oily Waste | 1<br>3"<br>Oily Waste |
| Normal Forced Draft Ventilation,<br>Normal Ventilation Flow Rate, | None<br>N/A | None<br>N/A |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables; For Area 82

Equipment

480V MCC 4A

| Cables | Power (P), Control(C) |
|---|---|
| AFW Pump Steam Supply Valve MOV-4-1404 | P, C |
| Norm. Contain. Cool. 4A | C |
| Norm. Contain. Cool. 4B | C |
| Norm. Contain. Cool. 4C | P, C |
| Norm. Contain. Cool. 4D | C |
| Emer. Contain. Cool. 4A | C |
| Emer. Contain. Cool. 4B | P, C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| Accumulator Stop Valve MOV-4-865B | P, C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 4C MOV-4-1412 | P, C |

2. Safe Shutdown Equipment/Cables; For Area 87

Hot Shutdown Equipment/Cables

Equipment

480V MCC 3A

| Cables | Power (P), Control (C) |
|---|---|
| AFW Pump Steam Supply Valve S/G 3B MOV-3-1404 | P, C |
| Norm. Contain. Cool. 3A | P, C |
| Norm. Contain. Cool. 3B | C |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |
| Chg. Pump 3C | C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| Accumulator Stop Valve MOV-3-865A | P, C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3C SV-3-6275C | P, C |

3. Safe Shutdown Equipment/Cables; For Area 77

Hot Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| AFW to S/G 4A Control Valve SV-4-2914 | C |
| AFW to S/G 4A Backup Control Valve SV-4-2915 | C |
| AFW to S/G 4B Control Valve SV-4-2916 | C |
| AFW to S/G 4B Backup Control Valve SV-4-1917 | C |
| AFW to S/G 4C Control Valve SV-4-2918 | C |
| AFW to S/G 4C Backup Control Valve SV-4-2919 | C |

<u>Equipment/Cables to Mitigate the Consequences of a Fire</u>

<u>Equipment</u>

S/G 4A Blowdown Isolation Valve
MOV-4-1410

S/G 4B Blowdown Isolation Valve
MOV-4-1411

S/G 4C Blowdown Isolation Valve
MOV-4-1412

4. <u>Safe Shutdown Equipment/Cables; For Area 79</u>

<u>Hot Shutdown Equipment/Cables</u>

<u>Equipment</u>

AFW Pump Steam Supply Valves
- S/G 4A MOV-4-1403
- S/G 4B MOV-4-1404
- S/G 4C MOV-4-1405

Steam Generator 4A Pressure Transmitter
PT-4-1606

Steam Generator 4B Pressure Transmitter
PT-4-1607

Steam Generator 4C Pressure Transmitter
PT-4-1608

| Cables | Power (P), Control (C) |
|---|---|
| AFW to S/G 3A Control Valve SV-3-2914 | C |
| AFW to S/G 3A Backup Control Valve SV-3-1915 | C |
| AFW to S/G 3B Control Valve SV-3-2916 | C |
| AFW to S/G 3B Backup Control Valve SV-3-2917 | C |
| AFW to S/G 3C Control Valve SV-3-2918 | C |

| Cables | Power (P),Control (C) |
|---|---|
| AFW to S/G 3C Backup Control Valve SV-3-2919 | C |
| AFW to S/G 4A Control Valve SV-4-2914 | C |
| AFW to S/G 4A Backup Control Valve SV-4-2915 | C |
| AFW to S/G 4B Control Valve SV-4-2916 | C |
| AFW to S/G 4B Backup Control Valve SV-4-2917 | C |
| AFW to S/G 4C Control Valve SV-4-2918 | C |
| AFW to S/G 4C Backup Control Valve SV-4-2919 | C |
| Chg. Pump 3A | C |
| Chg. Pump 3B | C |
| Chg. Pump 3C | C |
| Chg. Pump 4A | P, C |
| Chg. Pump 4B | P, C |
| Chg. Pump 4C | P, C |
| CCW Pump 3A | C |
| CCW Pump 3B | C |
| CCW Pump 3C | C |
| CCW Pump 4A | P, C |
| CCW Pump 4B | P, C |
| CCW Pump 4C | P, C |
| ICW Pump 3A | C |
| ICW Pump 3B | C |
| ICW Pump 3C | C |

| Cables | Power (P), Control (C) |
|---|---|
| ICW Pump 4A | P, C |
| ICW Pump 4B | P, C |
| ICW Pump 4C | P, C |
| BA Transfer Pump 3A | C |
| BA Transfer Pump 3B | C |
| BA Transfer Pump 4A | C |
| BA Transfer Pump 4B | C |
| Pressurizer Heaters | |
| Control Group 3A | C |
| Control Group 4A | P, C |
| Backup Group 3A | C |
| Backup Group 3B | C |
| Backup Group 4A | P, C |
| Backup Group 4B | P, C |
| AFW Pump Steam Supply Valve S/G 3A MOV-3-1403 | P, C |
| AFW Pump Steam Supply Valve S/G 3B MOV-3-1404 | C |
| AFW Pump Steam Supply Valve S/G 3C MOV-3-1405 | P, C |
| AFW Pump Steam Supply Valve S/G 4A MOV-4-1403 | P, C |
| AFW Pump Steam Supply Valve S/G 4B MOV-4-1404 | P, C |
| AFW Pump Steam Supply Valve S/G 4C MOV-4-1405 | P, C |
| BA Injection Stop Valve MOV-3-350 | P, C |
| BA Injection Stop Valve MOV-4-350 | P, C |
| VCT Lo-Level Isolation Valve MOV-3-115C | P, C |
| VCT Lo-Level Isolation Valve MOV-4-115C | P, C |
| MSIV S/G 4A POV-4-2604 | C |

| Cables | Power (P), Control (C) |
|---|---|
| MSIV S/G 4B POV-4-2605 | C |
| MSIV S/G 4C POV-4-2606 | C |
| MSIV S/G 3A POV-3-2604 | C |
| MSIV S/G 3B POV-3-2605 | C |
| MSIV S/G 3C POV-3-2606 | C |
| AFW Pump A Steam Supply Pressure Control Valve SV-3705 | C |
| AFW Pump B Steam Supply Pressure Control Valve SV-3706 | C |
| AFW Pump C Steam Supply Pressure Control Valve SV-3707 | C |
| AFW Pump Auto Start Circuit Unit 3 | C |
| AFW Pump Auto Start Circuit Unit 3 Backup | C |
| AFW Pump Auto Start Circuit Unit 4 | C |
| AFW Pump Auto Start Circuit Unit 4 Backup | C |
| RCS Temperature Hot Leg TE-3-413 | C |
| RCS Temperature Hot Leg TE-3-423 | C |
| RCS Temperature Hot Leg TE-3-433 | C |
| RCS Temperature Cold Leg TE-3-410 | C |
| RCS Temperature Cold Leg TE-3-420 | C |
| RCS Temperature Cold Leg TE-3-430 | C |

| Cables | Power (P), Control (C) |
|---|---|
| Steam Generator Pressure S/G 4A | |
| PT/PI-4-474 | C |
| PT/PI-4-475 | C |
| PT/PI-4-476 | C |
| Steam Generator Pressure S/G 4B | |
| PT/PI-4-484 | C |
| PT/PI-4-485 | C |
| PT/PI-4-486 | C |
| Steam Generator Pressure S/G 4C | |
| PT/PI-4-494 | C |
| PT/PI-4-495 | C |
| PT/PI-4-496 | C |
| Steam Generator Level S/G 3A | |
| LT/LI-3-477 | C |
| LT/LI-3-474 | C |
| LT/LI-3-475 | C |
| LT/LI-3-476 | C |
| Steam Generator Level S/G 3B | |
| LT/LI-3-487 | C |
| LT/LI-3-484 | C |
| LT/LI-3-485 | C |
| LT/LI-3-486 | C |
| Steam Generator Level S/G 3C | |
| LT/LI-3-497 | C |
| LT/LI-3-494 | C |
| LT/LI-3-495 | C |
| LT/LI-3-496 | C |
| Steam Generator Level S/G 4A | |
| LT/LI-4-477 | C |
| LT/LI-4-476 | C |
| LT/LI-4-475 | C |
| LT/LI-4-474 | C |
| Steam Generator Level S/G 4B | |
| LT/LI-4-487 | C |
| LT/LI-4-486 | C |
| LT/LI-4-485 | C |
| LT/LI-4-484 | C |
| Steam Generator Level S/G 4C | |
| LT/LI-4-497 | C |
| LT/LI-4-496 | C |
| LT/LI-4-495 | C |
| LT/LI-4-494 | C |

| Cables | Power (P), Control (C) |
|---|---|
| Pressurizer Level | |
| LT/LI-3-459 | C |
| LT/LI-3-461 | C |
| LT/LI-3-460 | C |
| LT/LI-3-462 | C |
| Diesel Generator #3 Breaker Bus 3A | C |
| Diesel Generator #3 Breaker Bus 4A | P, C |
| Diesel Generator #4 Breaker Bus 3B | C |
| Diesel Generator #4 Breaker Bus 4B | P, C |
| AB Exhaust Fan A | C |
| AB Exhaust Fan B | C |
| AB Supply Fan B | C |
| CCW Sup. Valves for Emer. Contain. Cool. | |
| 3-2903 | C |
| 3-2904 | C |
| 3-2905 | C |
| 4-2903 | C |
| 4-2904 | C |
| 4-2905 | C |
| Steam Generator Pressure S/G 3A | |
| PT/PI-3-476 | C |
| PT/PI-3-475 | C |
| PT/PI-3-474 | C |
| Steam Generator Pressure S/G 3B | |
| PT/PI-3-486 | C |
| PT/PI-3-485 | C |
| PT/PI-3-484 | C |
| Steam Generator Pressure S/G 3C | |
| PT/PI-3-496 | C |
| PT/PI-3-495 | C |
| PT/PI-3-494 | C |
| Chg. Control Valve HCV-4-121 | C |
| Chg. Control Valve HCV-3-121 | C |

| Cables | Power (P), Control (C) |
|---|---|
| Chg. Line Isolation Valve 4-310A | C |
| Chg. Line Isolation Valve 4-310B | C |
| Chg. Line Isolation Valve 3-310A | C |
| Chg. Line Isolation Valve 3-310B | C |
| CCW Rtn. Valve for Norm. Contain. Cool. MOV-4-1418 | P, C |
| CCW Rtn. Valve for Norm. Contain. Cool. MOV-3-1418 | P, C |
| CCW Rtn. Valves for Emer. Contain. Cool. | |
| 3-2906 | C |
| 3-2907 | C |
| 3-2908 | C |
| 4-2906 | C |
| 4-2907 | C |
| 4-2908 | C |
| CCW Sup. Valve for Norm. Cool. MOV 3-1417 | C |
| CCW Sup. Valve for Norm. Cool. MOV 4-1417 | C |
| AB Supply Fan A | C |
| Letdown Isolation Valve LCV-3-460 | C |
| Emer. Contain. Cool. 3A | C |
| Emer. Contain. Cool. 3B | P, C |
| Emer. Contain. Cool. 3C | P, C |
| Norm. Contain. Cool. 3A | C |
| Norm. Contain. Cool. 3B | P, C |
| Norm. Contain. Cool. 3C | P, C |
| Norm. Contain. Cool. 3D | P, C |
| Norm. Contain. Cool. 4A | P, C |

| Cables | Power (P), Control (C) |
|---|---|
| Norm. Contain. Cool. 4B | P, C |
| Norm. Contain. Cool. 4C | P, C |
| Norm. Contain. Cool. 4D | P, C |
| Emer. Contain. Cool. 4A | C |
| Emer. Contain. Cool. 4B | P, C |
| Emer. Contain. Cool. 4C | P, C |
| RCS/Pressurizer Pressure | |
| PT/PI-3-455 | C |
| PT/PI-3-444 | C |
| PT/PI-3-445 | C |
| PT/PI-3-456 | C |
| PT/PI-3-457 | C |
| PT/PI-3-458 | C |
| PT/PI-3-402 | C |
| PT/PI-3-403 | C |
| Pressurizer Level | |
| LT/LI-4-462 | C |
| LT/LI-4-460 | C |
| LT/LI-4-459 | C |
| LT/LI-4-461 | C |
| RCS/Pressurizer Pressure | |
| PT/PI-4-444 | C |
| PT/PI-4-445 | C |
| PT/PI-4-456 | C |
| PT/PI-4-455 | C |
| PT/PI-4-458 | C |
| PT/PI-4-457 | C |
| PT/PI-4-402 | C |
| PT/PI-4-403 | C |
| Letdown Isolation Valve LCV-4-460 | C |
| Control Rm. A/C C | P |
| Control Rm. A/C B | P |

**Cold Shutdown Equipment/Cables**

| Cables | Power (P), Control (C) |
|---|---|
| RHR Pump 3A | C |

| Cables | Power (P), Control (C) |
|---|---|
| RHR Pump 3A | C |
| RHR Pump 3B | C |
| RHR Pump 4A | P, C |
| RHR Pump 4B | P, C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749A | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749B | P, C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-4-749A | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-4-749B | P, C |
| RWST Isolation Valve from RHR Header MOV-3-862A | C |
| RWST Isolation Valve from RHR Header MOV-3-862B | P, C |
| RWST Isolation Valve from RHR Header MOV-4-862A | C |
| RWST Isolation Valve from RHR Header MOV-4-862B | P, C |
| RCS Inlet Isolation Valve from RHR MOV-3-744A | P, C |
| RCS Inlet Isolation Valve from RHR MOV-3-744B | C |
| RCS Inlet Isolation Valve from RHR MOV-4-744A | C |
| RCS Inlet Isolation Valve from RHR MOV-4-744B | P, C |
| RHR Inlet Isolation Valve from RCS MOV-3-750 | C |
| RHR Inlet Isolation Valve from RCS MOV-4-750 | P, C |

| Cables | Power (P), Control (C) |
|---|---|
| RHR Inlet Isolation Valve from RCS MOV-3-751 | P, C |
| RHR Inlet Isolation Valve from RCS MOV-4-751 | C |
| RWST Isolation Valve from RHR Header MOV-4-863A | C |
| RWST Isolation Valve from RHR Header MOV-4-863B | P, C |
| RHR Flow Control Valve HCV-3-758 | C |
| RHR Flow Control Valve HCV-4-758 | C |
| Accumulator Stop Valves | |
| MOV-3-865-A | C |
| MOV-3-865-B | C |
| MOV-3-865-C | P, C |
| MOV-4-865-A | C |
| MOV-4-865-B | P, C |
| MOV-4-865-C | P, C |
| RWST Isolation Valve from RHR Header MOV-3-863A | C |
| RWST Isolation Valve from RHR Header MOV-3-863B | C |
| RWST Supply Valve to Chg. Header LCV-3-115B | P, C |
| RWST Supply Valve to Chg. Header LCV-4-115B | P, C |
| Pressurizer Auxiliary Spray Valve 3-311 | C |
| Pressurizer Auxiliary Spray Valve 4-311 | C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3A SV-3-6275A | C |

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 4B MOV-4-1411 | P, C |
| Blowdown Isolation Valve S/G 4A MOV-4-1410 | P, C |
| Blowdown Isolation Valve S/G 3B SV-3-6275B | C |
| Excess Letdown Isolation Valve HCV-3-137 | C |
| BA Transfer Pump Recirculation Valve HCV-105 | C |
| Blowdown Isolation Valve S/G 3C SV-3-6275C | C |
| Letdown Isolation Valves | |
| LCV-4-460 | C |
| 4-204 | C |
| Excess Letdown Isolation Valve 4-387 | C |
| Letdown Isolation Valve 4-200A | C |
| Letdown Isolation Valve 4-200B | C |
| Letdown Isolation Valve 4-200C | C |
| Excess Letdown Isolation Valve 3-387 | C |
| Letdown Isolation Valves | |
| LCV-3-460 | C |
| 3-204 | C |
| Letdown Isolation Valve 3-200A | C |
| Letdown Isolation Valve 3-200B | C |
| Letdown Isolation Valve 3-200C | C |
| Excess Letdown Isolation Valve HCV-4-137 | C |
| PORV PCV -4-456 | C |
| PORV Block Valve MOV-4-536 | P, C |
| PORV Block Valve MOV-4-535 | P, C |
| PORV PCV-3-455C | C |

| Cables | Power (P), Control (C) |
|---|---|
| PORV PCV-3-456 | C |
| PORV Block Valve MOV-3-536 | P, C |
| PORV Block Valve MOV-3-535 | P, C |
| PORV PCV-4-455C | C |
| Blowdown Isolation Valve S/G 4C MOV-4-1412 | C |
| Pressurizer Spray Valve PCV-3-455B | C |
| Pressurizer Spray Valve PCV-3-455A | C |
| Pressurizer Spray Valve PCV-4-455A | C |
| Pressurizer Spray Valve PCV-4-455B | C |
| High Containment Pressure | |
| PS-3-2007 | C |
| PS-3-2008 | C |
| PS-3-2009 | C |
| High-High Containment Pressure | |
| PS-3-2056 | C |
| PS-3-2057 | C |
| PS-3-2058 | C |
| High Containment Pressure | |
| PS-4-2007 | C |
| PS-4-2008 | C |
| PS-4-2009 | C |
| High-High Containment Pressure | |
| PS-4-2056 | C |
| PS-4-2057 | C |
| Steam Flow S/G 3A | |
| FI/FT-3-474 | C |
| FI/FT-3-475 | C |
| Steam Flow S/G 3B | |
| FI/FT-3-484 | C |
| FI/FT-3-485 | C |
| Steam Flow S/G 3C | |
| FI/FT-3-494 | C |
| FI/FT-3-495 | C |
| Steam Flow S/G 4A | |
| FI/FT-4-474 | C |

| Cables | Power (P),Control (C) |
|---|---|
| Steam Flow S/G 4B FI/FT-4-484 | C |
| Steam Flow S/G 4C FI/FT-4-494 | C |

5. Safe Shutdown Equipment/Cables; For Area 88

Hot Shutdown Equipment/Cables

| Cables | Power (P),Control (C) |
|---|---|
| Chg. Pump 3A | P, C |
| Chg. Pump 3B | P, C |
| Chg. Pump 3C | P, C |
| CCW Pump 3A | P, C |
| CCW Pump 3B | P, C |
| CCW Pump 3C | P, C |
| ICW Pump 3A | P, C |
| ICW Pump 3B | P, C |
| ICW Pump 3C | P, C |
| BA Transfer Pump 3A | C |
| BA Transfer Pump 3B | C |
| AFW Pump Steam Supply S/G 3C MOV-3-1404 | P, C |
| Pressurizer Heater Control Group 3A | P, C |
| Pressurizer Heater Backup Group 3A | P, C |
| Pressurizer Heater Backup Group 3B | P, C |
| AFW Pump Auto Start Circuit Unit 3 | C |
| AFW Pump Auto Start Circuit Unit 3 Backup | C |
| Emer. Contain. Cool. 3A | C |

| Cables | Power (P), Control (C) |
|---|---|
| Emer. Contain. Cool. 3B | C |
| Emer. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3A | P, C |
| Norm. Contain. Cool. 3B | C |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |
| Diesel Generator #3 Breaker | |
| Bus 3A | C |
| Bus 4A | P, C |
| Diesel Generator #4 Breaker | |
| Bus 3B | C |
| Bus 4B | P, C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| RHR Pump 3A | P, C |
| RHR Pump 3B | P, C |
| Accum. Disch. Stop Valve MOV-3-865A | P, C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Fire Pump B | P |
| Blowdown Isolation Valve S/G 3C SV-3-6275C | C |

6. Safe Shutdown Equipment/Cables; For Area 89

Hot Shutdown Equipment/Cables

Equipment

AFW Pump Steam Supply Valves
- S/G 3A MOV-3-1403
- S/G 3B MOV-3-1404
- S/G 3C MOV-3-1405

| Cables | Power (P), Control (C) |
|---|---|
| Steam Generator Pressure S/G 3A<br>PT-3-1606 | |
| Steam Generator Pressure S/G 3B<br>PT-3-1607 | |
| Steam Generator Pressure S/G 3C<br>PT-3-1608 | |
| AFW Pump Steam Supply Valve S/G 3A<br>MOV-3-1403 | P, C |
| AFW Pump Steam Supply Valve S/G 3C<br>MOV-3-1405 | P, C |
| Chg. Pump 3C | C |
| AFW Pump Steam Supply Valve S/G 3B<br>MOV-3-1404 | P, C |
| MSIV S/G 3A<br>POV-3-2604 | C |
| AFW to S/G 3A Control Valve<br>SV-3-2914 | C |
| AFW to S/G 3B Control Valve<br>SV-3-2916 | C |
| AFW to S/G 3C Control Valve<br>SV-3-2918 | C |
| AFW to S/G 3A Backup Control Valve<br>SV-3-2915 | C |
| AFW to S/G 3B Backup Control Valve<br>SV-3-2917 | C |
| AFW to S/G 3C Backup Control Valve<br>SV-3-2919 | C |
| Steam Generator Level S/G 3A | |
| LT/LI-3-477 | C |
| LT/LI-3-475 | C |
| LT/LI-3-476 | C |
| Steam Generator Level S/G 3B | |
| LT/LI-3-487 | C |
| LT/LI-3-485 | C |
| LT/LI-3-486 | C |

| Cables | Power (P), Control (C) |
|---|---|
| Steam Generator Level S/G 3C | |
| LT/LI-3-497 | C |
| LT/LI-3-495 | C |
| LT/LI-3-496 | C |
| Diesel Generator #3 Breaker Bus 3A | C |
| Diesel Generator #4 Breaker Bus 3B | C |
| Steam Generator Pressure S/G 3/A | |
| PT-3-475 | C |
| PT-3-476 | C |
| Steam Generator Pressure S/G 3B | |
| PT-3-485 | C |
| PT-3-486 | C |
| Emer. Contain. Cool. 3A | C |
| Emer. Contain. Cool. 3B | C |
| Emer. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3A | P, C |
| Norm. Contain. Cool. 3B | C |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |

Equipment/Cables to Mitigate the Consequences of a Fire

Equipment

Blowdown Isolation Valves
S/G 3A SV-3-6275A
S/G 3B SV-3-6275B
S/G 3C SV-3-6275C

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valves | |
| S/G 3A SV-3-6275A | C |
| S/G 3B SV-3-6275B | C |
| S/G 3C SV-3-6275C | C |

7. Safe Shutdown Equipment/Cables; For Area 84

Hot Shutdown Equipment/Cables

Equipment

AFW Pump A

AFW Pump B

AFW Pump C

AFW Steam Supply Pressure
Control Valves
SV-3705
SV-3706
SV-3707

| Cables | Power (P), Control (C) |
|---|---|
| Chg. Pump 3B | C |
| Chg. Pump 3C | C |
| CCW Pump 3B | C |
| ICW Pump 3B | C |
| ICW Pump 3C | C |
| BA Transfer Pump 3B | C |
| Blowdown Isolation Valves | |
| S/G 3A SV-3-6275A | C |
| S/G 3B SV-3-6275B | C |
| S/G 3C SV-3-6275C | C |
| AFW Pump Steam Supply Valves | |
| S/G 3A MOV-3-1403 | P,C |
| S/G 3B MOV-3-1404 | P, C |
| S/G 3C MOV-3-1405 | P, C |
| Norm. Contain. Cool. 3A | C |
| Norm. Contain. Cool. 3B | C |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |
| Emer. Contain. Cool. 3B | C |
| Emer. Contain. Cool. 3C | C |

| Cables | Power (P), Control (C) |
| --- | --- |
| Pressurizer Heaters | |
| Control Group 3A | C |
| Backup Group 3B | P, C |
| MSIV S/G 3A POV-3-2604 | C |
| MSIV S/G 3B POV-3-2605 | C |
| MSIV S/G 3C POV-3-2606 | C |
| AFW Pump Auto Start Circuit Unit 3 Backup | C |
| AFW Steam Supply Pressure Control Valves | |
| SV-3705 | C |
| SV-3706 | C |
| SV-3707 | C |
| AFW to S/G 3A Control Valve SV-3-2914 | C |
| AFW to S/G 3B Control Valve SV-3-2916 | C |
| AFW to S/G 3C Control Valve SV-3-2918 | C |
| AFW to S/G 3A Backup Control Valve SV-3-2915 | C |
| AFW to S/G 3B Backup Control Valve SV-3-2917 | C |
| AFW to S/G 3C Backup Control Valve SV-3-2919 | C |
| Diesel Generator #3 Breaker Bus 3A | C |
| Diesel Generator #4 Breaker | |
| Bus 3B | C |
| Bus 4B | C |
| Steam Generator Level S/G 3A | |
| LT/LI-3-475 | C |
| LT/LI-3-477 | C |
| Steam Generator Level S/G 3B | |
| LT/LI-3-485 | C |
| LT/LI-3-486 | C |
| LT/LI-3-487 | C |

| Cables | Power (P), Control (C) |
| --- | --- |
| Steam Generator Level S/G 3C | |
| LT/LI-3-495 | C |
| LT/LI-3-496 | C |
| LT/LI-3-497 | C |
| Steam Generator Level S/G 4A | |
| LT/LI-4-474 | C |
| LT/LI-4-475 | C |
| LT/LI-4-476 | C |
| LT/LI-4-477 | C |
| Steam Generator Level S/G 4B | |
| LT/LI-4-484 | C |
| LT/LI-4-485 | C |
| LT/LI-4-486 | C |
| LT/LI-4-487 | C |
| Steam Generator Level S/G 4C | |
| LT/LI-4-494 | C |
| LT/LI-4-495 | C |
| LT/LI-4-496 | C |
| LT/LI-4-497 | C |
| Steam Generator Pressure S/G 3A | |
| PT/PI-3-475 | C |
| PT/PI-3-476 | C |
| PT/PI-3-474 | C |
| Steam Generator Pressure S/G 3B | |
| PT/PI-3-485 | C |
| PT/PI-3-484 | C |
| PT/PI-3-486 | C |
| Steam Generator Pressure S/G 3C | |
| PT/PI-3-494 | C |
| PT/PI-3-496 | C |
| PT/PI-3-495 | C |
| RCS/Pressurizer Pressure | |
| PT/PI-3-444 | C |
| PT/PI-3-457 | C |
| PT/PI-3-445 | C |
| PT/PI-3-458B | C |
| PT/PI-3-403 | C |
| PT/PI-3-402 | C |
| PT/PI-3-455 | C |
| PT/PI-3-456 | C |

| Cables | Power (P), Control (C) |
|---|---|
| RCS/Pressurizer Pressure | |
| PT/PI-4-444 | C |
| PT/PI-4-402 | C |
| PT/PI-4-445 | C |
| PT/PI-4-457 | C |
| PT/PI-4-458B | C |
| PT/PI-4-403 | C |
| PT/PI-4-456 | C |
| PT/PI-4-455 | C |
| Pressurizer Level | |
| LT/LI-3-459 | C |
| LT/LI-3-460 | C |
| LT/LI-4-459 | C |
| LT/LI-4-460 | C |
| RCS Temperature Hot Leg | |
| TE-3-413 | C |
| TE-3-423 | C |
| TE-3-433 | C |
| RCS Temperature Cold Leg | |
| TE-3-410 | C |
| TE-3-420 | C |
| TE-3-430 | C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| RHR Pump 3B | C |

Equipment/Cables Required to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Excess Letdown Isolation Valve 3-387 | C |
| PORV PCV-3-455C | C |
| Pressurizer Spray Valves | |
| PCV-3-455A | C |
| PCV-3-455B | C |
| PCV-4-455A | C |
| PCV-4-455B | C |

8. Safe Shutdown Equipment/Cables; For Area 91

Hot Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| AFW Pump Steam Supply S/G 4B MOV-4-1404 | P, C |
| Norm. Contain. Cool. 4A | C |
| Norm. Contain. Cool. 4B | C |
| Norm. Contain. Cool. 4C | P, C |
| Norm. Contain. Cool. 4D | C |
| Emer. Contain. Cool. 4A | C |
| Emer. Contain. Cool. 4B | P, C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| Accumulator Stop Valve MOV-4-865B | P, C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 4C MOV-4-1412 | P, C |

9. Safe Shutdown Equipment/Cases; For Area 92

Hot Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| AFW Pump Steam Supply S/G 3B MOV-3-1404 | P, C |
| Norm. Contain. Cool. 3A | P, C |
| Norm. Contain. Cool. 3B | C |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |
| Chg. Pump 3C | C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| Accumulator Stop Valve MOV-3-865A | P, C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 4C SV-3-6275C | P, C |

10. Safe Shutdown Equipment/Cables; For Area 105

Hot Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| AFW Pump Steam Supply S/G 3B MOV-3-1404 | C |
| AFW Pump A Supply Pressure Control Valve SV-3705 | C |
| AFW to S/G 3A Backup Control Valve SV-3-2915 | C |
| AFW to S/G 3B Backup Control Valve SV-3-2917 | C |
| AFW to S/G 3C Backup Control Valve SV-3-2919 | C |
| Norm. Contain. Cool. 3A | C |
| Chg. Pump 3C | C |
| Chg. Pump 4C | C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| Accumulator Stop Valve MOV-3-865A | C |

**Equipment/Cables to Mitigate the Consequences of a Fire**

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3C SV-3-6275C | C |

11. **Safe Shutdown Equipment/Cables; For Area 117**

**Hot Shutdown Equipment/Cables**

**Equipment**

Steam Generator Pressure S/G 3A
PT-3-474
PT-3-475
PT-3-476

Steam Generator Pressure S/G 3B
PT-3-484
PT-3-485
PT-3-486

Steam Generator Pressure S/G 3C
PT-3-494
PT-3-495
PT-3-496

Steam Generator Pressure S/G 4A
PT-4-474
PT-4-475
PT-4-476

Steam Generator Pressure S/G 4B
PT-4-484
PT-4-485
PT-4-486

Steam Generator Pressure S/G 4C
PT-4-494
PT-4-495
PT-4-496

| Cables | Power (P), Control (C) |
|---|---|
| MSIV S/G 3A POV-3-2604 | P, C |
| MSIV S/G 3B POV-3-2605 | P, C |
| MSIV S/G 3C POV-3-2606 | P, C |

| Cables | Power (P), Control (C) |
|---|---|
| AFW Pump Steam Supply Valve S/G 3A MOV-3-1403 | C |
| AFW Pump Steam Supply Valve S/G 3B MOV-3-1404 | C |
| AFW Pump Steam Supply Valve S/G 3C MOV-3-1405 | C |
| AFW Pump Steam Supply Valve S/G 4A MOV-4-1403 | C |
| AFW Pump Steam Supply Valve S/G 4B MOV-4-1404 | C |
| AFW Pump Steam Supply Valve S/G 4C MOV-4-1405 | C |
| AFW to S/G 3A Control Valve SV-3-2914 | C |
| AFW to S/G 3B Control Valve SV-3-2916 | C |
| AFW to S/G 3C Control Valve SV-3-2918 | C |
| AFW to S/G 3A Backup Control Valve SV-3-2915 | C |
| AFW to S/G 3B Backup Control Valve SV-3-2917 | C |
| AFW to S/G 3C Backup Control Valve SV-3-2919 | C |
| AFW to S/G 4A Control Valve SV-4-2914 | C |
| AFW to S/G 4B Control Valve SV-4-2916 | C |
| AFW to S/G 4B Control Valve SV-4-2918 | C |
| AFW to S/G 4A Backup Control Valve SV-4-2915 | C |
| AFW to S/G 4B Backup Control Valve SV-4-2917 | C |
| AFW to S/G 4C Backup Control Valve SV-4-2919 | C |

**Equipment/Cables to Mitigate the Consequences of a Fire**

| Cables | Power (P),Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3C SV-3-6275C | C |

## 11. Nuclear Safety Evaluation

As indicated by the preceding equipment/cable list, Fire Areas 77, 79, 82, 84, 87, 88, 89, 91, 92, 105, and 117 contain primarily safe shutdown related cables. Exceptions to this are Areas 77, 79, 82, 84, 87, 89, and 117 which also contain equipment.

Fire Areas 79 and 89 contain the auxiliary feedwater pump steam supply valves for Units 4 & 3, respectively. These valves are as follows: MOV-4-1403, 1404, and 1405 and MOV-3-1403, 1404, and 1405. The steam supply requirements for two of the three turbine driven auxiliary feedwater pumps are satisfied by one steam supply valve from either unit (1 out of 6). Due to the separation distance (in excess of 150 feet) between the Unit 3 and Unit 4 auxiliary feedwater pump steam supply valves, a single postulated fire could not conceivably impair both Unit 3 and 4 valves. However, in order to ensure the steam supply requirements for the AFW pumps are met when only one unit is operating, one steam supply valve from each unit must be protected.

In addition, Fire Area 79 contains the redundant pneumatic pressure transmitters for steam generators A, B, and C for both units. These pressure transmitters are as follows:

| Unit 3 | | Unit 4 | |
|---|---|---|---|
| S/G A | PT-3-1606 | S/G A | PT-4-1606 |
| S/G B | PT-3-1607 | S/G B | PT-4-1607 |
| S/G C | PT-3-1608 | S/G C | PT-4-1608 |

Safety related pressure transmitters for steam generators A, B, and C are located in Fire Area 117. These transmitters are as follows:

| Unit 3 | | Unit 4 | |
|---|---|---|---|
| S/G A | PT-3-474<br>PT-3-475<br>PT-3-476 | S/G A | PT-4-474<br>PT-4-475<br>PT-4-476 |
| S/G B | PT-3-484<br>PT-3-485<br>PT-3-486 | S/G B | PT-4-484<br>PT-4-485<br>PT-4-486 |
| S/G C | PT-3-494<br>PT-3-495<br>PT-3-496 | S/G C | PT-4-494<br>PT-4-495<br>PT-4-496 |

Of the above safety related and pneumatic pressure transmitters, only one pressure transmitter per steam generator is required. Thus, two pressure transmitters (one per steam generator, two generators required) per unit must remain operable. Due to the fact that a solid concrete wall separates Areas 79 and 117, a single postulated fire could not conceivably impact both the pneumatic and safety related pressure transmitters. Therefore, no further evaluation of this equipment is required.

Fire Areas 82 and 87 contain motor control centers (MCC's) 4A and 3A, respectively, which power safe shutdown related equipment and instrumentation. A review of this equipment and instrumentation was conducted to verify the capability to achieve hot and cold shutdown conditions independent of these motor control centers. Based on this review, the following equipment was determined to lack redundancy in performance of system function: MOV-3-865A (MCC 3A) and MOV-4-865B (MCC 4A). These motor operated valves are isolation valves located inside containment which are utilized during cooldown to prevent discharge of the safety injection accumulators into the RCS. MOV-3-865A is located on the Unit 3 accumulator A discharge and MOV-4-865B is located on the Unit 4 accumulator B discharge. Should a design basis fire affect the functionality of either MCC 3A or MCC 4A, the following operator actions may be required:

MCC 3A failure
MOV-3-865A

Should this valve lose power, local manual operation of this valve may be required prior to achieving cold shutdown.

MCC 4A failure
MOV-4-865B

Should this valve lose power, local manual operation of this valve may be required prior to achieving cold shutdown.

The steam generator blowdown valves, MOV-4-1410, 1411, and 1412 located in Fire Area 77 and SV-3-6275A, B and C located in Fire Area 89, are of concern from a spurious actuation aspect. Since there are no remotely operated valves which perform this same function, two steam generator blowdown valves per unit must be protected.

Fire Area 84 contains the AFW pumps A, B, and C and various safe shutdown related cable trays. As indicated by the Area Description, FPL is committing to full compliance with the rule in regards to the AFW pumps. Therefore, this analysis must only address the cable trays in this area

As previously stated, numerous cable trays are routed throughout these fire areas. Redundant cable tray separation is complicated by the relatively short distances between trays and the congestion of

existing piping and non-safety equipment.. Based on the anticipated difficulties to be encountered in providing redundant cable separation, a concept of total cable protection was deemed to be the most viable approach for ensuring the capability to achieve and maintain hot/cold shutdown conditions. The fire hazards analysis contained herein quantifies the level of protection to be provided by a combination of Flamemastic coatings on cables, baffles beneath cable trays, and the use of a thermal insulating material to protect conduit.

## c. FIRE HAZARDS ANALYSIS

### 1. Fire Area Combustibles

The combustibles inventory for each fire area consists primarily of the lubricating oil and grease associated with the various pumps and motor operated valves located in the areas and the cables routed in cable trays. As indicated by the Area Descriptions, Fire Areas 77 and 89 contain the condensate transfer pumps and motors, Fire Areas 91 and 92 contain the condensate pumps, and Fire Area 84 contains the AFW pumps and turbine drivers. Lubricating oil can only be considered a combustible if it is sprayed upon a hot surface which raises its temperature to above its flash point, i.e., above approximately 450°F. Since the condensate pumps and condensate transfer pumps do not have pressurized lube oil systems and there are no potential ignition sources in these areas, e.g. , hot piping, etc., the potential for a lube oil fire involving this equipment is considered acceptably small. Refer to Section 4.0 of this report for details on the ease of ignition and propagation. The turbine lube oil system associated with the AFW pumps is a pressurized system, however due to its inherent design features it is not perceived to be a likely combustible source. Provided below is a brief description of the turbine lube oil system and additional justification for not including it in the combustibles inventory.

The lube oil system on the auxiliary feedwater pumps is a steel system and is shared by the pump and turbine driver. A shaft driven (off the turbine) lube oil pump takes suction from a steel reservoir ( 24.5 gal. capacity) and pumps through the tube side of a U-tube oil cooler to the bearings on the pump and turbine. The oil then gravity drains back to the reservoir. The piping is all schedule 80 and of welded construction. Possible lube oil leakage paths are limited to failed gaskets or a break in the lube oil piping or reservoir.

As stated previously, failure of gaskets due to physical damage should be considered remote and even with gasket failure, leakage would be minimal. Failure of the piping or reservoir boundary is considered unlikely based on the all steel construction. An external fire source would not be expected to cause leakage due to the all steel construction and 70% asbestos gaskets.

Fire Areas 82 and 87 also contain the piping and valving associated with the hydrogen monitoring system for the turbine generator. The

piping is ½" schedule 80 with socket welded fittings. Failure of the pipe or fittings is not expected to cause flammable or explosive hydrogen concentrations since this is an outdoor area. The resultant fire would most likely be a propane torch-like fire which could provide an ignition source for a design basis fire described herein, but will not significantly add to the combustible inventory.

All areas, with the exception of Fire Areas 91, 92 and 117, contain cables in cable trays. All cables are sprayed with Flamemastic and therefore can only be considered a combustible if exposure fires of sufficient intensity are postulated such that piloted or auto ignition of the cables occurs. For these reasons, only transient combustibles are considered in the fire hazards analysis.

Three transient combustibles are considered in the analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plant. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6), transient combustibles will be strictly limited. In Fire Areas 77, 79, 82, 87, 88, 89, 91, 92, 105 and 117, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

These fire areas are divided into the following five sectors for the purpose of analysis.

| Fire Sector E | Description |
|---|---|
| E | Located in the open corridor, west of the east-west main hallway of the Auxiliary Building on the 17 foot 4 inch level. It runs north-south connecting the outside areas located to the west of Units 3 and 4 containments in either direction. (Ref. Turkey Point Nuclear Plant Units 3 and 4 Drawing 5610-E-119, Rev. 8, dated August 31, 1977). This fire sector can accommodate an effective spill diameter of 8' 6". |

H — Located to the west of the Unit 3 containment on the 18.0 foot level. It extends north from the chemistry storage area to the gland steam condenser. (Ref. Turkey Point Nuclear Plant Units 3 and 4 Drawing 5610-E-131, Rev. 12, dated December 13, 1971). This fire sector can accommodate an effective spill diameter of 37 feet.

I — Located to the west of the Unit 4 containment on the 18.0 foot level. It extends north to the Reactor Control Rod Equipment Room and south as far as the south end of the Unit 4 containment. (Ref. Turkey Point Nuclear Plant Units 3 and 4 Drawing 5610-E-133, Rev. 8, dated December 20, 1971). This fire sector can accommodate an effective spill diameter of 40 feet.

J — Located to the west of the open corridor which connects the outside areas west of Units 3 and 4 containments on the 18.0 foot level. It extends north as far as the Unit 3 Switchgear Rooms and south to the Unit 4 condenser. (Ref. Turkey Point Nuclear Plant Units 3 and 4 Drawing 5610-E-150, Rev. 12, dated August 31, 1977). This fire sector can accommodate an effective spill diameter of 16 feet 6 inches.

K — Located in the Turbine Building on the 30'-0" mezzanine level and consists of two platforms located at the south end and the center of the Turbine Building and their associated catwalks. The fire sector is open to the outside on the west and through several access hatches located in the deck above at elev. 42'-0". (Ref. Turkey Point Nuclear Plant Units 3 and 4 Drawings:

5610-E-151, Rev. 10, dated August 31, 1977
5610-E-154, Rev. 8, dated December 13, 1971
5610-E-161, Rev. 8, dated August 31, 1977
5610-E-164, Rev. 5, dated December 16, 1971)

This fire sector can accommodate an effective spill diameter of 19'-6".

Fires involving three different fuels are postulated in these fire sectors: acetone, lubricating oil and heptane. In considering the effects of such fires, two levels of passive protection are considered.

The first involves only that protection which is associated with the existing separation and use of flame retardant coatings. The second adds the protection afforded by baffles and radiant energy shields to the existing level of protection. Assuming these protective measures, a "back" calculation analysis is utilized. A "back"

calculation is directed towards determining the minimum quantities of the three fuels which, if ignited, may exceed the damage criterion of the most limiting cable.

The results of the "back" calculation for these Fire Areas are presented in Tables 5.2.13 through 5.2.22. For the case of piloted ignition of a cable, the results indicated that the most limiting fuel quantity involves the combustion of 6.5 gallons of either lubricating oil or acetone in Fire Sector E. Fire Sector E represents the fuel quantities necessary to exceed the damage criterion for the most limiting cable in the breezeway area located to the west of the main east-west hallway only. Presence of such fuel quantities in that part of the fire area and its ignition are not considered likely. Moreover, in the event of a fire in the area, the existence of detection systems, the frequency of presumed access, the availability of local portable fire extinguishers and the nearby hose stations ensure that a rapid response would be expected prior to fire growth and cable damage.

Table 5.2.13 Fire Sector E, Existing Configuration

| Damage Criterion | Fuel Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux (kW/m²) | Maximum Heat Flux (BTU/Hr.ft²) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 4.9 | 60.2 | 19086.8 |
| | Lubricating Oil | 4.7 | 63.0 | 19974.5 |
| | Heptane | 7.5 | 167.9 | 53246.4 |
| Piloted Ignition | Acetone | 6.0 | 107.5 | 34096.2 |
| | Lubricating Oil | 6.0 | 124.2 | 39375.2 |
| | Heptane | 8.5 | 188.0 | 59593.8 |
| Electrical Failure | Acetone | 14.0 | 107.5 | 34096.2 |
| | Lubricating Oil | 11.5 | 177.4 | 56245.7 |
| | Heptane | 15.5 | 313.7 | 99451.0 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.14 Fire Sector E, Proposed Configuration

| Damage Criterion | Fuel Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux (kW/m2) | Maximum Heat Flux (BTU/Hr.ft2) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 5.5 | 99.6 | 31578.8 |
| | Lubricating Oil | 5.5 | 104.4 | 33097.5 |
| | Heptane | 8.0 | 161.8 | 51299.7 |
| Piloted Ignition | Acetone | 6.5 | 99.6 | 31578.8 |
| | Lubricating Oil | 6.5 | 121.3 | 38468.4 |
| | Heptane | 9.0 | 179.9 | 57035.2 |
| Electrical Failure | Acetone | 15.0 | 99.6 | 31578.8 |
| | Lubricating Oil | 12.0 | 164.3 | 52092.3 |
| | Heptane | 16.5 | 290.5 | 92104.8 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.15 Fire Sector H, Existing Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m$^2$) | (BTU/Hr.ft$^2$) |
| | Acetone | 37.0 | 291.9 | 92536.0 |
| Jacket Degradation | Lubricating Oil | 38.5 | 282.4 | 89530.3 |
| | Heptane | 53.0 | 416.5 | 132053.8 |
| | Acetone | 42.0 | 327.1 | 103715.4 |
| Piloted Ignition | Lubricating Oil | 43.5 | 315.2 | 99932.9 |
| | Heptane | 60.5 | 469.2 | 148759.5 |
| | Acetone | 86.5 | 376.1 | 119232.1 |
| Electrical Failure | Lubricating Oil | 81.5 | 554.6 | 175836.1 |
| | Heptane | 112.5 | 820.0 | 259979.6 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.16 Fire Sector H, Proposed Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m²) | (BTU/Hr.ft²) |
| Jacket Degradation | Acetone | 37.0 | 291.9 | 92536.0 |
| | Lubricating Oil | 38.5 | 282.4 | 89530.3 |
| | Heptane | 53.0 | 416.5 | 132053.8 |
| Piloted Ignition | Acetone | 42.0 | 327.1 | 103715.4 |
| | Lubricating Oil | 43.5 | 315.2 | 99932.9 |
| | Heptane | 60.5 | 469.2 | 148759.5 |
| Electrical Failure | Acetone | 86.5 | 376.1 | 119232.1 |
| | Lubricating Oil | 81.5 | 554.6 | 175836.1 |
| | Heptane | 112.5 | 820.0 | 259979.6 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.17 Fire Sector I, Existing Configuration

| Damage Criterion | Fuel Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux (kW/m$^2$) | Maximum Heat Flux (BTU/Hr.ft$^2$) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 34.5 | 364.0 | 115402.0 |
| | Lubricating Oil | 36.0 | 353.1 | 111939.8 |
| | Heptane | 49.5 | 520.2 | 164929.4 |
| Piloted Ignition | Acetone | 39.5 | 411.1 | 130351.2 |
| | Lubricating Oil | 41.0 | 396.9 | 125839.5 |
| | Heptane | 56.5 | 585.9 | 185779.0 |
| Electrical Failure | Acetone | 78.0 | 518.3 | 164330.1 |
| | Lubricating Oil | 76.5 | 695.8 | 220601.2 |
| | Heptane | 105.5 | 1027.9 | 325898.7 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.18 Fire Sector I, Proposed Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m$^2$) | (BTU/Hr.ft$^2$) |
| Jacket Degradation | Acetone | 34.5 | 364.0 | 115402.0 |
| | Lubricating Oil | 36.0 | 353.1 | 111939.8 |
| | Heptane | 49.5 | 520.2 | 164929.4 |
| Piloted Ignition | Acetone | 39.5 | 411.1 | 130351.2 |
| | Lubricating Oil | 41.0 | 396.9 | 125839.5 |
| | Heptane | 56.5 | 585.9 | 185779.0 |
| Electrical Failure | Acetone | 78.0 | 518.3 | 164330.1 |
| | Lubricating Oil | 76.5 | 695.8 | 220601.2 |
| | Heptane | 105.5 | 1027.9 | 325898.7 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.19 Fire Sector J, Existing Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | ($kW/m^2$) | ($BTU/Hr.ft^2$) |
| | Acetone | 16.0 | 69.7 | 22098.8 |
| Jacket Degradation | Lubricating Oil | 15.2 | 73.1 | 23176.8 |
| | Heptane | 28.8 | 79.2 | 25110.8 |
| | Acetone | 20.5 | 69.7 | 22098.8 |
| Piloted Ignition | Lubricating Oil | 19.6 | 73.1 | 23176.8 |
| | Heptane | 37.0 | 79.2 | 25110.8 |
| | Acetone | 67.7 | 69.7 | 22098.8 |
| Electrical Failure | Lubricating Oil | 62.0 | 101.6 | 32200.2 |
| | Heptane | 79.5 | 179.6 | 56933.7 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.20' Fire Sector J, Proposed Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | ($kW/m^2$) | ($BTU/Hr.ft^2$) |
| Jacket Degradation | Acetone | 27.0 | 61.6 | 19521.1 |
| | Lubricating Oil | 26.0 | 84.4 | 26772.2 |
| | Heptane | 35.5 | 123.6 | 39197.6 |
| Piloted Ignition | Acetone | 32.0 | 61.6 | 19521.1 |
| | Lubricating Oil | 29.5 | 94.6 | 29996.7 |
| | Heptane | 40.5 | 139.2 | 44134.2 |
| Electrical Failure | Acetone | 85.5 | 61.6 | 19521.1 |
| | Lubricating Oil | 62.0 | 101.6 | 32200.2 |
| | Heptane | 79.5 | 179.6 | 56933.7 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.21 Fire Sector K, Proposed Configuration

| Damage Criterion | Fuel Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux (kW/m$^2$) | Maximum Heat Flux (BTU/Hr.ft$^2$) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 12.0 | 259.3 | 82222.1 |
| | Lubricating Oil | 12.5 | 251.2 | 79631.8 |
| | Heptane | 17.0 | 366.4 | 116175.7 |
| Piloted Ignition | Acetone | 13.5 | 288.3 | 91416.8 |
| | Lubricating Oil | 14.0 | 278.1 | 88182.8 |
| | Heptane | 19.5 | 414.6 | 131445.1 |
| Electrical Failure | Acetone | 26.0 | 411.7 | 130544.6 |
| | Lubricating Oil | 26.0 | 485.5 | 153937.0 |
| | Heptane | 36.0 | 719.9 | 228235.9 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.22 Fire Sector K, Proposed Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | ($kW/m^2$) | ($BTU/Hr.ft^2$) |
| Jacket Degradation | Acetone | 12.0 | 259.3 | 82222.1 |
| | Lubricating Oil | 12.5 | 251.2 | 79631.8 |
| | Heptane | 17.0 | 366.4 | 116175.7 |
| Piloted Ignition | Acetone | 13.5 | 288.3 | 91416.8 |
| | Lubricating Oil | 14.0 | 278.1 | 88182.8 |
| | Heptane | 19.5 | 414.6 | 131445.1 |
| Electrical Failure | Acetone | 26.0 | 411.7 | 130544.6 |
| | Lubricating Oil | 26.0 | 485.5 | 153937.0 |
| | Heptane | 36.0 | 719.9 | 228235.9 |
| Auto Ignition | | Not Achieved | | |

## 3. Fire Hazards Evaluation

The fire hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

### Available Fire Suppression Capabilities Determination

These fire areas are outdoor areas and are therefore easily accessible. Hose stations and portable extinguishers are available to fight a fire in these areas. Area fire suppression equipment ratings are as follows:

Area 82

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 4.1.1 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.3 | 12 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.2 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.1.4 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.5 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 3.1.5 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| HS-5 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-13 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% eff) 735,000 $\frac{Btu}{min}$

Total type "B" Capability available 300 $ft^2$

Area 87

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.1.2 | 20 ABC | 210,000 Btu | 50 $ft^2$ | Acceptable |
| 3.1.1 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.1.3 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.1.4 | 10A: 40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| 3.1.5 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.1.9 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| HS-4 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-7 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% EFF) 840,000 $\frac{Btu}{min}$

Total type "B" Capability available 250 $ft^2$

Area 77

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 4.1.2 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.1.3 | 12 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.6 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.7 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| HS-13 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-14 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% EFF) 840,000 $\frac{Btu}{min}$

Total type "B" Capability available 175 $ft^2$

Area 89

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.1.1 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.1.2 | 20 BC | Minimal | 50 $ft^2$ | Acceptable |
| 3.1.8 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| HS-6 | 75 gpm @ 50% eff | 315,000 Btu/min | | "E" Rated Nozzle |
| HS-7 | 100 gpm @ 50% eff | 420,000 Btu/min | | "E" Rated Nozzle |
| Available fire suppression heat removal rate (2 hose stations @ 50% eff) | | | | 735,000 Btu/min |
| Total type "B" Capability available | | | | 175 $ft^2$ |

Area 79

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.1.5 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.4.3 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.4.4 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.6 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.7 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| HS-13 | 100 gpm @ 50% eff | 420,000 Btu/min | | "E" Rated Nozzle |
| HS-14 | 100 gpm @ 50% eff | 420,000 Btu/min | | "E" Rated Nozzle |
| Available fire suppression heat removal rate (2 hose stations @ 50% eff) | | | | 840,000 Btu/min |
| Total type "B" Capability available | | | | 125 $ft^2$ |

Area 88

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.1.9 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.1.4 | 10A: 40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| 3.1.3 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| HS-7 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-8 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% eff) 840,000 $\frac{Btu}{min}$

Total type "B" Capability available 150 $ft^2$

Area 84

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.6.1 | 10A: 60 BC | 105,000 Btu | 150 $ft^2$ | Acceptable |
| 3.6.2 | 10A: 60 BC | 105,000 Btu | 150 $ft^2$ | Acceptable |
| 3.6.3 | 10A: 60 BC | 105,000 Btu | 150 $ft^2$ | Acceptable |
| HS-8 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-15 | 100 gpm @50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% eff) 840,000 $\frac{Btu}{min}$

Total Type "B" Capability available 450 $ft^2$

Area 91

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 4.1.3 | 12 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.1 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.2 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.1.4 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.5 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| HS-8 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-13 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% eff) — 840,000 $\frac{Btu}{min}$

Total type "B" Capability available — 275 $ft^2$

Area 92

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.1.2 | 20 ABC | 210,000 Btu | 50 $ft^2$ | Acceptable |
| 3.1.1 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.1.4 | 10A: 40 BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| 3.1.3 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| HS-6 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-7 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% eff) — 735,000 $\frac{Btu}{min}$

Total type "B" Capability available — 200 $ft^2$

Area 105

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 4.4.9 | 4A: 40 BC | 42,000 Btu | 100 ft$^2$ | Acceptable |
| 3.2.1 | 10 BC | Minimal | 25 ft$^2$ | Acceptable |
| 4.2.2 | 4A: 40 BC | 42,000 Btu | 100 ft$^2$ | Acceptable |
| HS-15 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-9 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-20 | 100 gpm @ 50% eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-21 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% eff) 1,575,00 $\frac{Btu}{min}$

Total Type "B" Capability available 225 ft$^2$

Area 117

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.3.2 | 4A: 40 BC | 42,000 Btu | 100 ft$^2$ | Acceptable |
| 3.3.1 | 10 BC | Minimal | 25 ft$^2$ | Acceptable |
| 3.3.3 | 10 BC | Minimal | 25 ft$^2$ | Acceptable |
| 4.3.4 | 10 BC | Minimal | 25 ft$^2$ | Acceptable |
| 4.3.6 | 20A: 80 BC | 210,000 Btu | 200 ft$^2$ | Acceptable |
| 4.3.3 | 4A: 40 BC | 42,000 Btu | 100 ft$^2$ | Acceptable |
| 4.3.2 | 10 BC | Minimal | 25 ft$^2$ | Acceptable |
| 4.3.1 | 4A: 40 BC | 42,000 Btu | 100 ft$^2$ | Acceptable |
| 3.3.4 | 4A: 40 BC | 42,000 Btu | 100 ft$^2$ | Acceptable |

Area 117 (Cont'd)

| | | | |
|---|---|---|---|
| HS-10 | 75 gpm @ 50% eff | 315,000 Btu/min | "E" Rated Nozzle |
| HS-11 | 75 gpm @ 50% eff | 315,000 Btu/min | "E" Rated Nozzle |
| HS-12 | 75 gpm @ 50% eff | 315,000 Btu/min | "E" Rated Nozzle |
| HS-16 | 75 gpm @ 50% eff | 315,000 Btu/min | "E" Rated Nozzle |
| HS-17 | 100 gpm @ 50% eff | 420,000 Btu/min | "E" Rated Nozzle |
| HS-18 | 100 gpm @ 50% eff | 420,000 Btu/min | "E" Rated Nozzle |
| HS-19 | 100 gpm @ 50% eff | 420,000 Btu/min | "E" Rated Nozzle |

| | |
|---|---|
| Available fire suppression heat removal rate (2 hose stations @ 50% eff) | 840,000 Btu/min |
| Total type "B" Capability available | 700 ft$^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables in these areas. FPL proposes to provide this protection by the use of thermal shields, cable tray baffles and thermal insulating material to protect conduit. Although no credit is given for existing fire detection and suppression equipment, the potential for a large fire in this area is considered acceptably small. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Protect all electrical cable trays in these areas by installation of fire resistant baffles under these trays. Baffles are to span the width of the lowest cable tray in a stack and are to be located within 4 inches of the bottom of the lowest tray. These baffles will be constructed of ½ inch thick marinite or equivalent. See Appendix D.

2. Protect one train of conduit in these areas utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

3. Provide a fire barrier or enclosure of non-combustible material ½" thick marinite or equivalent around valve operators for valves SV-3-6275A, SV- 3-6275B, MOV-4-1410, and MOV-4-1411.

4. Provide the equivalent of a 1 hour rated barrier for the electrical conduit associated with valves SV-3-6275A, SV-3-6275B, MOV-4-1410 and MOV-4-1411 by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

5. Provide a fire barrier or enclosure of non-combustible material (½" thick marinite or equivalent) around the valve operators of valves MOV-4-1403 and MOV-3-1403.

6. Provide the equivalent of a 1 hour rated barrier for the electrical conduit associated with valves MOV-4-1403 and MOV-3-1403 by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

7. Protect all vertical cable trays penetrating the floor of these areas by the installation of a fire resistant partial enclosure or heat shield around the trays. This enclosure will be constructed of ½" thick marinite or equivalent, and will extend from the floor up to the lowest horizontal tray in a stack. See Appendix D.

8. Protect one train of wireways in these areas utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a 1 hour rated barrier.

9. Prepare procedures to allow manual operation of MOV-4-865B and MOV-3-865A. These are cold shutdown valves.

e. EXEMPTION REQUEST

FPL requests exemption for Areas 77, 79, 82, 84, 87, 88, 89, 91, 92, 105 and 117 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with these areas supplemented by the specific modifications identified provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications coupled with a strict combustible control program based on Appendix C of this report provide reasonable assurance that safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section II.G.2 in Areas 77, 79, 82, 84, 87, 88, 89, 91, 92, 105 and 117 based on implementation of the specific requirements of subsection (c) is estimated to be $442,755 versus the cost for the proposed modifications of $239,000.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are five types of backfit activities necessary to support our exemption requests which do not require a unit outage. FPL requests exemption from 10CFR50.48(c)(1&2) to extend the allowed completion schedule for these activities from 1 month and 9 months respectively, (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There is one type of backfit activity necessary to support our exemption request which requires an outage on both Units 3 and 4 to construct equipment fire barriers which will not be seismically qualified until completed. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from

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*Specifically, FPL requests exemption from those provisions that require the separation of redundant safe shutdown related cable trays by a 1 hour rated fire barrier and the installation of 1 hour rated fire barriers for the valve operators of SV-3-6275A, SV-3-6275B, MOV-4-1410, MOV-4-1411, MOV-4-1403, and MOV-3-1403. In addition FPL requests exemption from the installation of additional fire detection and suppression systems for these areas.

180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of these activities are not possible during the Steam Generator Repair (Winter 1982) or Fall 1983 refueling outage and that NRC approval of this exemption request is required prior to March 1, 1983 in order to assure installation during the Spring 1985 and Fall 1984 refueling outages.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed as follows.

1. There are five types of backfit activities necessary to implement the III.G.2 criteria which do not require a unit outage. FPL requests exemption from 10CFR50.48(c)(1&2) to extend the allowed completion schedule for these activities from 1 month and 9 months respectively, (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR 50.48(c)(3)(i), (ii) or (iii).

2. There is one type of backfit activity necessary to implement III.G.2 criteria which requires a unit outage because the modifications may require cutting and welding of the Fire System water supply piping. This activity would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR 50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair (Winter 1982) or Fall 1983 refueling outages and that NRC action is required prior to June 1, 1983 in order to assure installation during the Spring 1985 and Fall 1984 refueling outages.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.11 FIRE AREAS 98 AND 132

### a. Area Description

Fire areas 98 and 132 include the shared Cable Spreading Room for Units 3 and 4 and the Control Building stairwell. Provided below is a brief description of Areas 98 and 132.

**Fire Area 98**

This Fire Area 98 is the Units 3 and 4 shared Cable Spreading Room located at Elevation 30'-0" inside the Control Building. It houses plant computer equipment, reactor protection instrumentation racks, and general relay panels. The area is accessible from the mezzanine deck (30' level) of the Turbine Building, the inverter rooms (Area 101 and 104) and the Control Building stairway (Area 132). All cable trays in the area are sprayed with Flamemastic 71A. Numerous safe shutdown related cables are routed in trays or in conduit exiting from these trays. Trays are at various elevations, principally being located at elevations 36'-6", 37'-6", and 38'-6". A one foot separation between trays is maintained.

**Fire Area 132**

Fire Area 132 is the Control Building stairway (elevation 18' to 42'). This area also contains electrical cables required for plant shutdown. Cables are routed through the area in trays located at Elevations 37'-6" and 38'-6". All cable trays are sprayed with Flamemastic 71A. Pertinent fire area details are provided below:

| | Area 98 | Area 132 |
|---|---|---|
| Floor Surface Area, | 2700 $ft^2$ | 133 $ft^2$ |
| Wall and Ceiling Surface Area, | 6000 $ft^2$ | 557 $ft^2$ |
| Free Volume Excluding Components, | 33000 $ft^3$ | 750 $ft^3$ |
| Ceiling Height, | 11 ft. 4 in. | 11 ft. 4 in. |
| Floor Composition,<br>Floor Thickness, | Concrete<br>8 in. | Concrete<br>8 in. |
| Wall Composition,<br>Wall Thickness, | Concrete<br>1 ft. 6 in. N & S<br>1 ft. E & W | Concrete<br>1 ft. |
| Ceiling Composition,<br>Ceiling Thickness, | Concrete<br>8 in. | Concrete<br>8 in. |

| | Area 98 | Area 132 |
|---|---|---|
| Fire Detectors in Area, | Yes | Yes |
| Detectors No./type, | 6-1, 6-2, 6-2A, 6-3, 6-4, 6-6, 6-7, 6-8. 6-10, 6-11, 6-12, 6-13, 6-15, 6/16/Ionization | 6-1, 6-8, 6-7/ Ionization |
| Automatic Supression, | No | No |
| Type of Auto Supression, | N/A | N/A |
| Installed Comm. Near Fire Area, | Telephone T-411<br>Pax M-411<br>Telephone T-365<br>Pax M-365 | Control Room |
| Hose Station Available to Area, | #15<br>#21 | #15<br># 8 |
| Fire Extinguishers Immediately available to area, | 3.3.8<br>3.3.9<br>4.2.1<br>4.2.2<br>4.4.7<br>4.4.9 | 4.1.3<br>4.1.2<br>4.4.9 |
| Number of Floor Drains, | 2 | None |
| Drain(s) Size, | 3" | N/A |
| Drain(s) Flow to, | Sewer | N/A |
| Normal Forced draft Ventilation, | Yes/AC | No |
| Normal Ventilation Flow Rate, | 2500 CFM (Supply & Exhaust) | N/A |
| Emergency Forced Draft Ventilation, | None | None |
| Emergency Ventilation Flow Rate, | N/A | N/A |

Fire Area Penetrations: Area 98

| | |
|---|---|
| West Wall | 4'x 8' Doorway to Mezzanine Deck<br>3' x 7' -2" Doorway to Area 132<br>3' x 7' - 2" Doorway to Area 100<br>20" x 20" Ventilation Duct<br>14" x 20" Ventilation Duct<br>30" x 30" Ventilation Duct<br>20" x 24" Duct<br>1 - 4" Hole for 1½" Pipe |

| | |
|---|---|
| South Wall | 3'-0" x 7'-2" Doorway to Area 99<br>3'-8" x 7'-2" Doorway to Area 97<br>30" x 48" Duct |
| East Wall | 3'-8" x 8' Doorway to Area 101<br>3'-8" x 7'-2" Doorway to area 104<br>10" x 10" Hole for 8" x 8" Conduits<br>16" x 16" Hole for 8" x 8" Conduits<br>10" x 14" Hole for 8" x 10" Conduits<br>6" x 8" Duct |
| Floor | 2-1" Holes |
| Ceiling | 2-3" Holes for 2" Conduit |

Fire Area Penetrations: Area 132

| | |
|---|---|
| West Wall | 3' x 7'-2" Doorway to Mezzanine Deck |
| South Wall | Open to the Control Building Hallway at the 18"-0" level |
| East Wall | 3' x 7'-2" Doorway to Area 98 |

b. Safe Shutdown Equipment/Cables/Nuclear Safety Evaluation

1. Safe Shutdown Equipment/Cables; for Area 98

Hot Shutdown Equipment/Cables

| Cables | Power(P) Control(C) |
|---|---|
| Chg. Pump 3A | C |
| Chg. Pump 3B | C |
| Chg. Pump 3C | C |
| Chg. Pump 4A | C |
| Chg. Pump 4B | C |
| Chg. Pump 4C | C |
| CCW Pump 3A | C |
| CCW Pump 3B | C |
| CCW Pump 3C | C |
| CCW Pump 4A | C |
| CCW Pump 4B | C |

| Cables | Power(P) Control(C) |
|---|---|
| CCW Pump 4C | C |
| ICW Pump 3A | C |
| ICW Pump 3B | C |
| ICW Pump 3C | C |
| ICW Pump 4A | C |
| ICW Pump 4B | C |
| ICW Pump 4C | C |
| BA Transfer Pump 3A | C |
| BA Transfer Pump 3B | C |
| BA Transfer Pump 4A | C |
| BA Transfer Pump 4B | C |
| AFW Pump Steam Supply S/G 3A MOV-3-1403 | C |
| AFW Pump Steam Supply S/G 3B MOV-3-1404 | C |
| AFW Pump Steam Supply S/G 3C MOV-3-1405 | C |
| AFW Pump Steam Supply S/G 4A MOV-4-1403 | C |
| AFW Pump Steam Supply S/G 4B MOV-4-1404 | C |
| AFW Pump Steam Supply S/G 4C MOV-4-1405 | C |
| BA Injection Stop Valve MOV-3-350 | C |
| BA Injection Stop Valve MOV-4-350 | C |
| VCT Lo-Level Isolation Valve MOV-3-115C | C |

| Cables | Power(P) Control(C) |
|---|---|
| VCT Lo-Level Isolation Valve MOV-4-115C | C |
| AB Exhaust Fan 3A | C |
| AB Exhaust Fan 3B | C |
| AB Supply Fan 3A | C |
| AB Supply Fan 3B | C |
| Pressurizer Heater Control Group 3A | C |
| Pressurizer Heater Control Group 4A | C |
| Pressurizer Heater Backup Group 3A | C |
| Pressurizer Heater Backup Group 3B | C |
| Pressurizer Heater Backup Group 4A | C |
| Pressurizer Heater Backup Group 4B | C |
| MSIV S/G 3A POV-3-2604 | C |
| MSIV S/G 3B POV-3-2605 | C |
| MSIV S/G 3C POV-3-2606 | C |
| MSIV S/G 4A POV-4-2604 | C |
| MSIV S/G 4B POV-4-2605 | C |
| MSIV S/G 4C POV-4-2606 | C |
| AFW Pump Auto Start Circuit Unit 3 | C |
| AFW Pump Auto Start Circuit Unit 3 Backup | C |
| AFW Pump Auto Start Circuit Unit 4 | C |
| AFW Pump Auto Start Circuit Unit 4 Backup | C |
| AFW Pump B Steam Supply Pressure Control Valve SV-3706 | C |

| Cables | Power(P) Control(C) |
|---|---|
| AFW Pump C Steam Supply Pressure Control Valve SV-3707 | C |
| AFW to S/G 3A Control Valve SV-3-2914 | C |
| AFW to S/G 3B Control Valve SV-3-2916 | C |
| AFW to S/G 3C Control Valve SV-3-2918 | C |
| AFW to S/G 3A Backup Control Valve SV-3-2915 | C |
| AFW to S/G 3B Backup Control Valve SV-3-2917 | C |
| AFW to S/G 3C Backup Control Valve SV-3-2919 | C |
| AFW To S/G 4A Control Valve SV-4-2914 | C |
| AFW to S/G 4B Control Valve SV-4-2916 | C |
| AFW to S/G 4C Control Valve SV-4-2918 | C |
| AFW to S/G 4A Backup Control Valve SV-4-2915 | C |
| AFW to S/G 4B Backup Control Valve SV-4-2917 | C |
| AFW to S/G 4C Backup Control Valve SV-4-2919 | C |
| RCS/Pressurizer Pressure PI-3-403 | C |
| RCS/Pressurizer Pressure PI-4-403 | C |
| RCS Temperature Hot Leg TE-3-413 | C |
| RCS Temperature Hot Leg TE-3-423 | C |

| Cables | Power(P) Control(C) |
|---|---|
| RCS Temperature Hot Leg TE-3-433 | C |
| RCS Temperature Hot Leg TE-4-413 | C |
| RCS Temperature Hot Leg TE-4-423 | C |
| RCS Temperature Hot Leg TE-4-433 | C |
| RCS Temperature Cold Leg TE-3-410 | C |
| RCS Temperature Cold Leg TE-3-420 | C |
| RCS Temperature Cold Leg TE-3-430 | C |
| RCS Temperature Cold Leg TE-4-410 | C |
| RCS Temperature Cold Leg TE-4-420 | C |
| RCS Temperature Cold Leg TE-4-430 | C |
| Steam Generator 3A Pressure | |
| PT/PI-3-474 | C |
| PT/PI-3-475 | C |
| PT/PI-3-476 | C |
| Steam Generator 3B Pressure | |
| PT/PI-3-484 | C |
| PT/PI-3-485 | C |
| PT/PI-3-486 | C |
| Steam Generator 3C Pressure | |
| PT/PI-3-494 | C |
| PT/PI—494 | C |
| PT/PI—496 | C |
| AFW Pump A Steam Supply Pressure Control Valve SV-3705 | C |

| Cables | Power(P) Control(C) |
|---|---|
| Steam Generator 4A Pressure | |
| PT/PI-4-474 | C |
| PT/PI-4-475 | C |
| PT/PI-4-476 | C |
| Steam Generator 4B Pressure | |
| PT/PI-4-484 | C |
| PT/PI-4-485 | C |
| PT/PI-4-486 | C |
| Steam Generator 4C Pressure | |
| PT/PI-4-494 | C |
| PT/PI-4-495 | C |
| PT/PI-4-496 | C |
| Steam Generator 3A Level | |
| LT/LI-3-477 | C |
| LT/LI-3-474 | C |
| LT/LI-3-475 | C |
| LT/LI-3-476 | C |
| Steam Generator 3B Level | |
| LT/LI-3-487 | C |
| LT/LI-3-484 | C |
| LT/LI-3-485 | C |
| LT/LI-3-486 | C |
| Steam Generator 3C Level | |
| LT/LI-3-497 | C |
| LT/LI-3-494 | C |
| LT/LI-3-495 | C |
| LT/LI-3-496 | C |
| Steam Generator 4A Level | |
| LT/LI-4-477 | C |
| LT/LI-4-474 | C |
| LT/LI-4-475 | C |
| LT/LI-4-476 | C |
| Steam Generator 4B Level | |
| LT/LI-4-487 | C |
| LT/LI-4-484 | C |
| LT/LI-4-485 | C |
| LT/LI-4-486 | C |
| Steam Generator 4C Level | |
| LT/LI-4-497 | C |
| LT/LI-4-494 | C |
| LT/LI-4-495 | C |
| LT/LI-4-496 | C |

| Cables | Power(P) Control(C) |
|---|---|
| Pressurizer Level Unit 3 | |
| LT/LI-3-459 | C |
| LT/LI-3-460 | C |
| LT/LI-3-461 | C |
| LT/LI-3-462 | C |
| Pressurizer Level Unit 4 | |
| LT/LI-4-459 | C |
| LT/LI-4-460 | C |
| LT/LI-4-461 | C |
| LT/LI-4-462 | C |
| Diesel Generator #3 Breaker Bus 3A | C |
| Diesel Generator #3 Breaker Bus 4A | C |
| Diesel Generator #4 Breaker Bus 3B | C |
| Diesel Generator #4 Breaker Bus 4B | C |
| CCW Sup. Valve for Contain. Cool. 3-2904 | C |
| CCW Sup. Valve for Contain. Cool. 4-2904 | C |
| CCW Rtn. Valve for Contain. Cool. 3-2906 | C |
| CCW Sup. Valve for Contain. Cool. 3-2905 | C |
| Chg. Line Isolation Valve 4-310A | C |
| Chg. Line Isolation Valve 4-310B | C |
| Chg. Line Isolation Valve 3-310A | C |
| Chg. Line Isolation Valve 3-310B | C |
| CCW Sup. Valve for Emer. Contain. Cool. CV-3-2903 | C |
| Contain. Cool. Discharge MOV-4-1418 | C |

| Cables | Power(P) Control(C) |
|---|---|
| Contain. Cool. Discharge MOV-3-1418 | C |
| CCW Sup. Valve for Contain. Cool. 3-1417 | C |
| CCW Sup. Valve for Contain. Cool. 4-1417 | C |
| Emer. Contain. Cool. 3A | C |
| Emer. Contain. Cool. 3B | C |
| Emer. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3A | C |
| Norm. Contain. Cool. 3B | C |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |
| Norm. Contain. Cool. 4A | C |
| Norm. Contain. Cool. 4B | C |
| Norm. Contain. Cool. 4C | C |
| Norm. Contain. Cool. 4D | C |
| Emer. Contain. Cool. 4A | C |
| Emer. Contain. Cool. 4B | C |
| Emer. Contain. Cool. 4C | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 4C 4-2908 | C |
| CCW Sup. Valve for Emer. Contain. Cool. 4C 4-2905 | C |
| RCS/Pressurizer Pressure PT-4-455 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 4A 4-2906 | C |
| CCW Sup. Valve for Emer. Contain. Cool. 4A 4-2903 | C |

| Cables | Power(P) Control(C) |
|---|---|
| CCW Rtn. Valve for Emer. Contain. Cool. 3B 3-2907 | C |
| RCS/Pressurizer Pressure PT-3-444 | C |
| RCS/Pressurizer Pressure PT-3-455 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 4B 4-2907 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 3C 3-2908 | C |
| RCS/Pressurizer Pressure PT-4-444 | C |
| Control Rm. A/C -B | P |
| Control Rm. A/C -C | P |
| RCS/Pressurizer Pressure PT-3-455 | C |
| RCS/Pressurizer Pressure PT-3-457 | C |
| RCS/Pressurizer Pressure PT-3-458 | C |
| RCS/Pressurizer Pressure PT-4-402 | C |
| RCS/Pressurizer Pressure PT-4-445 | C |
| RCS/Pressurizer Pressure PT-4-457 | C |
| RCS/Pressurizer Pressure PT-4-458 | C |

Cold Shutdown Equipment/Cables

| Cables | Power(P) Control(C) |
|---|---|
| RHR Pump 3A | C |
| RHR Pump 3B | C |
| RHR Pump 4A | C |
| RHR Pump 4B | C |
| Accumulator Stop Valve MOV-3-865A | C |
| Accumulator Stop Valve MOV-3-865B | C |

| Cables | Power(P) Control(C) |
|---|---|
| Accumulator Stop Valve MOV-3-865C | C |
| Accumulator Stop Valve MOV-4-865A | C |
| Accumulator Stop Valve MOV-4-865B | C |
| Accumulator Stop Valve MOV-4-865C | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749A | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749B | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749A | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-4-749B | C |
| RWST Isolation Valve from RHR Header MOV-3-862A | C |
| RWST Isolation Valve From RHR Header MOV-3-862B | C |
| RWST Isolation Valve From RHR Header MOV-4-862A | C |
| RWST Isolation Valve From RHR Header MOV-4-862B | C |
| Inlet Isolation Valve From RHR MOV-3-744A | C |
| RCS Inlet Isolation Valve From RHR MOV-3-744B | C |
| RCS Inlet Isolation Valve From RHR MOV-4-744A | C |
| RCS Inlet Isolation Valve From RHR MOV-4-744B | C |
| RHR Inlet Isolation Valve from RCS MOV-3-750 | C |

| Cables | Power(P) Control(C) |
|---|---|
| RHR Inlet Isolation Valve from RCS MOV-4-750 | C |
| RHR Inlet Isolation Valve from RCS MOV-3-751 | C |
| RHR Inlet Isolation Valve from RCS MOV-4-751 | C |
| RWST Isolation Valve From RHR Header MOV-4-863A | C |
| RWST Isolation Valve From RHR Header MOV-4-863B | C |
| RHR Flow Control HCV-4-758 | C |
| RWST Isolation Valve From RHR Header MOV-3-863A | C |
| RWST Isolation Valve From RHR Header MOV-3-863B | C |
| RWST Supply Valve to Charging Header LCV-3-115B | C |
| RWST Supply Valve to Charging Header LCV-4-115B | C |
| Pressurizer Auxiliary Spray Valve 4-311 | C |
| Pressurizer Auxiliary Spray Valve 3-311 | C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power(P) Control(C) |
|---|---|
| Blowdown Isolation Valve S/G 3A SV-3-6275A | C |
| Blowdown Isolation Valve S/G 3B SV-3-6275B | C |
| Blowdown Isolation Valve S/G 3C SV-3-6275C | C |
| Blowdown Isolation Valve S/G 4A MOV-4-1410 | C |

| Cables | Power(P) Control(C) |
|---|---|
| Blowdown Isolation Valve S/G 4B MOV-4-1411 | C |
| Blowdown Isolation Valve S/G 4C MOV-4-1412 | C |
| Letdown Isolation Valve 4-204 | C |
| Excess Letdown Isolation Valve 4-387 | C |
| Letdown Isolation Valve 4-200A | C |
| Letdown Isolation Valve 4-200B | C |
| Letdown Isolation Valve 4-200C | C |
| Excess Letdown Isolation Valve 3-387 | C |
| Letdown Isolation Valve 3-204 | C |
| Letdown Isolation Valve 3-200A | C |
| Letdown Isolation Valve 3-200B | C |
| Letdown Isolation Valve 3-200C | C |
| Letdown Isolation Valve LCV-3-460 | C |
| Letdown Isolation Valve LCV-4-460 | C |
| PORV PCV-4-456 | C |
| PORV Block Valve 4-536 | C |
| PORV Block Valve 4-535 | C |
| PORV PCV-3-455C | C |
| PORV PCV-3-456 | C |
| PORV Block Valve 3-536 | C |
| PORV Block Valve 3-535 | C |
| PORV PCV-4-455C | C |
| Pressurizer Spray Valve PCV-3-455B | C |
| Pressurizer Spray Valve PCV-3-455A | C |

| Cables | Power(P) Control(C) |
|---|---|
| Pressurizer Spray Valve PCV-4-455A | C |
| Pressurizer Spray Valve PCV-4-455B | C |
| High-Containment Pressure | |
| PS-3-2007 | C |
| PS-3-2008 | C |
| PS-3-2009 | C |
| High-Containment Pressure | |
| PS-4-2007 | C |
| PS-4-2008 | C |
| PS-4-2009 | C |
| High-High Containment Pressure | |
| PS-3-2056 | C |
| PS-3-2057 | C |
| PS-3-2058 | C |
| High-High Containment Pressure | |
| PS-4-2056 | C |
| PS-4-2057 | C |
| PS-4-2058 | C |

2. Safe Shutdown Equipment/Cables; for Area 132

Hot Shutdown Equipment/Cables

| Cables | Power(P) Control(C) |
|---|---|
| Chg. Pump 4A | C |
| Chg. Pump 4B | C |
| Chg. Pump 4C | C |
| AFW Pump Steam Supply Valve S/G 4B MOV-4-1404 | C |
| AFW to S/G 4A Control Valve SV-4-2914 | C |
| AFW to S/G 4B Control Valve SV-4-2916 | C |
| AFW to S/G 4C Control Valve SV-4-2918 | C |
| AFW to S/G 4A Backup Control Valve SV-4-2915 | C |

| Cables | Power(P) Control(C) |
|---|---|
| AFW to S/G 4B Backup Control Valve SV-4-2917 | C |
| AFW to S/G 4C Backup Control Valve SV-4-2919 | C |
| Steam Generator 4A Level | |
| LT/LI-4-477 | C |
| LT/LI-4-474 | C |
| LT/LI-4-475 | C |
| LT/LI-4-476 | C |
| Steam Generator 4B Level | |
| LT/LI-4-487 | C |
| LT/LI-4-484 | C |
| LT/LI-4-485 | C |
| LT/LI-4-486 | C |
| Steam Generator 4C Level | |
| LT/LI-4-497 | C |
| LT/LI-4-494 | C |
| LT/LI-4-495 | C |
| LT/LI-4-496 | C |
| Diesel Generator #3 Breaker Bus 4A | C |
| Diesel Generator #4 Breaker Bus 4B | C |
| CCW Sup. Valve for Norm. Contain Cool. 4-1417 | C |
| Norm. Contain. Cool. 4C | C |
| Norm. Contain. Cool. 4D | C |
| MSIV S/G 4C POV-4-2606 | C |
| MSIV S/G 4B POV-4-2605 | C |
| MSIV S/G 4A POV-4-2604 | C |

Cold Shutdown Equipment/Cables

| Cables | Power(P) Control(C) |
|---|---|
| Accumulator Stop Valve MOV-4-865B | C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power(P) Control(C) |
|---|---|
| Blowdown Isolation Valve S/G 4C MOV-4-1412 | C |

3. **Nuclear Safety Evaluation**

As indicated by the preceding hot/cold shutdown cable listing, the Cable Spreading Room contains numerous A and B train cables required for safe shutdown. Whereas redundant equipment separation in this area is feasible, redundant cable tray separation is complicated by the number of divisional crossovers and relatively short distance between trays. Based on the congestion of A and B safe shutdown related cable trays, a concept of total cable protection was deemed to be the most viable approach for ensuring the capability to achieve and maintain hot/cold shutdown conditions.

In addition, the Cable Spreading Room was determined to contain various power panels for safe shutdown related instrumentation and air operated valves. FPL proposes to protect one train of this equipment. The fire hazards analysis and evaluation contained herein quantifies the level of protection to be provided by a combination of Flamemastic coatings on cables, baffles beneath cable trays, and the use of a thermal insulator to protect conduit.

c. **FIRE HAZARDS ANALYSIS**

1. **Fire Area Combustibles**

The major potential combustible sources of concern in the Cable Spreading Room are the electrical equipment cabinets and numerous cable trays throughout the area. The major potential combustible sources of concern in the Control Building stairwell are cable trays. All cable trays are sprayed with Flamemastic, and therefore can only be considered a combustible if exposure fires of sufficient intensity are postulated such that piloted ignition or auto ignition of the cables occurs. A review of the electrical equipment and cables has shown that only low voltage electrical devices are employed, and that these devices and wiring are highly flame resistant. The Cable Spreading Room contains cabinet mounted components with separation of redundant trains provided by appropriate barriers or usually the cabinet itself. Such physical separation as the cabinets provide limits the total concentration of combustibles to small quantities. For these reasons only transient combustibles were utilized in the analysis.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in

any quantity onsite at the Turkey Point plant. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time, while heptane has no use at all onsite. Thus while fires involving substantial quantities of these fuels are modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6), transient combustibles will be strictly limited. In Fire Areas 98 and 132, flammable liquids will be limited to one quart and combustible liquids will be limited to one gallon. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

Fire Areas 98 and 132 were divided into two fire sectors. Fire Sector F is located in the Cable Spreading Room on the 30.0 foot level. (Ref. Turkey Point Nuclear Plant Units 3 and 4 Drawing 5610-E-128, Rev. 11, dated August 31, 1977). This fire sector can accommodate an effective spill diameter of 20 feet. Fire Sector G is located in the vestibule west of the Cable Spreading Room on the 30.0 foot level. (Ref. Turkey Point Nuclear Plant Units #3 and #4, Drawing 5610-E-128, Rev. 11, dated August 31, 1977). This fire sector can accommodate an equivalent to a free floor area of 14 feet, 7 inches. Fires involving three different fuels are postulated in these sectors: acetone, lubricating oil, and heptane. In considering the effects of such fires, two levels of passive protection are considered.

The first involves only that protection which is associated with the existing separation and use of flame retardant coatings. The second adds the protection afforded by baffles and radiant energy shields to the existing level of protection.

Assuming these protective measures, a "back" calculation analysis is utilized. A "back" calculation is directed towards determining the minimum quantities of the three fuels which, if ignited, may exceed the damage criterion of the most limited cable.

The results of the "back" calculation are presented in Tables 5.2.21 thru 5.2.24. For the case of piloted ignition of a cable, the results indicate that the most limiting fuel quantity involves the combustion of 10.5 gallons of either lubricating oil or acetone in Fire Sector G, and 11.5 gallons of acetone in Fire Sector F.

These quantities are considered to be well in excess of that quantity which may realistically be introduced into the plant as a result of a breakdown of administrative controls. Fires of this size and location

are considered to be the fire area's design basis fire. It is noted that the proposed modifications have little impact on the protection of the limiting cable given the tray configurations which exists. Nevertheless, modifications are proposed to provide some additional protection.

Based on these considerations, it is concluded that the existing configurations will adequately protect the cables from the effects of exposure fires. Further modifications to comply with the specific provisions of Appendix R would not enhance fire protection safety.

3. Fire Hazards Evaluation

The fire area hazards evaluation was separated into four categories, viz., fire area structural ratings evaluation, fire area adjacent effects evaluation, available fire suppresssion capabilities determination, and a fire area summary.

Fire Area Structural Ratings Evaluation Data for Areas 98 and 132 is as Follows:

Area boundary structural fire rating estimates based on standardized curves for solid concrete walls (See Section 5.2 for details);

| | Area 98 | Area 132 |
|---|---|---|
| Walls | 4 | 4 (Except South Wall) |
| Floor | 4 | 4 |
| Ceiling | 4 | 4 |

Fire area structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to adjacent areas, hot gas radiation, or burning liquid spread. No fire spread hazard was found to exist. There are no significant ignition sources near these penetrations. Any burning liquid entering the drain system would not be expected to have an effect on adjacent areas. In spite of this determination, FPL proposes upgrading the perimeter walls, floors, and ceilings for Fire Areas 98 and 132 by sealing all piping penetrations and installation of fire barriers.

Available Fire Suppression Capabilities Evaluation

Fire Area 98 is accessible from the mezzanine deck of the Turbine Building, the inverter rooms and the Control Building stairway, Area 132. Hose Stations 8, 15, and 21 are available to fight a fire in these areas, and portable extinguishers 3.3.8, 3.3.9, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.4.7, and 4.4.9 are available for use. In addition, it should be

Table 5.2.21 Fire Sector F, Existing Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m$^2$) | (BTU/Hr-ft$^2$) |
| Jacket Degradation | Acetone | 9.0 | 371.6 | 117811.7 |
| | Lubricating Oil | 9.0 | 346.9 | 109983.6 |
| | Heptane | 12.5 | 515.7 | 163518.7 |
| Piloted Ignition | Acetone | 10.0 | 408.5 | 129530.1 |
| | Lubricating Oil | 10.5 | 398.5 | 126353.2 |
| | Heptane | 14.5 | 589.4 | 186888.7 |
| Electrical Failure | Acetone | 19.0 | 663.0 | 210220.8 |
| | Lubricating Oil | 19.5 | 695.7 | 220566.3 |
| | Heptane | 27.0 | 1031.4 | 327024.2 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.22 Fire Sector F, Proposed Configuration

| Damage Criterion | Fuel Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | Maximum Heat Flux ($kW/m^2$) | Maximum Heat Flux ($BTU/Hr\text{-}ft^2$) |
|---|---|---|---|---|
| Jacket Degradation | Acetone | 10.5 | 324.2 | 102783.2 |
| | Lubricating Oil | 10.5 | 302.6 | 95953.8 |
| | Heptane | 14.5 | 447.6 | 141923.8 |
| Piloted Ignition | Acetone | 11.5 | 351.8 | 111549.8 |
| | Lubricating Oil | 12.0 | 341.3 | 108204.9 |
| | Heptane | 16.5 | 502.8 | 159428.4 |
| Electrical Failure | Acetone | 22.0 | 535.6 | 169821.5 |
| | Lubricating Oil | 22.5 | 600.9 | 190525.3 |
| | Heptane | 31.0 | 887.0 | 281225.5 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.23 Fire Sector G, Existing Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m$^2$) | (BTU/Hr-ft$^2$) |
| Jacket Degradation | Acetone | 9.0 | 191.3 | 60649.6 |
| | Lubricating Oil | 9.5 | 187.5 | 59441.7 |
| | Heptane | 13.0 | 275.0 | 87203.1 |
| Piloted Ignition | Acetone | 10.5 | 219.7 | 69673.1 |
| | Lubricating Oil | 10.5 | 205.1 | 65044.0 |
| | Heptane | 14.5 | 303.4 | 96207.5 |
| Electrical Failure | Acetone | 20.5 | 250.6 | 79454.2 |
| | Lubricating Oil | 20.0 | 366.4 | 116163.0 |
| | Heptane | 27.0 | 531.0 | 168350.4 |
| Auto Ignition | | Not Achieved | | |

Table 5.2.24 Fire Sector G, Proposed Configuration

| Damage Criterion | Fuel | | Maximum Heat Flux | |
|---|---|---|---|---|
| | Type | Fuel Quantity Necessary to Achieve Failure Criterion (Gals) | (kW/m²) | (BTU/Hr·ft²) |
| Jacket Degradation | Acetone | 9.0 | 191.3 | 60649.6 |
| | Lubricating Oil | 9.5 | 187.5 | 59441.7 |
| | Heptane | 13.0 | 275.0 | 87203.1 |
| Piloted Ignition | Acetone | 10.5 | 219.7 | 69673.1 |
| | Lubricating Oil | 10.5 | 205.1 | 65044.0 |
| | Heptane | 14.5 | 303.4 | 96207.5 |
| Electrical Failure | Acetone | 20.5 | 250.6 | 79454.2 |
| | Lubricating Oil | 20.0 | 366.4 | 116163.0 |
| | Heptane | 27.0 | 531.0 | 168350.4 |
| Auto Ignition | | Not Achieved | | |

noted that self-contained emergency lighting units have been installed in the Cable Spreading Room to enhance fire fighting capabilities.

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.3.8 | 10BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.3.9 | 10BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.1.2 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.1.3 | 12BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.2.1 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.2.2 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.4.7 | 10BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.4.9 | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| HS-8 | 100 GPM @ 50% Eff. | 420,000 Btu/min | | "E" Rated Nozzle |
| HS-15 | 100 GPM @ 50% Eff. | 420,000 Btu/min | | "E" Rated Nozzle |
| HS-21 | 75 GPM @ 50% Eff. | 315,000 Btu/min | | "E" Rated Nozzle |

| | Fire Area 98 | Fire Area 132 |
|---|---|---|
| Available Fire Suppression Heat Removal Rate (Two hose stations @ 50% eff) | 735,000 Btu/min | 840,000 Btu/min |
| Total type "B" Capability available | 375 $ft^2$ | 225 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables in the area. Fire spread from adjacent areas is prevented by upgrading the area perimeters to 3 hour rated fire barriers. FPL proposes to provide cable tray baffles, equipment partitions, and spray conduit in Areas 98 and 132. In addition, FPL proposes to provide an automatic fire suppression system for the Cable Spreading Room (Fire Area 98). Although no credit is given for existing fire detection and suppression equipment, the potential for a large fire in this area is considered acceptably small. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Upgrade perimeter walls, floor, and ceiling for combined Areas 98 and 132 to 3 hour rated barriers by sealing all piping and other penetrations and installation of 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. (See Appendix D.)

2. Protect one train of raceways in Areas 98 and 132 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a one hour rated barrier.

3. Protect all electrical cable trays located in Areas 98 and 132 by installation of fire resistant baffles under these trays. Baffles are to span the width of the lowest cable tray in a stack and are to be located within 4 inches of the bottom of the lowest tray. These baffles will be constructed of ½" thick marinite or equivalent. (See Appendix D.)

4. Protect one train of conduit in Areas 98 and 132 utilizing a thermal insulating material (such as that provided by TSI, Inc.) to provide the equivalent protection of a one hour rated barrier.

5. Protect all vertical cable trays penetrating the floor of Areas 98 and 132 by the installation of a fire resistant partial enclosure or heat shield around the trays. This enclosure will be constructed of ½" thick marinite or equivalent, and will extend down the floor up to the lowest horizontal tray in a stack. (See Appendix D.)

6. Protect proposed cable trays and one train of essential equipment power supplies by the installation of partial enclosures (no roof) or heat shields constructed of ½" marinite or equivalent. (See Appendix D.)

7. Install an automatically actuated fire suppression system in Fire Area 98. (See Appendix D.)

e. EXEMPTION REQUEST

FPL requests exemption for Areas 98 and 132 from those specific provisions of and Section III.G.3/III.L of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.3/III.L. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with these areas, supplemented by the specific modifications identified, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications coupled with a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.3/III.L in Areas 98 and 132 is estimated to be $2,466,924 versus the cost for the proposed modifications of $730,000.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are four types of backfit activities necessary to support our exemption requests which do not require a unit outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There are four types of backfit activities necessary to support our exemption request which require an outage on both Unit #3 and #4. One requires an outage because construction work is required on the ventilation system and modifications will impact equipment required to be operable by the plant Technical

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*Specifically, FPL requests exemption from the installation of an alternate shutdown system consisting of centrally located panels housing instrumentation, modulating control devices, and transfer devices. These local panels containing equipment on/off control and transfer devices would be provided in switchgear and motor control center areas. Locations of the panels would in all cases, be independent of Fire Areas 98 and 132. Assignment of equipment power sources and routing of cables would also ensure that neither the distribution equipment nor the cabling is exposed to Fire Areas 98 and 132.

Specifications. The second and third activities require an outage to construct equipment fire barriers which will not be seismically qualified until completed. The fourth activity requires an outage because some modifications may require cutting and welding of the Fire System water supply piping which would render the Fire System inoperable. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii), and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) and Fall 1983 refueling outage and that NRC action is required prior to March 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1) There are two types of backfit activities necessary to implement the III.G.2 criteria which do not require a unit outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2) There is one type of backfit activity necessary to implement III.G.2 criteria which requires an outage on both Units #3 and #4 because the modifications may require cutting and welding of the Ventilation System. This activity would render the Ventilation System inoperable. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii), and (iii). It is noted that completion of this activity is not possible during the Fall 1983 refueling outage and that NRC action is required prior to November 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

3) There are two types of backfits necessary to implement III.G.3 criteria that can only be completed during an outage on both units because of the impact on safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(5) to extend from 30 days to 6 months the time period for submitting detailed designs containing the informational requirements necessary for NRC review.

4) Additionally, for these two types of backfits necessary to implement III.G.3 criteria that can only be completed during an outage on both

units, consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(4) to extend from 180 days the period prior to the outages defined under subparts (i), (ii), and (iii) to 10CFR50.48(c)(3). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982), Fall 1983, Fall 1984 or Spring 1985 refueling outages and that NRC action is required prior to September 1, 1983 in order to assure installation during the Spring 1986 and Fall 1986 refueling outages.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.12 FIRE AREA 106

### a. AREA DESCRIPTION

Fire Area 106 is the shared Control Room for Units 3 and 4. The Control Room is located at the 42'-0" elevation of the Control Building. This is a continuously occupied space that houses the controls and instrumentation to remotely operated valves, pumps, motors, etc. required for plant operation. The majority of these controls and instruments are mounted on centrally located control panels. Safe shutdown related cables are routed in the Control Room. The area is bounded by concrete walls, floor and ceiling. It is accessible via three routes; from the turbine deck 42'-0" elevation; from the Inverter Room; and from a stairwell in the northwest corner of the area. Pertinent fire area details are listed below;

| | |
|---|---|
| Floor Surface Area, | 3600 $ft^2$ |
| Wall and Ceiling Surface Area, | 8030 $ft^2$ |
| Free Volume Excluding Components, | 52000 $ft^3$ |
| Ceiling Height, | 14 ft 6 in |
| Floor Composition,<br>Floor Thickness, | Concrete<br>8 in |
| Wall Composition,<br>Wall Thickness, | Concrete<br>18 in |
| Ceiling Composition,<br>Ceiling Thickness, | Concrete<br>2 ft |
| Fire Detectors in Area,<br>Detectors No./Type, | Yes<br>5-1, 5-2, 5-3, 5-4, 5-5, 5-6, 5-7, 5-8, 5-9, 5-10, 5-11, 5-12, 5-13, 5-14, 6-5*, 6-9*/ Ionization |
| Automatic Suppression,<br>Type of Automatic Suppression | None<br>N/A |
| Installed Comm. Near Fire Area, | Telephone T-425, PAX M-425 |
| Hose Station Available to Area, | #12, #17 |

*Located inside consoles 3C01 and 4C01

| | |
|---|---|
| Fire Extinguishers Immediately Available to Area, | 3.3.7, 4.3.2, 4.3.1 |
| Number of Floor Drains, | None |
| Drain(s) Size, | N/A |
| Drain(s) Flow to, | N/A |
| Normal Forced Draft Ventilation, | Yes/AC |
| Normal Ventilation Flow Rate, | 8330 cfm (Supply & Exhaust) |
| Emergency Forced Draft Ventilation, | Yes/AC |
| Emergency Ventilation Flow Rate, | 8330 cfm (Supply & Exhaust) |

Fire Area Penetrations:

| | |
|---|---|
| West Wall | 3'-8" x 7'-2" Doorway to 42' Elev. of Turbine Deck |
| East Wall | 3' x 6'-8" Doorway |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

Steam Generator Pressure
S/G 3A
- PI-3-474
- PI-3-475
- PI-3-476
- PI-3-1606

S/G 3B
- PI-3-484
- PI-3-485
- PI-3-486
- PI-3-1607

S/G 3C
- PI-3-494
- PI-3-495
- PI-3-496
- PI-3-1608

S/G 4A
- PI-4-474
- PI-4-475
- PI-4-476
- PI-4-1606

S/G 4B
- PI-4-484
- PI-4-485
- PI-4-486
- PI-4-1607

S/G 4C
- PI-4-494
- PI-4-495
- PI-4-496
- PI-4-1608

Steam Generator Level

S/G 3A
- LI-3-477
- LI-3-474
- LI-3-475
- LI-3-476

S/G 3B
- LI-3-487
- LI-3-484
- LI-3-485
- LI-3-486

S/G 3C
- LI-3-497
- LI-3-494
- LI-3-495
- LI-3-496

S/G 4A
- LI-4-477
- LI-4-474
- LI-4-475
- LI-4-476

S/G 4B
- LI-4-487
- LI-4-484
- LI-4-485
- LI-4-486

S/G 4C
- LI-4-497
- LI-4-494
- LI-4-495
- LI-4-496

RCS Temperature
Hot Leg
- TE-3-413
- TE-3-423
- TE-3-433
- TE-4-413
- TE-4-423
- TE-4-433

RCS Temperature
Cold Leg
- TE-3-410
- TE-3-420
- TE-3-430
- TE-4-410
- TE-4-420
- TE-4-430

Pressurizer Level
Unit 3
- LI-3-459
- LI-3-460
- LI-3-461
- LI-3-462

Unit 4
- LI-4-459
- LI-4-460
- LI-4-461
- LI-4-462

RCS/Pressurizer Pressure
Unit 3
- PI-3-402
- PI-3-403
- PI-3-444
- PI-3-445
- PI-3-455
- PI-3-456
- PI-3-457
- PI-3-458

Unit 4
PI-4-402
PI-4-403
PI-4-444
PI-4-445
PI-4-455
PI-4-456
PI-4-457
PI-4-458

| Cables | Power (P), Control (C) |
|---|---|
| Chg. Pump 3A | C |
| Chg. Pump 3B | C |
| Chg. Pump 3C | C |
| Chg. Pump 4A | C |
| Chg. Pump 4B | C |
| Chg. Pump 4C | C |
| CCW Pump 3A | C |
| CCW Pump 3B | C |
| CCW Pump 3C | C |
| CCW Pump 4A | C |
| CCW Pump 4B | C |
| CCW Pump 4C | C |
| ICW Pump 3A | C |
| ICW Pump 3B | C |
| ICW Pump 3C | C |
| ICW Pump 4A | C |
| ICW Pump 4B | C |
| ICW Pump 4C | C |
| BA Transfer Pump 3A | C |
| BA Transfer Pump 3B | C |
| BA Transfer Pump 4A | C |
| BA Transfer Pump 4B | C |

| Cables | Power (P), Control (C) |
|---|---|
| AFW Pump Steam Supply Valve S/G 3A MOV-3-1403 | C |
| AFW Pump Steam Supply Valve S/G 3B MOV-3-1404 | C |
| AFW Pump Steam Supply Valve S/G 3C MOV-3-1405 | C |
| AFW Pump Steam Supply Valve S/G 4A MOV-4-1403 | C |
| AFW Pump Steam Supply Valve S/G 4B MOV-4-1404 | C |
| AFW Pump Steam Supply Valve S/G 4C MOV-4-1405 | C |
| BA Injection Stop Valve MOV-3-350 | C |
| BA Injection Stop Valve MOV-4-350 | C |
| VCT Lo-Level Isolation Valve MOV-3-115C | C |
| VCT Lo-Level Isolation Valve MOV-4-115C | C |
| AB Exhaust Fan 3A | C |
| AB Exhaust Fan 3B | C |
| AB Supply Fan 3A | C |
| AB Supply Fan 3B | C |
| Pressurizer Heater Control Group 3A | C |
| Pressurizer Heater Control Group 4A | C |
| Pressurizer Heater Backup Group 3A | C |
| Pressurizer Heater Backup Group 3B | C |
| Pressurizer Heater Backup Group 4A | C |
| Pressurizer Heater Backup Group 4B | C |
| MSIV S/G 3A POV-3-2604 | C |

| Cables | Power (P), Control (C) |
|---|---|
| MSIV S/G 3B POV-3-2605 | C |
| MSIV S/G 3C POV-3-2606 | C |
| MSIV S/G 4A POV-4-2604 | C |
| MSIV S/G 4B POV-4-2605 | C |
| MSIV S/G 4C POV-4-2606 | C |
| AFW Pump Auto Start Circuit Unit 3 | C |
| AFW Pump Auto Start Circuit Unit 3 Backup | C |
| AFW Pump Auto Start Circuit Unit 4 | C |
| AFW Pump Auto Start Circuit Unit 4 Backup | C |
| AFW Pump A Steam Supply Pressure Control Valve SV-3705 | C |
| AFW Pump B Steam Supply Pressure Control Valve SV-3706 | C |
| AFW Pump C Steam Supply Pressure Control Valve SV-3707 | C |
| AFW to S/G 3A Control Valve SV-3-2914 | C |
| AFW to S/G 3B Control Valve SV-3-2916 | C |
| AFW to S/G 3C Control Valve SV-3-2918 | C |
| AFW to S/G 3A Backup Control Valve SV-3-2915 | C |
| AFW to S/G 3B Backup Control Valve SV-3-2917 | C |

| Cables | Power (P), Control (C) |
|---|---|
| AFW to S/G 3C Backup Control Valve SV-3-2919 | C |
| AFW to S/G 4A Control Valve SV-4-2914 | C |
| AFW to S/G 4B Control Valve SV-4-2916 | C |
| AFW to S/G 4C Control Valve SV-4-2918 | C |
| AFW to S/G 4A Backup Control Valve SV-4-2915 | C |
| AFW to S/G 4B Backup Control Valve SV-4-2917 | C |
| AFW to S/G 4C Backup Control Valve SV-4-2919 | C |
| RCS Temperature Hot Leg | |
| TE-3-413 | C |
| TE-3-423 | C |
| TE-3-433 | C |
| TE-4-413 | C |
| TE-4-423 | C |
| TE-4-433 | C |
| RCS Temperature Cold Leg | |
| TE-3-410 | C |
| TE-3-420 | C |
| TE-3-430 | C |
| TE-4-410 | C |
| TE-4-420 | C |
| TE-4-430 | C |
| Steam Generator Pressure | |
| S/G 3A | |
| PT/PI-3-474 | C |
| PT/PI-3-475 | C |
| PT/PI-3-476 | C |
| S/G 3B | |
| PT/PI-3-484 | C |
| PT/PI-3-485 | C |
| PT/PI-3-486 | C |

| Cables | Power (P), Control (C) |
|---|---|
| S/G 3C | |
| PT/PI-3-494 | C |
| PT/PI-3-495 | C |
| PT/PI-3-496 | C |
| S/G 4A | |
| PT/PI-4-474 | C |
| PT/PI-4-475 | C |
| PT/PI-4-476 | C |
| S/G 4B | |
| PT/PI-4-484 | C |
| PT/PI-4-485 | C |
| PT/PI-4-486 | C |
| S/G 4C | |
| PT/PI-4-494 | C |
| PT/PI-4-495 | C |
| PT/PI-4-496 | C |
| Steam Generator Level | |
| S/G 3A | |
| LT/LI-3-477 | C |
| LT/LI-3-474 | C |
| LT/LI-3-475 | C |
| LT/LI-3-476 | C |
| S/G 3B | |
| LT/LI-3-487 | C |
| LT/LI-3-484 | C |
| LT/LI-3-485 | C |
| LT/LI-3-486 | C |
| S/G 3C | |
| LT/LI-3-497 | C |
| LT/LI-3-494 | C |
| LT/LI-3-495 | C |
| LT/LI-3-496 | C |
| S/G 4A | |
| LT/LI-4-477 | C |
| LT/LI-4-474 | C |
| LT/LI-4-475 | C |
| LT/LI-4-476 | C |
| S/G 4B | |
| LT/LI-4-487 | C |
| LT/LI-4-484 | C |
| LT/LI-4-485 | C |
| LT/LI-4-486 | C |

| Cables | Power (P), Control (C) |
|---|---|
| S/G 4C | |
| LT/LI-4-497 | C |
| LT/LI-4-494 | C |
| LT/LI-4-495 | C |
| LT/LI-4-496 | C |
| Pressurizer Level | |
| Unit 3 | |
| LT/LI-3-459 | C |
| LT/LI-3-460 | C |
| LT/LI-3-461 | C |
| LT/LI-3-462 | C |
| Unit 4 | |
| LT/LI-4-459 | C |
| LT/LI-4-460 | C |
| LT/LI-4-461 | C |
| LT/LI-4-462 | C |
| Diesel Generator #3 Breaker Bus 3A | C |
| Diesel Generator #3 Breaker Bus 4A | C |
| Diesel Generator #4 Breaker Bus 3B | C |
| Diesel Generator #4 Breaker Bus 4B | C |
| AB Exhaust Fan A | C |
| AB Exhaust Fan B | C |
| AB Supply Fan A | C |
| AB Supply Fan B | C |
| MSIV S/G 3A POV-3-2604 | C |
| MSIV S/G 3B POV-3-2605 | C |
| MSIV S/G 3C POV-3-2606 | C |
| CCW Sup. Valve for Emer. Contain. Cool. 3B 3-2904 | C |

| Cables | Power (P), Control (C) |
|---|---|
| CCW Sup. Valve for Emer. Contain. Cool. 4B 4-2904 | C |
| MSIV S/G 4A POV-4-2604 | C |
| MSIV S/G 4B POV-4-2605 | C |
| MSIV S/G 4C POV-4-2606 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 3A 3-2906 | C |
| CCW Sup. Valve for Emer. Contain. Cool. 3C 3-2905 | C |
| Chg. Control Valve HCV-4-121 | C |
| Chg. Control Valve HCV-3-121 | C |
| Chg. Line Isolation Valve 4-310A | C |
| Chg. Line Isolation Valve 4-310B | C |
| Chg. Line Isolation Valve 3-310A | C |
| Chg. Line Isolation Valve 3-310B | C |
| CCW Sup. Valve for Emer. Contain. Cool. 3A 3-2903 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 4C 4-2908 | C |
| CCW Rtn. Valve for Norm. Contain. Cool. 4-1418 | C |
| CCW Rtn. Valve for Norm. Contain. Cool. 3-1418 | C |
| CCW Sup. Valve for Norm. Contain. Cool. 3-1417 | C |
| CCW Sup. Valve for Norm. Contain. Cool. 4-1417 | C |
| Emer. Contain. Cool. 3A | C |
| Emer. Contain. Cool. 3B | C |

| Cables | Power (P), Control (C) |
|---|---|
| Emer. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3A | C |
| Norm. Contain. Cool. 3B | C |
| Norm. Contain. Cool. 3C | C |
| Norm. Contain. Cool. 3D | C |
| Norm. Contain. Cool. 4A | C |
| Norm. Contain. Cool. 4B | C |
| Norm. Contain. Cool. 4C | C |
| Norm. Contain. Cool. 4D | C |
| Emer. Contain. Cool. 4A | C |
| Emer. Contain. Cool. 4B | C |
| Emer. Contain. Cool. 4C | C |
| CCW Sup. Valve for Emer. Contain. Cool. 4C 4-2905 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 4A 4-2906 | C |
| CCW Sup. Valve for Emer. Contain. Cool. 4A 4-2903 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 3B 3-2907 | C |
| RCS/Pressurizer Pressure | |
| PT-3-455 | C |
| PT-3-444 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 3C 3-2908 | C |
| CCW Rtn. Valve for Emer. Contain. Cool. 4B 4-2907 | C |
| Control Rm. A/C - A | P |

| Cables | Power (P), Control (C) |
|---|---|
| RCS/Pressurizer Pressure | |
| PT/PI-3-402 | C |
| PT/PI-3-403 | C |
| PT/PI-3-444 | C |
| PT/PI-3-445 | C |
| PT/PI-3-455 | C |
| PT/PI-3-456 | C |
| PT/PI-3-457 | C |
| PT/PI-3-458 | C |
| RCS/Pressurizer Pressure | |
| PT/PI-4-402 | C |
| PT/PI-4-403 | C |
| PT/PI-4-444 | C |
| PT/PI-4-445 | C |
| PT/PI-4-455 | C |
| PT/PI-4-456 | C |
| PT/PI-4-457 | C |
| PT/PI-4-458 | C |

Cold Shutdown Equipment/Cables

| Cables | Power (P), Control (C) |
|---|---|
| RHR Pump 3A | C |
| RHR Pump 3B | C |
| RHR Pump 4A | C |
| RHR Pump 4B | C |
| Accumulator Stop Valve MOV-3-865A | C |
| Accumulator Stop Valve MOV-3-865B | C |
| Accumulator Stop Valve MOV-3-865C | C |
| Accumulator Stop Valve MOV-4-865A | C |
| Accumulator Stop Valve MOV-4-865B | C |

| Cables | Power (P), Control (C) |
|---|---|
| Accumulator Stop Valve MOV-4-865C | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749A | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-3-749B | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-4-749A | C |
| RHR Ht. Exch. Cooling Water Isolation Valve MOV-4-749B | C |
| RWST Isolation Valve from RHR Header MOV-3-862A | C |
| RWST Isolation Valve from RHR Header MOV-3-862B | C |
| RWST Isolation Valve from RHR Header MOV-4-862A | C |
| RWST Isolation Valve from RHR Header MOV-4-865B | C |
| RCS Inlet Isolation Valve from RHR MOV-3-744A | C |
| RCS Inlet Isolation Valve from RHR MOV-3-744B | C |
| RCS Inlet Isolation Valve from RHR MOV-4-744A | C |
| RCS Inlet Isolation Valve from RHR MOV-4-744B | C |
| RHR Inlet Isolation Valve from RCS MOV-3-750 | C |
| RHR Inlet Isolation Valve from RCS MOV-4-750 | C |
| RHR Inlet Isolation Valve from RCS MOV-3-751 | C |
| RHR Inlet Isolation Valve from RCS MOV-4-751 | C |

| Cables | Power (P), Control (C) |
|---|---|
| RWST Isolation Valve from RHR Header MOV-4-863A | C |
| RWST Isolation Valve from RHR Header MOV-4-863B | C |
| RHR Flow Control Valve HCV-3-758 | C |
| RHR Flow Control Valve HCV-4-758 | C |
| RWST Isolation Valve from RHR Header MOV-3-863A | C |
| RWST Isolation Valve from RHR Header MOV-3-863B | C |
| RWST Supply Valve to Chg. Header LCV-3-115B | C |
| RWST Supply Valve to Chg. Header LCV-4-115B | C |
| Pressurizer Auxiliary Spray Valve 4-311 | C |
| Pressurizer Auxiliary Spray Valve 3-311 | C |

Equipment/Cables to Mitigate the Consequences of a Fire

| Cables | Power (P), Control (C) |
|---|---|
| Blowdown Isolation Valve S/G 3A SV-3-6275A | C |
| Blowdown Isolation Valve S/G 3B SV-3-6275B | C |
| Blowdown Isolation Valve S/G 3C SV-3-6275C | C |
| Blowdown Isolation Valve S/G 4A MOV-4-1410 | C |
| Blowdown Isolation Valve S/G 4B MOV-4-1411 | C |
| Blowdown Isolation Valve S/G 4C MOV-4-1412 | C |

| Cables | Power (P), Control (C) |
|---|---|
| Excess Letdown Isolation Valve HCV-3-137 | C |
| BA Transfer Pump Recirculation Valve HCV-105 | C |
| Letdown Isolation Valve 4-204 | C |
| Excess Letdown Isolation Valve 4-387 | C |
| Letdown Isolation Valve 4-200A | C |
| Letdown Isolation Valve 4-200B | C |
| Letdown Isolation Valve 4-200C | C |
| Excess Letdown Isolation Valve 3-387 | C |
| Letdown Isolation Valve 3-204 | C |
| Letdown Isolation Valve 3-200A | C |
| Letdown Isolation Valve 3-200B | C |
| Letdown Isolation Valve 3-200C | C |
| Letdown Isolation Valve LCV-3-460 | C |
| Excess Letdown Isolation Valve LCV-4-137 | C |
| Letdown Isolation Valve LCV-4-460 | C |
| PORV PCV-4-456 | C |
| PORV Block Valve 4-536 | C |
| PORV Block Valve 4-535 | C |
| PORV PCV-3-455C | C |
| PORV PCV-3-456 | C |
| PORV Block Valve 3-536 | C |
| PORV Block Valve 3-535 | C |
| PORV PCV-4-455C | C |
| Pressurizer Spray Valve PCV-3-455A | C |
| Pressurizer Spray Valve PCV-3-455B | C |

| Cables | Power (P), Control (C) |
|---|---|
| Pressurizer Spray Valve PCV-4-455A | C |
| Pressurizer Spray Valve PCV-4-455B | C |
| High-High Containment Pressure | |
| PS-3-2056 | C |
| PS-3-2057 | C |
| PS-3-2058 | C |
| High Containment Pressure | |
| PS-3-2007 | C |
| PS-3-2008 | C |
| PS-3-2009 | C |
| High Containment Pressure | |
| PS-4-2007 | C |
| PS-4-2008 | C |
| PS-4-2009 | C |
| High-High Containment Pressure | |
| PS-4-2056 | C |
| PS-4-2057 | C |
| PS-4-2058 | C |
| Steam Flow | |
| S/G 3A | |
| FT-3-474 | C |
| FT-3-475 | C |
| S/G 3B | |
| FT-3-484 | C |
| FT-3-485 | C |
| S/G 3C | |
| FT-3-494 | C |
| FT-3-495 | C |
| S/G 4A | |
| FT-4-474 | C |
| FT-4-475 | C |
| S/G 4B | |
| FT-4-484 | C |
| FT-4-485 | C |
| S/G 4C | |
| FT-4-494 | C |
| FT-4-495 | C |

2. **Nuclear Safety Evaluation**

The Turkey Point Unit #3 and #4 Control Room is being upgraded in accordance with NUREG 0737, Section III.D.3.4 to meet the habitability requirements of GDC 19 of Appendix A to 10CFR Part 50. In the event that operations cannot safely be conducted from the Control Room or the Control Room is inaccessible, individual controls and instrumentation at local pushbutton stations or at the respective switchgear, load center, or motor control center are provided to allow placing both units in a safe hot shutdown condition. The capability for achieving and maintaining hot shutdown conditions independent of the control room is addressed in the plant emergency operating procedure #20005 titled "Control Room Inaccessibility". However, since the necessary instrumentation and controls for achieving cold shutdown outside the control room are not provided, the potential for fire damage to the control room cold shutdown instrumentation and controls must be evaluated.

c. **FIRE HAZARDS ANALYSIS**

1. **Fire Area Combustibles**

The Control Room has a combustibles inventory consisting primarily of miscellaneous items normally used to support operations, namely paper, plastics, and wood. The majority of these combustibles are located on the west side of the Control Room, thus well removed from the control panels, cables, etc.

Other potential combustible sources which must be addressed are those associated with the electrical equipment and cables located in the Control Room. A review of equipment and cables has shown that only low voltage electrical devices are employed, and that these devices and their wiring are highly flame resistant. In addition, the Control Room, like other instrument rooms, contains cabinet or console mounted components with separation of redundant trains provided by appropriate barriers or usually the cabinet itself. The physical separation provided by these cabinets limits the total concentration of combustibles to small quantities. Furthermore, as indicated by the area description, ionization type smoke detectors located inside the consoles provide the operator early warning of a fire within the console. In view of these facts, it can be concluded that the potential for a major electrical fire in the Control Room is extremely unlikely.

In addition, access to the Control Room is controlled by strict security and administrative procedures, and therefore transient combustibles are extremely limited. In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 106, flammable liquids will be limited to 1 quart and combustible liquids will be

limited to 1 quart. These liquid amounts are limited when the plant is in all operating modes. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

Design basis fire calculations were not conducted for the Control Room based on the low probability of a fire in this area. As demonstrated by the previous discussion of in situ fire area combustibles, there are no significant fire hazards associated with this area. In addition, a major point which must be emphasized is that the Control Room is a continuously occupied space, thus further precluding the possibility of any significant fires.

3. Fire Hazards Evaluation

The fire area hazards evaluation was separated into four categories, viz., fire area structural ratings evaluation, fire area adjacent effects evaluation, available fire suppression capabilities determination and a fire area summary.

Fire Area Structural Ratings Evaluation Data for Area 106 is as Follows:

Area boundary structural fire rating estimates based on standardized curves for solid concrete walls (See Section 5.2 for details);

| | |
|---|---|
| Walls | 4 |
| Floor | 4 |
| Ceiling | 4 |

Fire area structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to or from adjacent areas, hot gas radiation, or burning liquid spread. No fire spread hazard was found to exist. There are no significant ignition sources near these penetrations. In spite of this determination, FPL proposes upgrading the exterior walls of Area 106 and the floor over Area 97 by sealing all penetrations.

Available Fire Suppression Capabilities Determination

Fire Area 106 is accessible from the Turbine Deck and the Inverter Room. Hose Stations 12 and 17 are available for fighting a fire in Area 106 in addition to portable extinguishers 3.3.7, 4.3.2 and 4.3.1. Self-contained emergency lighting units have been installed in the Control Room to enhance fire fighting capabilities. Area fire suppression equipment is as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.3.7 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.3.1 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.3.2 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| HS-12 | 75 gpm @ 50% Eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-17 | 100 gpm @ 50% Eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (2 hose stations @ 50% Eff) 735,000 $\frac{Btu}{min}$

Total type "B" Capability available 150 $ft^2$

Fire Area Summary

A review of the existing combustibles in the Control Room yields the conclusion that no significant fire hazards are associated with this area. Transient combustibles are not considered to present a significant potential fire source, since access to and from this area is controlled by strict security and administrative procedures. In addition, the possibility of fire spread to and from Area 106 is prevented by the modifications proposed herein. In view of the fact that the Control Room is a continuously occupied space and existing fire detection and suppression equipment are available, the potential for a significant fire in this area is considered acceptably small. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown.

## d. SUMMARY OF PROPOSED MODIFICATIONS

1. Upgrade perimeter walls and floor for Area 106 to 3 hour rated barriers by sealing all piping and other penetrations and installation of 3 hour rated fire dampers and doors on all ventilation duct penetrations and doorways. See Appendix D.

e. EXEMPTION REQUEST

FPL requests exemption for Area 106 from those specific provisions of Section III.G.3 of Appendix R to 10CFR Part 50 that would require alternative shutdown capability independent of the cables, systems and components in this area, and the installation of an automatic suppression system.* Such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. It is FPL's position that, based on the preceding fire hazards analysis and evaluation, with the level of protection to be provided by the proposed fire protection modifications described herein, the lack of significant fire hazards in the area, the inherent electrical design features associated with the equipment of concern, and the continuous occupancy and availability of fire detection and suppression equipment in this area, no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.3 In summary, the proposed modifications, coupled with a strict combustible control program based on Appendix C of this report, are considered to provide reasonable assurance that the capability to achieve and maintain hot/cold shutdown conditions is maintained. Furthermore, the minimum cost estimate associated with full compliance in Area 106 is $2,250,600, as opposed to $98,000 for the proposed modifications.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There is one type of backfit activity necessary to support our exemption requests which does not require a unit outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for this activity from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that this backfit installation phase will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii). There is one type of backfit activity necessary to support our exemption request which requires an outage on both Units #3 and #4 because construction work is required on the ventilation system and modifications will impact equipment required to be operable by the plant Technical

*Specifically, FPL requests exemption from the installation of an alternate shutdown system consisting of centrally located panels housing instrumentation, modulating control devices, and transfer devices. These local panels containing equipment on/off control and transfer devices would be provided in switchgear and motor control center areas. Locations of the panels would, in all cases, be independent of Fire Area 106. Assignment of equipment power sources and routing of cables would also ensure that neither the distribution equipment nor the cabling is exposed to this fire area. In addition, FPL request exemption from the installation of a fixed fire suppression system.

Specifications. Consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) or Fall 1983 refueling outage and that NRC approval of this exemption request is required prior to March 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1. There is one type of backfit activity necessary to implement III.G.2 criteria which requires an outage on both Units #3 and #4 because the modifications may require cutting and welding of the Fire System water supply piping. This activity would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) or Fall 1983 refueling outage and that NRC action is required prior to June 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

2. There are two types of backfits necessary to implement III.G.3 criteria that can only be completed during an outage on both units because of the impact on safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications, FPL requests exemption from 10 CFR 50.48(c)(5) to extend from 30 days to 6 months the time period for submitting detailed designs containing the informational requirements necessary for NRC review.

3. Additionally, for these two types of backfits necessary to implement III.G.3 criteria that can only be completed during an outage on both units, consistent with the Section 5.2.19 schedules, FPL requests exemption from 10CFR50.48(c)(4) to extend from 180 days the period prior to the outage defined under subparts (i), (ii) and (iii) to 10CFR50.48(c)(3). It is noted that completion of these activities is not possible during the Steam Generator Repair outage (Winter 1982), Fall 1983, Fall 1984 or Spring 1985 refueling outages and that NRC action and approval of the detailed designs would be required prior to September 1, 1983 in order to assure installation during the Spring 1986 and Fall 1986 refueling outages.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.13 FIRE AREA 113

### a. AREA DESCRIPTION

Fire Area 113 is the feedwater platform for Unit 4. This area is located off of the southeast end of the Unit 4 turbine deck adjacent to the Unit 4 Reactor Containment Building at elevation +38'-0". The feedwater platform contains the piping and associated valves for the feedwater and auxiliary feedwater systems which penetrate into the Reactor Containment Building. The area is bounded on two sides, north and west, by concrete walls. The east side is bounded by the Unit 4 Reactor Containment Building. The remaining south side is open. The ceiling is concrete and the floor is checker plate. Safe shutdown equipment in the area consists of 6 auxiliary feedwater valves and their associated cables. Two 50% flow capacity valves are associated with each of the steam generator auxiliary feedwater lines A, B, and C. These valves are located at an approximate elevation of 40' with a separation distance of 8 ft (center to center) between the A and B auxiliary feedwater lines, and a separation distance of 3 ft between the B and C auxiliary feedwater lines. Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 1344 $ft^2$ |
| Wall and Ceiling Area, | N/A |
| Free Volume Excluding Components, | N/A |
| Ceiling Height, | 17 ft 10 in |
| Floor Composition, | Checkered Plate |
| Floor Thickness, | ¼" |
| Wall Composition, | Concrete |
| Wall Thickness, | 18 " |
| Ceiling Composition, | Concrete |
| Ceiling Thickness, | 18 " |
| Fire Detectors in Area, | No |
| Detectors No./Type, | N/A |
| Automatic Suppression, | No |
| Type of Automatic Suppression, | N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T-426<br>PAX M-426 |

| | |
|---|---|
| Hose Station Available to Area, | #18, #19 |
| Fire Extinguishers Immediately Available to Area, | 4.3.1, 4.3.2, 4.3.3, 4.3.4 |
| Number of Floor Drains, | None |
| Drain(s) Size, | N/A |
| Drain(s) Flow To, | N/A |
| Normal Forced Draft Ventilation, | None |
| Normal Ventilation Flow Rate, | N/A |

b. <u>SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION</u>

1. <u>Safe Shutdown Equipment/Cables</u>

<u>Hot Shutdown Equipment/Cables</u>

<u>Equipment</u>

AFW to S/G 4A Control Valve
SV-4-2914

AFW to S/G 4A Backup Control Valve
SV-4-2915

AFW to S/G 4B Control Valve
SV-4-2916

AFW to S/G 4B Backup Control Valve
SV-4-2917

AFW to S/G 4C Control Valve
SV-4-2918

AFW to S/G 4C Backup Control Valve
SV-4-2919

| Cables | Power (P), Control (C) |
|---|---|
| AFW to S/G 4A Control Valve SV-4-2914 | C |

| Cables | Power (P), Control (C) |
|---|---|
| AFW to S/G 4B Control Valve SV-4-2916 | C |
| AFW to S/G 4C Control Valve SV-4-2918 | C |
| AFW to S/G 4A Backup Control Valve SV-4-2915 | C |
| AFW to S/G 4B Backup Control Valve SV-4-2917 | C |
| AFW to S/G 4C Backup Control Valve SV-4-2919 | C |
| Steam Generator Level S/G 4A LT/LI-4-477 | C |
| S/G 4B LT/LI-4-487 | C |
| S/G 4C LT/LI-4-497 | C |

2. **Nuclear Safety Evaluation**

As indicated in the preceding equipment/cable listing for Fire Area 113, only hot shutdown equipment and cables are located in this area.

Auxiliary feedwater (AFW) to steam generator (S/G) A supply valves SV-4-2914 and SV-4-2915 are each 50% capacity flow control valves, therefore both valves are essential to meet the auxiliary feedwater flow requirements for steam generator A. Such is the case for the AFW flow control valves to S/G B and S/G C. Two out of three steam generators require full AFW flow for decay heat removal, and thus a total of four AFW flow control valves are required for hot shutdown.

The fire hazards analysis contained herein must demonstrate that auxiliary feedwater flow to two steam generators (i.e. both the control valves and their associated cables for the respective steam generators) will not be affected by a design basis fire or adequate protection of the necessary equipment/cables must be provided.

In addition, Fire Area 113 contains cables associated with the level indicators/transmitters for steam generators A, B, and C. The following redundant steam generator level transmitter/indicators are located independent of this fire area:

S/G A LI/LT-4-474
LI/LT-4-475
LI/LT-4-476

S/G B LI/LT-4-484
LI/LT-4-485
LI/LT-4-486

S/G C LI/LT-4-494
LI/LT-4-495
LI/LT-4-496

Only two level indicators/transmitters (one per steam generator, two steam generators required) per unit are required to remain operable. Therefore, the loss of LI/LT-4-477, 487, and 497 will not impair the capability to achieve and maintain hot and cold shutdown conditions.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The combustible inventory for this area consists of the grease in the motor operated valves located there. This grease is contained within each motor operator steel enclosure and would not be expected to contribute to the fires postulated in these areas.

Three transient combustibles were considered in this analysis: acetone, lubricating oil and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plant. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 113, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 4 is in all operating modes, except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

The design basis fire calculations for Area 113 consist of design basis fire heat release rate calculations, burn duration calculations, and effective spill area calculations. Three transient combustibles were

considered in the analysis. These combustibles are acetone (5 gal.), heptane (5 gal.), and lubricating oil (10 gal.). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential impact on essential hot shutdown equipment/cables in the area (refer to the Nuclear Safety Evaluation for specific equipment to be evaluated). The results of the design basis fire calculations are provided below: (Appendix A of this report provides a detailed discussion and development of the design basis fire methdology.)

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$) | 926 | 926 | 543.3 |
| Design Basis Fire Heat Release Rate $\left(\frac{Btu}{min}\right)$ | $4.6x10^6$ | $1.3x10^7$ | $4.4x10^6$ |
| Design Basis Fire Burn Duration (sec) | 4.4 | 2.1 | 14.9 |

An examination of the design basis fire effective spill areas and the separation distance between the redundant sets of auxiliary feedwater flow control valves yields the conclusion that all six valves could potentially be engulfed by any of the three design basis fires. In order to ensure the required AFW flow to two steam generators, FPL proposes to provide a thermal barrier or enclosure of non-combustible material (½" thick marinite or equivalent) around the valve operators of four of the AFW flow control valves. In addition, the electrical conduit associated with these valves will be provided 1 hour fire rated barrrier protection by use of a thermal insulating material. This level of protection is deemed adequate for the design basis fires postulated herein. Although the intensity of these fires is severe, Area 113 is an outdoor area, and thus most of this heat will be released in the form of hot gases and combustion products directly to atmosphere above the flames.

3. **Fire Hazards Evaluation**

The fire hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

Available Fire Suppression Capabilities Determination

Fire Area 113 is an outdoor area and is therefore easily accessible. Hose stations 18 and 19 from the Turbine Deck are available, in

addition to portable extinguishers 4.3.1, 4.3.2, 4.3.3 and 4.3.4. Area 113 fire suppression equipment ratings are as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 4.3.1 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.3.2 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.3.3 | 4A: BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.3.4 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| HS-18 | 100 gpm @ 50% Eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-19 | 100 gpm @ 50% Eff | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| Available fire suppression heat removal rate (two hose stations @ 50% Eff) | | | | 840,000 $\frac{Btu}{min}$ |
| Total type "B" capability available | | | | 250 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables in Area 113. FPL proposes to provide such protection by the use of thermal barriers of non-combustible material to protect required valve operators and the utilization of a thermal insulating material to protect electrical conduit. Although no credit is given for existing fire suppression equipment available in the area, the potential for a large fire in this area is considered acceptably small. It should be emphasized that the fires postulated in the preceding fire methodology are not considered credible fires and in reality, the existing fire fighting equipment provides more than adequate fire suppression capability. Thus based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Provide a fire barrier or enclosure of non-combustible material ½" thick marinite or equivalent around valve operators for valves SV-4-2914, -2915, -2916 and -2917.

2. Provide the equivalent of a 1 hour fire rated barrier for the electrical conduit associated with valves SV-4-2914, -2915, -2916 and -2917 by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

e. **EXEMPTION REQUEST**

FPL requests exemption for Area 113 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with this area supplemented by the specific modifications identified, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications combined with a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 113 based on implementation of the specific requirements of subsection (c), is estimated to be $311,017 versus the cost for the proposed modifications of $81,641.

f. **SCHEDULE EXEMPTION**

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are two types of backfit activities necessary to support our exemption requests which do not require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1. There are three types of backfit activities necessary to implement the III.G.2 criteria which do not require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed

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*Specifically, FPL requests exemption from those provisions that require the separation of redundant safe shutdown equipment by 1 hour fire rated barriers, i.e., the installation of 1 hour fire rated barrier protection for the valve operators of CV-4-2914, CV-4-2915, CV-4-2916 and CV-4-2917. In addition, FPL requests exemption from the installation of a fire detection and automatic suppression system in this area.

completion schedule for two of these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2. There is one type of backfit activity necessary to implement III.G.2 criteria which requires a Unit 4 outage because the modifications may require cutting and welding of the Fire System water supply piping. These modifications would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) and that NRC action is required prior to June 1, 1983 in order to assure installation during the Fall 1984 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.14 FIRE AREA 114

### a. AREA DESCRIPTION

Fire Area 114 is the Unit 4 main steam platform which is located at an elevation of 53'-6". This area houses the main steam isolation valves and the atmospheric dump valves. The main steam platform is an outside concrete platform and is not bounded by any walls or ceiling. This area is adjacent to the Unit 4 containment, located immediately to the east, and the turbine deck 42' elevation located immediately to the west. The area is accessible from the turbine deck, 42' elevation, via stairs to the north end of the main steam platform. Safe shutdown equipment consists of the main steam isolation valves, POV-4-2604, 2605, and 2606 and the atmospheric dump valves, CV-4-1606, 1607, and 1608. The main steam isolation valves are located at an elevation of approximately 54' and have center to center separation distance of approximately 28 ft. The atmospheric dump valves are located at an elevation of approximately 55'-0" and also have center to center separation distance of approximately 28'. Safe shutdown related cables are routed to this area in conduit through penetrations in the platform. Pertinent fire area details are listed below;

| | |
|---|---|
| Floor Surface Area, | 2015 $ft^2$ |
| Wall and Ceiling Surface Area, | N/A |
| Free Volume Excluding Components, | N/A |
| Ceiling Height, | N/A |
| Floor Composition,<br>Floor Thickness, | Concrete<br>18 in |
| Wall Composition,<br>Wall Thickness, | N/A<br>N/A |
| Ceiling Composition,<br>Ceiling Thickness, | N/A<br>N/A |
| Fire Detectors in Area,<br>Detectors No./Type, | No<br>N/A |
| Automatic Suppression,<br>Type of Automatic Suppression, | No<br>N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T-426<br>PAX M-426 |
| Hose Station Available to Area, | #18, #17 |

| | |
|---|---|
| Fire Extinguishers Immediately Available to Area, | 4.3.3, 4.3.2, 4.3.1 |
| Number of Floor Drains, | None |
| Drain(s) Size, | N/A |
| Drain(s) Flow To, | N/A |
| Normal Forced Draft Ventilation, | None |
| Normal Ventilation Flow Rate, | N/A |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

MSIV S/G 4A
POV-4-2604

MSIV S/G 4B
POV-4-2605

MSIV S/G 4C
POV-4-2606

Atmospheric Dump Valves
S/G 4A CV-4-1606
S/G 4B CV-4-1607
S/G 4C CV-4-1608

| Cables | Power (P), Control (C) |
|---|---|
| MSIV S/G 4A POV-4-2604 | C |
| MSIV S/G 4B POV-4-2605 | C |
| MSIV S/G 4C POV-4-2606 | C |

2. Nuclear Safety Evaluation

As indicated in the preceding equipment/cable list, Fire Area 114 contains only hot shutdown equipment and cables.

Three atmospheric dump valves are located in this area, CV-4-1606, CV-4-1607, and CV-4-1608. These valves are used for venting main steam to the atmosphere in the event of a turbine trip or during cooldown of the RCS should the condensers not be available. Two out of three atmospheric dump valves are required for hot shutdown.

Although these valves are totally pneumatic in operation and control and thus the potential for fire damage is not considered great, the fire hazards analysis contained herein must demonstrate the operability of two out of the three atmospheric dump valves in the event of a design basis fire in the area. Three main steam isolation valves are also located in this area. The main steam isolation valves are utilized to isolate the main steam header outside containment from the steam generators inside containment. The main steam isolation valves are MSIV S/G A POV-2604, MSIV S/G B POV-4-2605 and MSIV S/G C POV-4-2606. The fire hazards analysis contained herein must demonstrate the operability of two out of three main steam isolation valves, and their associated cables in the event of a design basis fire in this area, or adequate protection of this equipment must be provided.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The combustibles inventory for Fire Area 114 consists primarily of the grease contained within each of the motor operated valves (MOV's) in the area. Since there are 6 MOV's in the area, with 1 lb. of grease per valve, this amounts to about 6 lbs. of grease total. This grease is contained within the respective steel enclosure of each valve motor operator and is not considered to contribute to the design basis fires postulated herein.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at Turkey Point plant. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 114, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 4 is in all operating modes, except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

## 2. Design Basis Fire Calculations

The design basis fire calculations for Area 114 consist of design basis fire heat release rate calculations, burn duration calculations, and effective spill area calculations. Three transient combustibles were considered in the analysis. These combustibles are acetone (5 gal), heptane (5 gal), and lubricating oil (10 gal). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential impact on essential hot shutdown equipment/cables in the area (refer to the Nuclear Safety Evaluation for specific equipment to be evaluated). The results of the design basis fire calculations are provided below:

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$) | 926 | 926 | 543.3 |
| Design Basis Fire Heat Release Rate ($\frac{Btu}{min}$) | $4.6x10^6$ | $1.3x10^7$ | $4.4x10^6$ |
| Design Basis Fire Burn Duration (sec) | 4.4 | 2.1 | 14.9 |

Effective spill areas provided are idealistic, worst case areas. No credit is given for the fact that a significant portion of the liquid combustibles could drain off the edges of the platform.

An examination of the design basis fire effective spill areas and the separation distance between the redundant main steam isolation and atmospheric dump valves concludes that two of the three redundant sets of valves could possibly be engulfed by any of the three design basis fires. In order to ensure the operability of two atmospheric valves, a thermal barrier or enclosure of non-combustible material (½" thick marinite or equivalent) will be provided around the valve operators of CV-4-1606 and 1607. Likewise, a horizontal flame impingement shield of non-combustible material will be provided under the valve operators for the main steam isolation valves POV-4-2604 and 2605. In addition, the electrical conduit associated with POV-4-2604 and 2605 will be provided 1 hour fire rated barrier protection by use of a thermal insulating material. This level of protection is deemed adequate for the design basis fires postulated herein. Although the intensity of these fires is severe, Area 114 is an outdoor area, and thus most of this heat will be released in the form of hot gases and combustion products directly to atmosphere above the flames.

## 3. Fire Hazards Evaluation

The fire hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

### Available Fire Suppression Capabilities Determination

Fire Area 114 is an outdoor area and is therefore easily accessible. Hose stations 17 and 18 from the Turbine Deck are available, in addition to portable extinguishers 4.3.1, 4.3.2, and 4.3.3. Area 114 fire suppression equipment ratings are as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 4.3.2 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 4.3.1 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.3.3 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| HS-17 | 100 gpm @ 50% eff. | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-18 | 100 gpm @ 50% eff. | 420,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

Available fire suppression heat removal rate (two hose stations @ 50% eff.) — 840,000 $\frac{Btu}{min}$

Total type "B" capability available — 225 $ft^2$

### Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables located on the Unit 4 main steam platform. FPL proposes to provide such protection as indicated in the following section. Although no credit is given for existing fire fighting equipment available in the area, the potential for a large fire in this area is considered acceptably small. It should be emphasized that the fires postulated in the preceding fire methodology are not considered credible fires and in reality, the existing fire fighting equipment provides more than adequate fire suppression capability. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Provide a fire barrier or enclosure of non-combustible material ½" thick marinite or equivalent around valve operators for valves CV-4-1606 and 1607.

2. Provide the equivalent of a 1 hour fire rated barrier for the electrical conduit associated with valves POV-4-2604 and 2605 by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

3. Install horizontal flame impingement shields of ½" thick marinite or equivalent under the valve operators for POV-4-2604 and 2605.

e. EXEMPTION REQUEST

FPL requests exemption for Area 114 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with this area supplemented by the specific modifications identified, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications coupled with a strict combustible control program based on Appendix C of this report, provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 114 based on implementation of the specific requirements of subsection (c), is estimated to be $120,376 versus the cost for the proposed modifications of $80,000.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are three types of backfit activities necessary to support our exemption requests which do not

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*Specifically, FPL requests exemption from those provisions that require the separation of redundant safe shutdown equipment by 1 hour fire rated barriers, i.e., the installation of 1 hour rated barrier protection for the valve operators of CV-4-1606, CV-4-1607, POV-4-2604, and POV-4-2605. In addition, FPL requests exemption from the installation of a fire detection and automatic suppression system for this area.

require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFRPart 50 are also provided in Section 5.2.19 and are discussed below.

1. There are three types of backfit activities necessary to implement the III.G.2 criteria which do not require a Unit 4 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for two of these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a Unit 4 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2. There is one type of backfit activity necessary to implement III.G.2 criteria which requires a Unit 4 outage because the modifications may require cutting and welding of the Fire System water supply piping. This activity would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii) and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) and that NRC action is required prior to June 1, 1983 in order to assure installation during the Fall 1984 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.15 FIRE AREA 115

### a. AREA DESCRIPTION

Fire Area 115 is the Unit 3 main steam platform which is located at an elevation of 53'-6". This area contains the main steam isolation valves and the atmospheric dump valves. The main steam platform is an outside concrete platform and is not bounded by any walls or ceiling. This area is adjacent to the Unit 3 Reactor Containment Building located immediately to the east and the turbine deck 42' elevation located immediately to the west. The area is accessible from the turbine deck via stairs to the north end of the main steam platform. Safe shutdown equipment consists of the main steam isolation valves, POV-3-2604, 2605, and 2606 and the atmospheric dump valves, CV-3-1606, CV-3-1607, and CV-3-1608. The main steam isolation valves are located at an elevation of approximately 54'-0" and have a center to center separation distance of approximately 28 feet. The atmospheric dump valves are located at an elevation of approximately 55'-0" and have a center to center separation distance of approximately 28 feet. Safe shutdown related cables are routed to this area in conduit through penetrations in the platform. Pertinent fire area details are listed below:

| | |
|---|---|
| Floor Surface Area, | 1579 $ft^2$ |
| Wall and Ceiling Surface Area, | N/A (outside area) |
| Free Volume Excluding Components, | N/A |
| Ceiling Height, | N/A |
| Floor Composition,<br>Floor Thickness, | Concrete<br>1'-6" |
| Wall Composition,<br>Wall Thickness, | N/A<br>N/A |
| Ceiling Composition,<br>Ceiling Thickness, | N/A<br>N/A |
| Fire detector(s) in Area,<br>Detector Type, | None<br>N/A |
| Automatic Suppression in Area,<br>Type of Automatic Suppression, | None<br>N/A |
| Installed Communications Near Fire Area, | Telephone handset<br>T-326<br>PA M-326 |

| | |
|---|---|
| Hose Station(s) Available To Area, | FH #11, #12 |
| Fire Extinguisher(s) Immediately Available To Area, | 4.3.6, 3.33, 3.3.4 |
| Number of Floor Drains, | None |
| Drain(s) Size/Capacity, | N/A |
| Drain(s) Flow To, | N/A |
| Normal Forced Draft/ Type Ventilation, | None (Outside Area) |
| Normal Ventilation Flow Rate, | N/A |
| Fire Area Penetrations: | |
| Floor | Unsealed penetrations |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

Main Steam Isolation Valves

S/G 3A POV-3-2604
S/G 3B POV-3-2605
S/G 3C POV-3-2606

Atmospheric Dump Valves

S/G 3A CV-3-1606
S/G 3B CV-3-1607
S/G 3C CV-3-1608

| Cables | Power (P), Control (C) |
|---|---|
| MSIV S/G 3A POV-3-2604 | C |
| MSIV S/G 3B POV-3-2605 | C |
| MSIV S/G 3C POV-3-2606 | C |

2. Nuclear Safety Evaluation

As indicated in the preceding equipment/cable list, Fire Area 115 contains only hot shutdown equipment and cables.

Three atmospheric dump valves are located in this area, CV-3-1606, CV-3-1607, and CV-3-1608. These valves are used for venting main steam to the atmosphere in the event of a turbine trip or during cooldown of the RCS should the condensers not be available. Two out of three atmospheric dump valves are required for hot shutdown. Although these valves are totally pneumatic in operation and control, and thus the potential for fire damage is not considered great, the fire hazards analysis contained herein must demonstrate the operability of two out of the three atmospheric dump valves in the event of a design basis fire in the area, or adequate protection of the equipment must be provided.

Three main steam isolation valves are also located in this area. The main steam isolation valves are utilized to isolate the main steam header outside containment from the steam generators inside containment. The main steam isolation valves are as follows: S/G A MSIV POV-3-2604, S/G B MSIV POV-3-2605, and S/G C MSIV POV-3-2606. The fire hazards analysis contained herein must demonstrate the operability of two out of three main steam isolation valves, and their associated cables in the event of a design basis fire in this area, or adequate protection of the equipment must be provided.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The combustibles inventory for Fire Area 115 consists primarily of the grease contained within each of the motor operated valves (MOV's) in the area. Since there are 6 MOV's in the area, with 1 lb. of grease per valve, this amounts to about 6 lbs. of grease total. This grease is contained within the respective steel enclosure of each valve motor operator and is not considered to contribute to the design basis fires postulated herein.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plant. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 115, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 3 is in all operating modes, except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

The design basis fire calculations for Area 115 consist of design basis fire heat release rate calculations, burn duration calculations, and effective spill area calculations. Three transient combustibles were considered in the analysis. These combustibles are acetone (5 gal), heptane (5 gal), and lubricating oil (10 gal). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential for a single fire to damage redundant equipment. The results of the design basis fire calculations are provided below:

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$)* | 926.0 | 926.0 | 543.3 |
| Design Basis Fire Heat Release Rate (Btu/min) | $4.6x10^6$ | $13.4x10^6$ | $4.4x10^6$ |
| Design Basis Fire Burn Duration (sec) | 4.4 | 2.1 | 14.9 |

*Effective spill areas provided are idealistic, worst case areas. No credit is given for the fact that a significant portion of the liquid combustibles could drain off the edges of the platform.

An examination of the design basis fire effective spill areas and the separation distance between the redundant main steam isolation and atmospheric dump valves concludes that two of the three redundant groups of valves could possibly be engulfed by any of the three design basis fires. In order to ensure the operability of two atmospheric dump valves, a thermal barrier or enclosure of non-combustible material ½" thick marinite or equivalent will be provided around the valve operators of CV-3-1606 and 1607. Likewise, a horizontal flame impingement shield of non-combustible material will be provided under the valve operators for the main steam isolation valves POV-3-2604 and 2605. In addition, the electrical conduit associated with POV-3-2604 and 2605 will be provided 1 hour rated barrier protection

by use of a thermal insulating material. This level of protection is deemed adequate for the design basis fires postulated herein. Although the intensity of the three design basis fires is severe, Area 115 is an outdoor area and thus most of the heat will be released in the form of hot gases and combustion products directly above the flames.

3. Fire Hazards Evaluation

The fire hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

Available Fire Suppression Capabilities Determination

Fire Area 115 is an outdoor area and is therefore easily accessible. Fire hydrants and hose stations from the Turbine Building operating deck (el. 42') are available, in addition to portable extinguishers 4.3.6, 3.3.3, and 3.3.4. Area 115 fire suppression equipment ratings are summarized as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 4.3.6 | 20A: 80BC | 210,000 Btu | 200 $ft^2$ | Acceptable |
| 3.3.3 | 10BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.3.4 | 4A: 40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| FH #11 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| FH #12 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| Available fire suppression heat removal rate (2 hose stations @ 50% eff) | | | | 630,000 $\frac{Btu}{min}$ |
| Total type "B" Capability available | | | | 325 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables in Area 115. FPL proposes to provide the specific equipment modifications identified in the following section to ensure a fire in this area will not impact achieving and maintaining safe shutdown. Although no credit is given for existing fire suppression equipment available for fighting a fire in

this area, the potential for a large fire in Area 115 is considered acceptably small. It should be emphasized that the fires postulated in the preceding fire methodology are not considered credible fires, and in reality the existing fire fighting equipment provides more than adequate fire suppression capability.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Provide a fire barrier or enclosure of noncombustible material ½" thick marinite or equivalent around valve operators for valves CV-3-1606 and -1607.

2. Provide the equivalent of a 1 hour rated barrier for the electrical conduit associated with valves POV-3-2604 and -2605 by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

3. Install horizontal flame impingement shields of ½" thick marinite or equivalent under the valve operators for POV-3-2604 and -2605.

e. EXEMPTION REQUEST

FPL requests exemption for Area 115 from those specific provisions of Section III.G.2 of Appendix R to 10 CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with this area coupled with the proposed modifications and a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 115 based on implementation of the specific requirements of subsection (c), is estimated to be $120,376 versus the cost for the proposed modifications of $80,000.

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* Specifically, FPL requests exemption from those provisions that require the separation of redundant safe shutdown equipment by 1 hour fire rated barriers, i.e. the installation of 1 hour fire rated barrier protection for the valve operators of CV-3-1606, CV-3-1607, POV-3-2604, and POV-3-2605. In addition, FPL requests exemption from the installation of a fire detection and automatic suppression system in this area.

f. SCHEDULE EXEMPTION

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are three types of backfit activities necessary to support our exemption requests which do not require a Unit 3 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a Unit 3 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii), or (iii).

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1) There are three types of backfit activities necessary to implement the III.G.2 criteria which do not require a Unit 3 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for two of these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a Unit 3 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2) There is one type of backfit activity necessary to implement III.G.2 criteria which require a Unit 3 outage because the modifications require cutting and welding of the Fire System water supply piping. This activity would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii), and (iii). It is noted that completion of this activity is not possible during the Fall 1983 refueling outage and that NRC action is required prior to November 1, 1983 in order to assure installation during the Spring 1985 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.16 FIRE AREA 116

### a. AREA DESCRIPTION

Fire Area 116 is the feedwater platform for Unit 3. This area is located off the northeast end of Unit 3 turbine deck adjacent to the Reactor Containment Building at elevation 39'-9". The feedwater platform contains the piping and associated valves for the feedwater and auxiliary feedwater systems which penetrate into the Reactor Containment Building. This area is bounded on two sides, south and west, by concrete walls. The east side is bounded by the Unit 3 Reactor Containment Building. The remaining north side is open. The area has a concrete ceiling and a checker plate floor. Safe shutdown equipment in the area consists of 6 auxiliary feedwater valves and their associated cables. Two 50% flow capacity valves are associated with each of the steam generator auxiliary feedwater lines, A, B, and C. These valves are located at an approximate elevation of 42' with a separation distance of 12 ft (center to center) between the A and B auxiliary feedwater lines, and a separation distance of 10 ft. between the B and C auxiliary feedwater lines. Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 1,344 $ft^2$ |
| Wall and Ceiling Surface Area, | N/A |
| Free Volume Excluding Components, | N/A |
| Ceiling Height | 13'-9" |
| Floor Composition,<br>Floor Thickness, | Checkered Plate<br>¼" |
| Wall Composition,<br>Wall Thickness, | Concrete<br>18" |
| Ceiling Composition,<br>Ceiling Thickness, | Concrete<br>18" |
| Fire Detectors in Area,<br>Detectors Type, | None<br>N/A |
| Automatic Suppression in Area,<br>Type of Automatic Suppression, | None<br>N/A |
| Installed Comm. Near Fire Area, | Telephone Handset T 326<br>PAX M 326 |
| Hose Station(s) Available to Area, | #11<br>#12 |

| | |
|---|---|
| Fire Extinguishers Immediately Available to Area, | 3.3.1<br>3.3.2<br>4.3.6 |
| Number of Floor Drains, | None |
| Drain(s) Size, | N/A |
| Drain(s) Flow To, | N/A |
| Normal Forced Draft Ventilation, | None |
| Normal Ventilation Flow Rate, | N/A |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

AFW to S/G 3A Control Valve
SV-3-2914

AFW to S/G 3A Backup Control Valve
SV-3-2915

AFW to S/G 3B Control Valve
SV-3-2916

AFW to S/G 3B Backup Control Valve
SV-3-2917

AFW to S/G 3C Control Valve
SV-3-2918

AFW to S/G 3C Backup Control Valve
SV-3-2919

| Cables | Power (P) Control (C) |
|---|---|
| AFW to S/G 3A Control Valve SV-3-2914 | C |
| AFW to S/G 3B Control Valve SV-3-2916 | C |
| AFW to S/G 3C Control Valve SV-3-2918 | C |
| AFW to S/G 3A Backup Control Valve SV-3-2915 | C |
| AFW to S/G 3B Backup Control Valve SV-3-2917 | C |
| AFW to S/G 3C Backup Control Valve SV-3-2919 | C |
| Steam Generator Level S/G 3A LT/LI-3-477 | C |
| Steam Generator Level S/G 3B LT/LI-3-487 | C |
| Steam Generator Level S/G 3C LT/LI-3-497 | C |

2. **Nuclear Safety Evaluation**

As indicated in the preceding equipment/cable listing for Fire Area 116, only hot shutdown equipment and cables are located in this area.

Auxiliary feedwater (AFW) to steam generator (S/G) A supply valves SV-3-2914 and SV-3-2915 are each 50% capacity flow control valves, therefore both valves are essential to meet the auxiliary feedwater flow requirements for steam generator A. Such is the case for the AFW flow control valves to S/G B and S/G C. Two out of three steam generators require full AFW flow for decay heat removal, so a total of four AFW flow control valves are required for hot shutdown. The fire hazards analysis contained herein must demonstrate that auxiliary feedwater flow to two steam generators (i.e. both the control valves and their located cables for the respective steam generator) will not be affected by a design basis fire, or adequate protection of the necessary equipment/cables must be provided.

In addition, Fire Area 116 contains cables associated with the level indicators/transmitters for steam generators A, B, and C. The following redundant steam generator level transmitter/indicators are located independent of this fire area:

| | | | |
|---|---|---|---|
| S/G A | LI/LT-3-474<br>LI/LT-3-475<br>LI/LT-3-476 | S/G B | LI/LT-3-484<br>LI/LT-3-485<br>LI/LT-3-486 |
| S/G C | LI/LT-3-494<br>LI/LT-3-495<br>LI/LT-3-496 | | |

Only two level indicators/transmitters (one per steam generator, two steam generators required) per unit are required to remain operable. Therefore, the loss of LI/LT-3-477,487, and 497 will not impair the capability to achieve and maintain hot and cold shutdown conditions.

c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

The combustible inventory for this area consists of the grease in the motor operated valves located there. This grease is contained within each motor operator steel enclosure, exists in insignificant quantities when compared to the transient combustibles assumed in the fire hazards analysis, and would not be expected to contribute to the fires postulated in these areas.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plant. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 116, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons when Unit 3 is in all operating modes, except cold shutdown and refueling. In addition, these liquids will be transported only in approved safety containers.

2. Design Basis Fire Calculations

The design basis fire calculations for Area 116 consist of design basis fire heat release rate calculations, burn duration calculations, and effective spill area calculations. Three transient combustibles were considered in the analysis. These combustibles are acetone (5 gal), heptane (5 gal), and lubricating oil (10 gal). Each combustible was

situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential impact on essential hot shutdown equipment/cables in the area (refer to the Nuclear Safety Evaluation for specific equipment to be evaluated). The results of the design basis fire calculations are provided below: (Appendix A of this report provides a detailed discussion and development of the design basis fire methodology.)

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$) | 926 | 926 | 543.3 |
| Design Basis Fire Heat Release Rate (Btu)/(min) | $4.6x10^6$ | $1.3x10^7$ | $4.4x10^6$ |
| Design Basis Fire Burn Duration (sec) | 4.4 | 2.1 | 14.9 |

An examination of the design basis fire effective spill areas and the separation distance between the redundant sets of auxiliary feedwater flow control valves yields the conclusion that all six valves could potentially be engulfed by any of the three design basis fires. In order to ensure the required AFW flow to two steam generators, FPL proposes to provide a thermal barrier or enclosure of non-combustible material (½" thick marinite or equivalent) around the valve operators of four of the AFW flow control valves. In addition, the electrical conduit associated with these valves will be provided 1 hour fire rated barrier protection by use of a thermal insulating material. This level of protection is deemed adequate for the design basis fires postulated herein. Although the intensity of these fires is severe, Area 113 is an outdoor area, and thus most of the heat will be released in the form of hot gases and combustion products directly to atmosphere above the flames.

3. Fire Hazards Evaluation

The fire hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

Available Fire Suppression Capabilities Determination

Fire Area 116 is an outdoor area and is therefore easily accessible. Hose Stations 11 and 12 from the Turbine Deck are available, in addition to portable extinguishers 3.3.1, 3.3.2, and 4.3.6. Area 1 fire suppression equipment ratings are as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.3.1 | 10 BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.3.2 | 4A: 40 BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| 4.3.6 | 20A: 80 BC | 210,000 Btu | 200 $ft^2$ | Acceptable |
| HS-11 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |
| HS-12 | 75 gpm @ 50% eff | 315,000 $\frac{Btu}{min}$ | | "E" Rated Nozzle |

| | |
|---|---|
| Available fire suppression heat removal rate (two hose stations @ 50% eff) | 630,000 $\frac{Btu}{min}$ |
| Total type "B" Capability available | 325 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for the vital equipment/cables in Area 116. FPL proposes to provide such protection by the use of thermal barriers of non-combustible material to protect required valve operators and the utilization of a thermal insulating material to protect electrical conduit. Although no credit is given for existing fire suppression equipment available in the area, the potential for a large fire in this area is considered acceptably small. It should be emphasized that the fires postulated in the preceding fire methodology are not considered credible fires, and in reality the existing fire fighting equipment provides more than adequate fire suppression capability. Thus, based on this evaluation, the modifications proposed herein are deemed to provide an adequate level of fire protection to assure the capability to achieve and maintain hot/cold shutdown conditions.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Provide a fire barrier or enclosure of non-combustible material ½" thick marinite or equivalent around valve operators for valves CV-3-2914, -2915, -2916 and -2917.

2. Provide the equivalent of a 1 hour fire rated barrier for the electrical conduit associated with valves CV-3-2914, -2915, -2916 and -2917 by utilizing a thermal insulating material such as that manufactured by TSI, Inc.

e. **EXEMPTION REQUEST**

FPL requests exemption for Area 116 from the specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with the feedwater platform, supplemented by the specific modifications proposed herein, provide an adequate level of protection for even the incredible fires postulated in the fire methodology. These modifications, coupled with a strict combustible control program based on Appendix C of this report, provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 116 based on implementation of the specific requirements of subsection (c), is estimated to be $311,017 versus the cost for the proposed modifications of $81,641.

f. **SCHEDULE EXEMPTION**

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There are two types of backfit activities necessary to support our exemption requests which do not require a Unit 3 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for these activities from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

1) There are three types of backfit activities necessary to implement the III.G.2 criteria which do not require a Unit 3 outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed

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*Specifically, FPL requests exemption from those provisions that require the separation of redundant safe shutdown equipment by 1 hour fire rated barriers, i.e., the installation of 1 hour fire rated barrier protection for the valve operators of CV-3-2914, CV-3-2915, CV-3-2916, and CV-3-2917. In addition, FPL requests exemption from the installation of a fire detection and automatic suppression system in this area.

completion schedule for two of these activities from 9 months (based on the date of NRC action) to that provided in Section 5.2.19 schedules. At this time we do not believe that these backfit installation phases will require a Unit 3 outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii) or (iii).

2) There is one type of backfit activity necessary to implement III.G.2 criteria which requires a Unit 3 outage because the modifications may require cutting and welding of the Fire System water supply piping. This activity would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii), and (iii). It is noted that completion of this activity is not possible during the Fall 1983 refueling outage and that NRC action is required prior to November 1, 1983 in order to assure installation during the Spring 1985 refueling outage.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

## 5.2.17 FIRE AREA 122

### a. AREA DESCRIPTION

This is an outside area located in the northeast corner of the plant site at elevation 16'. It is easily accessible for fire fighting and houses one 500,000 gallon raw water storage tank, one 150,000 gallon elevated storage tank, four raw water pumps, a raw water booster pump, the A and B fire pumps and associated valves and cables.

All pumps are mounted on individual concrete foundations and the ground surface between the pumps is gravel. The two fire pumps are located about 67 feet apart, with the raw water pumps and the raw water booster pump situated between them. The pumps are located just south of the raw water storage tank.

In order to comply with Section III.A of Appendix R, FPL has committed to adding a 750,000 gallon raw water storage tank just east of the existing raw water storage tank. In addition, a diesel fire pump and a 550 gal. diesel fuel day tank will be added on the southeast side of the new tank. This new equipment will conform to the requirements of NFPA 20.

Safe shutdown related cables are routed through this area in underground duct banks. The fire pump cables are routed through this area in underground conduits (to fire pump B) and above ground in a cable tray at the 33' elevation (to fire pump A). Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | N/A (outside Area) |
| Wall and Ceiling Surface Area, | N/A |
| Free Volume Excluding Components, | N/A |
| Ceiling Height, | N/A |
| Floor Composition, | Gravel |
| Floor Thickness, | N/A |
| Wall Composition, | N/A |
| Wall Thickness, | N/A |
| Ceiling Composition, | N/A |
| Ceiling Thickness, | N/A |
| Fire Detector(s) in Area, | None |
| Detector Type, | N/A |
| Automatic Suppression in Area, | None |
| Type of Automatic Suppression, | N/A |

| | |
|---|---|
| Installed Communications Near Fire Area, | East side of Water Treatment Plant |
| Hose Station(s) Available to Area, | None |
| Fire Extinguisher(s) Immediately Available To Area, | ID # 7 |
| Number of Floor Drains, | None |
| Drain(s) Size/Capacity, | N/A |
| Drain(s) Flow To, | N/A |
| Normal Forced Draft Type Ventilation, | N/A (outside Area) |
| Normal Ventilation Flow Rate, | N/A |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

| Cables | Power (P) Control (C) |
|---|---|
| ICW Pump 3A | P,C |
| ICW Pump 3B | P,C |
| ICW Pump 3C | P,C |

Equipment/Cables to Mitigate the Consequences of a Fire

Equipment

Fire Pump A
Fire Pump B
Diesel Pump

| Cables | Power (P) Control (C) |
|---|---|
| Fire Pump A | P,C |
| Fire Pump B | P,C |

2. Nuclear Safety Evaluation

As indicated in the preceding equipment/cable list, Fire Area 122 presently contains two (A & B) 100% capacity electric motor driven fire pumps and their associated cables. In addition, FPL is committed to the purchase and installation of a third 100% capacity diesel driven fire pump by March 1984. Any one of the three 100% capacity fire pumps will meet the fire protection requirements for both Turkey Point units.

Thus, the fire hazards analysis contained herein must demonstrate that one of the three fire pumps remains operable and will not be affected by a postulated design basis fire, or adequate protection of this equipment must be provided.

In addition, cables for the intake cooling water pumps, 3A, 3B, and 3C are routed through this fire area. Since these cables are routed underground in conduit, no further analysis of these cables is required.

## c. FIRE HAZARDS ANALYSIS

1. Fire Area Combustibles

Liquid Combustibles:

Lube Oil in Fire Pumps
Lube Oil in Raw Water Pumps

The liquid combustibles listed above consist of the lubricating oil contained within the associated pump and/or driver. This oil can only be considered a combustible if it is sprayed onto a hot surface which raises its temperature above its flash point, i.e., above approximately 450°F. The lubricating oil systems for these pumps are not pressurized, therefore the potential for oil spray is unlikely. In addition, ignition sources, such as hot piping, etc., are not present in the area. Based on the oil confining design features associated with these pumps and the small amounts of oil involved, the design basis fire calculations contained herein do not consider the lubricating oil contained within pumps as a combustible source. Lubricating oil is considered in the analysis, however, as a transient combustible.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels, no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plants. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any

quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

The diesel-driven fire pump and 550 gallon diesel fuel day tank to be installed in this area shall conform with NFPA 20, and therefore are not considered as combustible sources in the design basis fire calculations provided herein.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 122, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons. In addition, these liquids will be transported only in approved safety containers.

2. <u>Design Basis Fire Calculations</u>

The design basis fire calculations for Area 122 consist of design basis fire heat release rate calculations, burn duration calculations, and effective spill area calculations. Three transient combustibles were considered in this analysis. These combustibles are acetone (5 gallons), heptane (5 gallons), and lubricating oil (10 gallons). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential for a single fire to damage redundant equipment. The results of the design basis fire calculations are provided below:

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| *Design Basis Fire Effective Spill Area ($ft^2$) | 926.0 | 926.0 | 543.3 |
| Design Basis Fire Heat Release Rate (Btu/min) | $4.6x10^6$ | $13.4x10^6$ | $4.4x10^6$ |
| Design Basis Fire Burn Duration (sec) | 4.4 | 2.1 | 14.9 |

*Effective spill areas provided are idealistic, worst case areas. No credit for the ground absorbing/flow inhibiting characteristics of the gravel surface was applied.

These design basis fire calculations were conducted under the assumption that the new raw water storage tank, the diesel fire pump, the 550 gallon diesel fuel day tank, and associated valves and cables are in place as proposed by FPL.

An examination of the design basis fire effective spill areas and the separation distance between redundant fire pumps yields the conclusion that not even two of the three pumps will be engulfed by any of the three design basis fires. In addition, it should be noted that the effective spill areas provided are idealistic and in reality these areas would be much smaller due to the existing gravel surface. Although the intensity of the three design basis fires is severe, Area 122 is an outdoor area and most of this heat will be released in the form of hot gases and combustion products directly above the flames. Thus, the two redundant fire pumps will only be exposed to the radiative heat transfer from the postulated fire. Since all three fire pumps are well separated (in excess of 50 ft.), the probability of even two of the three pumps being affected by a single fire is considered extremely unlikely.

3. Fire Hazards Evaluation

The fire hazards evaluation was separated into two categories, viz., available fire suppression capabilities determination and a fire area summary.

Available Fire Suppression Capabilities Determination

This fire area is outdoors and readily accessible for fire fighting. A portable fire extinguisher is available for use in Area 122. Fire suppression equipment ratings are summarized as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| (No Number) | 4A:40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| F.H. 14 | 175 gpm @ 50% eff | 735,000 Btu/min | | "E" Rated Nozzle |

Fire Area Summary

As indicated by the preceding fire hazards analysis, the fire pumps are sufficiently separated from each other to preclude a single fire from causing a loss of system function. Although no credit is given for existing fire suppression equipment available in the area, the potential for a large fire is considered acceptably small.

In summary, no modifications to Area 122 are deemed necessary.

d. SUMMARY OF PROPOSED MODIFICATIONS

None

e. - EXEMPTION REQUEST

FPL requests exemption for Area 122 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and security and is in the public interest. The inherent design features associated with this area coupled with a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 122 based on implementation of the specific requirements of subsection (b), is estimated to be $96,000.

f. SCHEDULE EXEMPTION

Should the above requested exemption be denied, the schedules for full implementation of Section III.G of Appendix R to 10 CFR Part 50 are provided in Section 5.2.19 and are discussed below.

1) There is one type of backfit activity necessary to implement III.G.2 criteria which requires an outage on both Units #3 and #4 because the modifications may require cutting and welding of the Fire System water supply piping. This activity would render the Fire System inoperable and thereby impact the operability of safety related equipment required to be operable by the plant Technical Specifications. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10 CFR 50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii), and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) or Fall 1983 refueling outage and that NRC action is required prior to June 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

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* Specifically, FPL requests exemption from the installation of a fire detection and automatic suppression system in this area.

## 5.2.18 -FIRE AREA 131

### a. AREA DESCRIPTION

Fire Area 131 is the Diesel Radiator Room, located north of the Unit 3 Containment Building and east of the Unit 3 4160V switchgear room. This fire area houses the diesel generator #3 and #4 radiators and cooling fans. The area is bounded on three sides by a metal grating missile barrier. The east wall and ceiling are concrete. The east wall contains two 12" pipe penetrations, two 5" x 10" penetrations, a 1' x 1' penetration, and two 4' x 3' square fan openings. In addition, there is a doorway to the Unit 4 Diesel Generator Room (Area 72). The area is accessible from the 18' elevation of the Turbine Building. Pertinent fire area details are provided below;

| | |
|---|---|
| Floor Surface Area, | 489 $ft^2$ |
| Wall and Ceiling Surface Area, | 2570 $ft^2$ |
| Free Volume Excluding Components, | 9291 $ft^3$ |
| Ceiling Height, | 19' |
| Floor Composition,<br>Floor thickness, | Concrete<br>(ground level) |
| Wall Composition,<br>Wall thickness | East Wall: Concrete 1' thick<br>North, South, West Walls: Metal grating |
| Ceiling Composition,<br>Ceiling thickness, | Concrete<br>1'-6" |
| Fire detector(s) in Area,<br>Detector Type, | None<br>N/A |
| Automatic Suppression in Area,<br>Type of Automatic Suppression, | None<br>N/A |
| Installed Communications Near Fire Area, | T-120, M-120 |
| Hose Station(s) Available to Area, | #6 |

| | |
|---|---|
| Fire Extinguisher(s) Immediately Available to Area, | 3.1.1, 3.1.2, 3.1.7, 3.1.8 |
| Number of Floor Drains,<br>Drain(s) Size/Capacity,<br>Drain(s) Flow To, | 1<br>2"/90 gpm<br>Oil Separator Tank/ Storm Drain |
| Normal Forced Draft/ Type Ventilation, | Yes/Fan |
| Normal Ventilation Flow Rate, | Exhaust: 1300 CFM |
| Fire Area Penetrations: | |
| Ceiling: | None |
| Floor: | None |
| East Wall | 2 - 12" penetrations w/8" pipes<br>2 - 5" x 10" penetrations w/4" shafts<br>1 - 1 $ft^2$ penetration<br>1 - 3' x 7' door<br>1 - 1'-2" x 1' penetration w/8" and 6" pipes<br>2 - 6" penetrations w/2" pipes<br>2 - 4'-3" square fan openings |

b. SAFE SHUTDOWN EQUIPMENT/CABLES/NUCLEAR SAFETY EVALUATION

1. Safe Shutdown Equipment/Cables

Hot Shutdown Equipment/Cables

Equipment

Diesel Generator #3
Radiator and Cooling Fan

Diesel Generator #4
Radiator and Cooling Fan

| Cables | Power (P) Control (C) |
|---|---|
| Diesel Generator #3 Breaker Bus 4A | C |
| Diesel Generator #4 Breaker Bus 4B | C |

2. **Nuclear Safety Evaluation**

As indicated by the Area Description and the safe shutdown equipment list, Area 131 contains the radiator cooling systems for both the #3 and #4 emergency diesel generator systems. Due to the dependency of these cooling systems on rubber belts and hoses, the potential for equipment fire damage must be evaluated. Each emergency diesel generator set is designed to provide the emergency power requirements for achieving safe shutdown following a loss of offsite power. Therefore, the fire hazards analysis provided herein must demonstrate that a design basis fire in Area 131 will not render both #3 and #4 diesel generators inoperable or adequate protection must be provided.

The diesel generator breaker control cables indicated in the safe shutdown cable listing are routed in underground duct banks and therefore do not warrant evaluation.

c. **FIRE HAZARDS ANALYSIS**

1. **Fire Area Combustibles**

There are no combustibles of significance in Fire Area 131. Therefore, the design basis fire calculations provided herein do not consider any combustibles already located in the area.

Three transient combustibles were considered in this analysis: acetone, lubricating oil, and heptane. In modeling fires involving such fuels no consideration is given to the presence of such fuels in any quantity onsite at the Turkey Point plant. For example, lubricating oil exists in the sumps and piping systems of mechanical components but is not normally transported in open containers in the plant areas analyzed. Further, spills involving lubricating oil require an intense and sustained heat flux in order to support ignition. Acetone is not expected to be found within the protected area in any quantity greater than a gallon at any time while heptane has no use at all onsite. Thus, while fires involving substantial quantities of these fuels is modeled, this is not to imply that such quantities are considered to be credible fire sources.

In accordance with the proposed transient combustibles control program (See Section 5.1.6) transient combustibles will be strictly limited. In Fire Area 131, flammable liquids will be limited to 1 gallon and combustible liquids will be limited to 5 gallons. In addition, these liquids will be transported only in approved safety containers.

2. **Design Basis Fire Calculations**

The design basis fire calculations for Area 131 consist of design basis fire heat release rate calculations, burn duration calculations, and effective spill area calculations. Three transient combustibles were considered in the analysis. These combustibles are acetone (5 gal), heptane (5 gal), and lubricating oil (10 gal). Each combustible was situated in the area so as to maximize its energy release rate. The results of these calculations are then examined to determine the potential impact on the redundant diesel generator cooling fans. The results of the design basis fire calculations are provided below:

| | Acetone | Heptane | Lubricating Oil |
|---|---|---|---|
| Design Basis Fire Effective Spill Area ($ft^2$) | 926 | 926 | 543.3 |
| Design Basis Fire Heat Release Rate (Btu/min) | $4.6 \times 10^6$ | $13.4 \times 10^6$ | $4.4 \times 10^6$ |
| Design Basis Fire Burn Duration (Sec) | 4.4 | 2.1 | 14.9 |

Since the north, south and west walls each consist of metal grating, a combustible liquid spill in Area 131 would not be confined to the area, but would spread to adjoining areas. Within the area, a fire resulting from a combustible liquid spill would be limited to a narrow strip of floor surface, about 5 ft by 43 ft. The cooling fans are mounted on a concrete foundation about 8" above the floor surface. It is evident from the design basis fire effective spill areas that all of the fans could potentially be affected by a fire. In order to ensure the operability of redundant fans, FPL proposes the installation of a 3 hour barrier between the diesel generator #3 and #4 cooling fans. A liquid spill outside of Area 131 and just west of the diesel radiators could potentially impact both #3 and #4 zones. In order to prevent an outside spill from entering the area through the metal grating on the west side, FPL proposes the installation of a 2" high curb running just outside the west wall. The modifications proposed above are deemed to provide an adequate level of protection from the design basis fires postulated herein.

3. **Fire Hazards Evaluation**

The fire hazards evaluation was separated into four categories, viz., fire area structual ratings evaluation, fire area adjacent effects evaluations, available fire suppression capabilities determination, and a fire area summary evaluation.

Fire Area Structural Ratings Evaluation Data for Area 131 is as follows:

Area boundary structural fire ratings are estimates based on standardized curves for solid concrete walls.

| | |
|---|---|
| East Wall | 4 Hrs |
| Floor | N/A (ground level) |
| Ceiling | 4 Hrs |

Fire area structural ratings are therefore determined to be acceptable.

Fire Area Adjacent Effects Evaluation

Fire area penetrations and openings were evaluated with respect to possible fire spread hazard to adjacent areas, hot gas radiation, or burning liquid spread. No fire spread hazard was found to exist. There are no significant ignition sources near these penetrations. Any burning liquid entering the drain system would not be expected to have an effect on adjacent areas. Radiators and cooling fans for diesel generators #3 and #4 will be separated by a 3 hour fire barrier, and therefore any fire spread through the east wall penetrations of either diesel generator room, though considered unlikely, would not impact the other diesel generator or its cooling equipment.

Available Fire Suppression Capabilities Determination

Fire Area 131 is accessible from the Turbine Building at an elevation of 18 ft. Fire hose station #6 and fire hydrant #4 are available for fighting a fire in this area, as well as portable extinguishers 3.1.1., 3.1.2, 3.1.7 and 3.1.8. Area 131 fire suppression equipment ratings are as follows:

| I.D. No. | Extinguisher/ Hose Station Rating | Type "A" Capability | Type "B" Capability | Type "C" Capability |
|---|---|---|---|---|
| 3.1.1 | 10BC | Minimal | 25 $ft^2$ | Acceptable |
| 3.1.2 | 20ABC | 210,000 Btu | 50 $ft^2$ | Acceptable |
| 3.1.7 | 10A: 40BC | 105,000 Btu | 100 $ft^2$ | Acceptable |
| 3.1.8 | 4A: 40BC | 42,000 Btu | 100 $ft^2$ | Acceptable |
| H.S.-6 | 75 gpm @ 50% eff. | 315,000 Btu/min | | "E" Rated Nozzle |
| F.H. 4 | 175 gpm @ 50% eff. | 735,000 Btu/min | | "E" Rated Nozzle |

| | |
|---|---|
| Available fire suppression heat removal rate | $1.05 \times 10^6$ Btu/min |
| Total Type "B" capability available | 275 $ft^2$ |

Fire Area Summary

As demonstrated by the fire hazards analysis provided herein, protection from the direct flame impingement and heating of a fire must be provided for redundant cooling fans in the Diesel Radiator Room. FPL proposes the installation of a part height, 3-hour rated wall between diesel generator #3 and #4 cooling fans and associated equipment. Fire spread from adjacent areas to both diesel radiator zones will be prevented by the installation of a 2" curb just outside of the west wall metal grating. Although no credit is given for existing fire suppression equipment available in the area, the potential for a large fire in this area in considered acceptably small. It should be emphasized that the fires postulated in the preceding fire methodology are not considered credible fires, and in reality the existing fire suppression capability for this area more than adequately suffices. In summary, with the modifications proposed herein, the ability to achieve and maintain hot/cold shutdown is assured.

d. SUMMARY OF PROPOSED MODIFICATIONS

1. Install a 3-hour fire rated barrier between the radiators for the #3 and the #4 diesel generators.

2. Provide curbing 2" high directly against the west side of the diesel generator radiators.

e. **EXEMPTION REQUEST**

FPL requests exemption for Area 131 from those specific provisions of Section III.G.2 of Appendix R to 10CFR Part 50.* Based on the preceding fire hazards analysis and evaluation, it is FPL's position that no additional fire safety will be gained by the implementation of the particular requirements of Section III.G.2. Further, such an exemption is authorized by law, will not endanger life or property or the common defense and is in the public interest. The inherent design features associated with this area coupled with the proposed modifications and a strict combustible control program based on Appendix C of this report provide reasonable assurance that the safe shutdown capability of the plant is maintained in conformance with the equipment damage criteria specified in Section I of Appendix R (i.e., one train of hot shutdown equipment is maintained free from fire damage by a single postulated fire). Furthermore, the minimum cost estimate for full compliance with Section III.G.2 in Area 131, based on implementation of the specific requirements of subsection (a), is estimated to be $246,000 versus the cost for the proposed modifications of $120,000.

f. **SCHEDULE EXEMPTION**

Schedules for modifications in support of the exemption request presented in this section are provided in Section 5.2.19. There is one type of backfit activity necessary to support our exemption requests which does not require a unit outage. FPL requests exemption from 10CFR50.48(c)(2) to extend the allowed completion schedule for this activity from 9 months (based on the date of NRC approval) to that provided in Section 5.2.19 schedules. At this time, we do not believe that these backfit installation phases will require a unit outage. However, in the event that during the final design and safety review phases it is determined that a unit outage is required, we will amend our request to complete the installation phases during an outage period as defined by 10CFR50.48(c)(3)(i), (ii), or (iii). There is one type of backfit activity necessary to support our exemption request which requires an outage on both Units #3 and #4 to construct equipment fire barriers which will not be seismically qualified until completed. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii), and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) or Fall 1983 refueling outages and that NRC action is required prior to March 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

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* Specifically, FPL requests exemption from the total enclosure of one Diesel Radiator Room by 3 hour rated fire barriers.

Should the above requested exemptions be denied, the schedules for full implementation of Section III.G of Appendix R to 10CFR Part 50 are also provided in Section 5.2.19 and are discussed below.

> There is one type of backfit activity necessary to implement III.G.2 criteria which requires an outage on both Units #3 and #4 because the modifications require major construction on equipment fire barriers which will not be seismically qualified until completed. Consistent with the Section 5.2.19 schedules, for these modifications FPL requests exemption from 10CFR50.48(c)(3) to extend from 180 days the period prior to the outages defined under subparts (i), (ii), and (iii). It is noted that completion of this activity is not possible during the Steam Generator Repair outage (Winter 1982) or Fall 1984 refueling outage and that NRC action is required prior to March 1, 1983 in order to assure installation during the Fall 1984 and Spring 1985 refueling outages.

The requested exemptions are justified on the basis of the reasonable time required to perform the work, the high degree of fire protection already present in the plant and the importance of minimizing the disruption of plant operations. Further, such exemptions are authorized by law and, for the reasons presented above, will not endanger life or property or the common defense and security and are in the public interest.

5.2.19.1

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | West Electrical Penetration Room - Unit 3 | 19 | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Wireway Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48 (C) (2) | | | | | |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48 (C) (2) | | | | | |
| | | | Barriers,Penetration Seals | 12 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48 (C) (3) | | | | | |
| 5.2 | South Electrical Penetration Room - Unit 3 | 20 | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Wireway Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Barriers,Penetration Seals | 12 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | Continued Next Page | | | | | | | | | | | |

# FIRE PROTECTION BACKPIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.2 | (Continued) South Electrical Penetration Room - Unit 3 | 20 | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48 (C) (3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48 (C) (1) | | | | | |
| 5.2 | Machine Shop | 25 | Wireways Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48 (C) (2) | | | | | |
| | | | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Barriers,Penetration Seals | 12 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| | | | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | North Electrical Penetration Room - Unit 4 | 26 | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48 (C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48 (C) (3) | | | | | |
| | | | Wireway Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Conduit Thermal Insualting Material | 8 months | 4 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Barriers, Penetration Seals | 12 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C) (1) | | | | | |
| 5.2 | West Electrical Penetration Room - Unit 4 | 27 | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Wireway Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C) (2) | | | | | |
| | Continued Next Page | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C) (2) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | (Continued) West Electrical Penetration Room - Unit 4 | 27 | Barriers, Penetration Seals | 12 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| 5.2 | Auxiliary Bldg. Ventilation System Exhaust Fans | 28 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| 5.2 | Boric Acid Storage Tank Area | 41 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48 (C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C) (1) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| | | | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | Charging Pump Room - Unit 4 | 45 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Cross Connect Between Charging Pump Discharge Piping - Units 3 & 4 | 12 months | 12 months | Yes | 10CFR50.48 (C) (3) | | | | | |
| | | | Plant Operating Procedures* | 1 month | 1 month | No | 10CFR50.48(C)(1) | | | | | |
| 5.2 | Component Cooling Water Pumps 3A, 3B, 3C | 54 | Equipment Fire Barriers/Walls | 16 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| 5.2 | Charging Pump Room - Unit 3 Continued Next Page | 55 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |

*This schedule exemption is based upon completion of the installation phase of the cross connect.

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.2 | (Continued) Charging Pump Room - Unit 3 | 55 | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48 (C) (3) | | | | | |
| | | | Cross Connect Between Charging Pump Discharge Piping - Units 3 & 4 | 12 months | 12 months | Yes | 10CFR50.48 (C) (3) | | | | | |
| | | | Plant Operating Procedures * | 1 month | 1 month | No | 10CFR50.48(C)(1) | | | | | |
| 5.2 | 4B Motor Control Center and Reactor Control Rod Equipment Room | 61 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C) (1) | | | | | |
| | | | Plant Operating Procedures * | 1 month | 1 month | No | 10CFR50.48(C)(1) | | | | | |

*This schedule exemption is based upon completion of the installation phase of the charging system cross connect proposed for Area 55.

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | 3B Motor Control Center and Reactor Control Rod Equipment Room | 63 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48 (C) (1) | | | | | |
| | | | Plant Operating Procedures* | 1 month | 1 month | No | 10CFR50.48(C)(1) | | | | | |
| | | | *This schedule exemption is based upon completion of the installation phase of the charging system cross connect proposed for Area 55. | | | | | | | | | |
| 5.2 | 4B 4160 V Switchgear Room | 67 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR1050.48(C) (3) | | | | | |
| | | | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | 4A 4160 V Switchgear Room | 68 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| 5.2 | 3B 4160 V Switchgear Room | 70 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | 3A 4160 V Switchgear Room | 71 | Barriers,Penetration Seals,and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| 5.2 | #4 Diesel Generator Room | 72 | Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| 5.2 | #3 Diesel Generator Room | 73 | Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | #3 Diesel Generator Day Tank Room | 74 | Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| 5.2 | #4 Diesel Generator Day Tank Room | 75 | Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| 5.2 | Auxiliary Feedwater Pump Area | 84 | Standby Steam Generator Feedwater Pumps | 16 months | 12 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Plant Operating Procedures* | 1 month | 1 month | No | 10CFR50.48(C)(1) | | | | | |

*This schedule exemption is based upon completion of the installation phase of the standby steam generator feedwater pumps.

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.2 | 480V Load Centers 4A and 4B | 93 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| 5.2 | 480 V Load Centers 4C and 4D | 94 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C) (2) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | 480 V Load Centers 3A and 3B | 95 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| 5.2 | 480 V Load Centers 3C and 3 D | 96 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR40.48(C) (2) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| | | | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | Control Building HVAC Equipment | 97 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Control Room Cooling Modification | 12 months | 6 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C) (1) | | | | | |
| 5.2 | Motor Generator Set Room - Unit 4 | 101 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48 (C) (2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C) (2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C) (3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C) (1) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | 4B Battery Room | 102 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| 5.2 | 3A Battery Room | 103 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| 5.2 | Motor Generator Set Room - Unit 3 | 104 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | Continued Next Page | | | | | | | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| | | | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| | (Continued) | | | | | | | | | | | |
| 5.2 | Motor Generator Set Room - Unit 3 | 104 | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Cable Tray Thermal Insulating Material | 12 months | 12 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C)(1) | | | | | |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | | | | | |
| 5.2 | Inverter Room | 108 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Equipment Fire Barriers/Walls | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C)(1) | | | | | |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2 | 4A Battery Room | 109 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| 5.2 | 3B Battery Room | 110 | Barriers, Penetration Seals, and Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| 5.2 | Intake Area - Units 3 & 4 | 119 & 120 | Equipment Fire Barriers/Walls - Unit 3 ICW Pump | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | Continued Next Page | | | | | | | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS FOR AREAS WARRANTING FULL COMPLIANCE WITH SECTION III.G. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| | (Continued) | | | | | | | | | | | |
| 5.2 | Intake Area - Units 3 & 4 | 119 & 120 | Equipment Fire Barriers/Walls - Unit 4 ICW Pump | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | | | | | |

## FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS: BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED: BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.2.1 | Auxiliary Bldg. Corridor - El.10'; and Chemical Drain, Laundry & Hot Shower Tank Room; and Pipeway | 4, 5, 9 & 10 | Cable Tray Flame Impingement/Thermal Shields | 12 months | 6 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C)(2) |
| | | | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | Conduit Thermal Insulating Material (Spray) | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| 5.2.2 | Residual Heat Exchangers; and RHR Sump & Pump - Unit 3 | 11, 12 & 13 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C) (2) | Conduit Thermal Insulating Material (Spray) | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| | | | Part Height Walls, Penetration Seals | 12 months | 5 months | No | 10CFR50.48(c)(2) | Barriers, Penetration Seals, and Fire Doors /Fire Proofing | 16 months | 5 months | No | 10CFR50.48(C)(2) |
| | | | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) |
| | | | | | | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |

# FIRE PROTECTION BACKFIT SCHEDULES

| | | | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS | | | | | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2.3 | Residual Heat Exchangers; and RHR Sump & Pump - Unit 4 | 14, 15 & 16 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR 50.48(C)(2) | Conduit Thermal Insulating Material (Spray) | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | Part Height Walls, Penetration Seals | 12 months | 5 months | No | 10CFR50.48(C)(2) | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| | | | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | Barriers, Penetration Seals, and Fire Doors /Fire Proofing | 16 months | 5 months | No | 10CFR50.48(C)(2) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) |
| | | | | | | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| 5.2.4 | Pipe & Valve Room - Unit 4 | 30 | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C)(2) | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| | | | Barriers, Penetration Seals, & Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | Conduit Thermal Insulating Material (Spray) | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | Barriers, Penetration Seals, and Fire Doors /Fire Proofing | 16 months | 5 months | No | 10CFR50.48(C)(2) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |
| | | | | | | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS | | | | | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2.5 | Pipe & Valve Room - Unit 3 | 40 | Cable Tray Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C)(2) | Conduit Thermal Insulating Material (Spray) | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | Barriers, Penetration Seals, and Fire Doors /Fire Proofing | 16 months | 5 months | No | 10CFR50.48(C)(2) |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |
| | | | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| | | | | | | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| 5.2.6 | Component Cooling Pump & Heat Exchanger - Unit 4 | 47 | Cable Tray Flame Impingement/Thermal Shields | 12 months | 6 months | No | 10CFR50.48(C)(2) | Equipment Fire Barriers/Walls | 16 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Cable Tray Fire Resistant Partial Enclosure | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| | | | Equipment Fire Barriers/Walls | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS | | | | | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2.7 | Auxiliary Bldg. Corridor - El. 18' | 58 | Cable Tray Flame Impingement/Thermal Shields | 12 months | 6 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(4) |
| | | | | | | | | Cable Rerouting | 12 months | 14 months | Yes | 10CFR50.48(C)(4) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | | | | | | Design Submittal For NRC Approval | 6 months | N/A | No | 10CFR50.48(C)(5) |
| | | | Wireway Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Cable Rerouting | 12 months | 14 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | | | | | | Alternate Shutdown Control Room and Instrumentation And Control Modifications | 12 months | 14 months | Yes | 10CFR50.48(C)(4) |
| | | | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | | | | | |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C)(1) | | | | | |
| 5.2.8 | Containment - Unit 4 | 59 | Dedicated Portable Emergency Lighting | 6 months | 2 months | No | None Required | Non-Combustible Radiant Energy Shields | 12 months | 6 months | Yes | 10CFR50.48(C)(3) |
| | | | | | | | | Electrical Work and Lighting | 10 months | 3 months | Yes | 10CFR50.48(C)(3) |
| 5.2.9 | Containment - Unit 3 | 60 | Dedicated Portable Emergency Lighting | 6 months | 2 months | No | None Required | Non-Combustible Radiant Energy Shields | 12 months | 6 months | Yes | 10CFR50.48(C)(3) |
| | | | | | | | | Electrical Work and Lighting | 10 months | 3 months | Yes | 10CFR50.48(C)(3) |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS | | | | | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2.10 | Major Outside Areas Surrounding The Control Building and Switchgear Room | 77, 79, 82, 84, 87, 88, 89, 91, 92, 105 and 117 | Cable Tray Flame Impingement/Thermal Shields | 12 months | 6 months | No | 10CFR50.48(C)(2) | Conduit Thermal Insulating Material (Spray) | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |
| | | | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | Cable Thermal Insulating Wrap | 12 months | 12 months | No | 10CFR50.48(C)(2) |
| | | | Cable Tray Fire Resistant Partial Enclosure | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| | | | Raceway Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C)(1) | Plant Operating Procedures | 1 month | 1 month | No | 10CFR50.48(C)(1) |

# FIRE PROTECTION BACKFIT SCHEDULES

| | | | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS | | | | | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2.11 | Cable Spreading Room; and Control Bldg. Stairwell | 98 & 132 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System (Halon) | 16 months | 5 months | No | 10CFR50.48(C)(2) |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | Barriers Penetration Seals and Fire Doors/ Fire Proofing | 16 months | 5 months | No | 10CFR50.48(C)(2) |
| | | | Raceway Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | Cable Rerouting | 12 months | 14 months | Yes | 10CFR50.48(C)(4) |
| | | | Cable Tray Flame Impingement/Thermal Shields | 12 months | 6 months | No | 10CFR50.48(C)(2) | Design Submittal For NRC Approval | 6 months | N/A | No | 10CFR50.48(c)(5) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) |
| | | | Cable Tray Fire Resistant Partial Enclosure | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | Alternate Shutdown Control Room and Instrumentation And Control Modifications | 12 months | 14 months | Yes | 10CFR50.48(C)(4) |
| | | | Equipment Power Panel Fire Resistant Partial Enclosures | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | | | | | |
| | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) | | | | | |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS | | | | | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2.12 | Control Room | 106 | Barriers, Penetration Seals, and Fire Doors | 16 months | 5 months | No | 10CFR50.48(C)(2) | Cable Rerouting | 12 months | 14 months | Yes | 10CFR50.48(C)(4) |
| | | | Fire Dampers | 9 months | 4 months | Yes | 10CFR50.48(C)(3) | Design Submittal For NRC Approval | 6 months | N/A | No | 10CFR50.48(C)(5) |
| | | | | | | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | | | | | | Alternate Shutdown Control Room And Instrumentation And Control Modifications | 12 months | 14 months | Yes | 10CFR50.48(C)(4) |
| 5.2.13 | Feedwater Platform - Unit 4 | 113 | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |
| | | | | | | | | Conduit Thermal Insulating Material (Spray) | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | | | | | | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| 5.2.14 | Main Steam Platform - Unit 4 | 114 | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | Conduit Thermal Insulation Material | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | Valve Operator Flame Impingement/Thermal Shields | 9 months | 3 months | No | 10CFR50.48(C)(2) | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| | | | | | | | | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |

# FIRE PROTECTION BACKFIT SCHEDULES

| | | | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS | | | | | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2.15 | Main Steam Platform - Unit 3 | 115 | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | Valve Operator Flame Impingement/Thermal Shields | 9 months | 3 months | No | 10CFR50.48(C)(2) | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| | | | | | | | | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |
| 5.2.16 | Feedwater Platform - Unit 3 | 116 | Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Conduit Thermal Insulating Material | 8 months | 4 months | No | 10CFR50.48(C)(2) | One Hour Rated Valve Operator Fire Barrier Enclosures | 9 months | 3 months | No | 10CFR50.48(C)(2) |
| | | | | | | | | Conduit Thermal Insulating Material (Spray) | 8 months | 4 months | No | 10CFR50.48(C)(2) |
| | | | | | | | | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |

# FIRE PROTECTION BACKFIT SCHEDULES

| REPORT SECTION | GENERAL AREA(s) DESCRIPTION | FIRE AREA NUMBER(s) | BACKFIT MODIFICATIONS IN SUPPORT OF EXEMPTION REQUESTS | | | | | BACKFITS REQUIRED IN THE EVENT THAT EXEMPTIONS ARE DENIED | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED | BACKFIT DESCRIPTION | PRE-INSTALLATION PHASE | INSTALLATION PHASE | UNIT OUTAGE | SCHEDULE EXTENSION/ EXEMPTION REQUIRED |
| 5.2.17 | Fire Pumps | 122 | | | | | | Automatic Fire Suppression System | 13 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | | | | | | Fire Detection | 3 months | 6 months | No | 10CFR50.48(C)(2) |
| 5.2.18 | Diesel Generator Cooling Area | 131 | Equipment Fire Barriers/Walls - A & B Diesel Generators Radiators | 16 months | 5 months | Yes | 10CFR50.48(C)(3) | Total Enclosure of One Diesel Generator Radiator With 3 hour Rated Barriers | 16 months | 5 months | Yes | 10CFR50.48(C)(3) |
| | | | Curbing Adjacent Diesel Generator Radiators | 8 months | 6 months | No | 10CFR50.48(C)(2) | | | | | |

# GUIDELINE FOR CONTROL OF TRANSIENT COMBUSTIBLES

TURKEY POINT PLANT

UNITS 3 AND 4

By

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## ABSTRACT

Transient combustibles present a significant fire exposure to cables needed for safe shutdown. Transient combustibles are used by all plant departments and by contractor personnel.

Two visits were made to the Florida Power & Light Co., Turkey Point Plant, Units 3 and 4. One visit involved a tour of the plant to determine what transient combustibles were present and whether this was typical of quantities normally present at other time periods. A second visit was made to determine type and amount of combustibles brought into areas necessary for safe shutdown as the result of maintenance and construction operations.

To minimize damage to safety related cable by a fire involving transient combustibles, a limit should be placed on the amount of combustible material brought into safe shutdown related areas. A staff dedicated to plant fire protection should be established and assigned the responsibility of inspecting these areas and testing and inspecting fire protection equipment in these areas.

## PURPOSE

The purpose of this guideline is to reduce the possibility of fire damage to cables needed for safe shutdown by limiting and controlling transient combustibles.

## SUMMARY AND CONCLUSIONS

The possibility of damage to circuits necessary for safe shutdown from a fire involving transient combustibles can be reduced by following the recommendations in Paragraphs 3.1 and 3.2. These recommendations are intended to

1) Establish an effective plant fire protection staff with clear responsibility for all plant fire protection programs.

2) Limit the quantity of combustibles which may be brought into safe shutdown related areas.

3) Provide a reasonable degree of assurance that an accumulation of combustibles sufficient to damage safe shutdown related cable will be prevented.

4) Establish an inspection program to detect accumulations of combustible materials.

# I
# INTRODUCTION

Two plant visits were made to gather information for this guideline. The first visit, during the week of March 21, 1982, concentrated on plant operations. The second visit, during the week of May 23, 1982, concentrated on maintenance and construction acitivities at the plant.

The purpose of the first visit was to determine what transient combustibles were normally present, whether this was typical of the quantities normally encountered and whether there were some periods that resulted in generation of larger quantities. Information was obtained by inspection of plant areas and discussions with plant personnel.

The purpose of the second visit was to determine the type and amount of combustibles brought into areas necessary for the safe shutdown of the reactor as the result of maintenance and construction operations. We also attempted to determine what ignition sources were present during these maintenance and construction activities.

Both specific and general recommendations are contained within this report. Specific recommendations are to be implemented by the named department. General recommendations apply to all personnel to minimize chance of ignition of transient combustibles and to keep the amount of transient combustibles below a predetermined level.

# II

# GENERAL

## 2.1 TRANSIENT COMBUSTIBLE CHARACTERISTICS

A transient combustible is any combustible material brought into an area which temporarily increases the fire loading in the area. A fire involving transient combustibles can impair the safe shutdown capability if enough heat is evolved to damage cable.

Transient combustibles are used by the Operations Department, Maintenance Department, and Florida Power & Light (FP&L) Construction. Typical transient combustibles for the Operations Department are paper and plastics in cardboard boxes. Typical transient combustibles for the Maintenance Department are oil, solvents and paint. Typical transient combustibles for FP&L Construction are solvents, paint, and cable insulation.

Transient combustible loadings are summarized for the Maintenance Department and FP&L Construction in Table 1. Values were obtained from discussions with personnel with several years experience in Electrical, Mechanical Maintenance, Instrument and Controls (I&C), and FP&L Construction.

Table 1 excludes I&C with the exception of containment (Areas 59 and 60). Quantities of combustibles are reportedly relatively small in other areas (see pg. 8) and are concluded to be negligable.

Minimum and maximum expected quantities are given for oil. Minimum values are determined based on the assumption that used oil is drained from a pump or motor and removed from the area, and the exact amount of new oil required returned to the area.

Maximum expected values are determined based on the quantity of used oil drained from the pump or motor plus the largest container of new oil reasonably expected to be used. The maximum expected values in radiation controlled areas assume that a 5 gal container is used for motors or pumps with reservoirs under 5 gal in size. It is assumed that a 55 gal drum is used to refill reservoirs greater than 5 gal.

The maximum expected values for other plant areas assume that one 55 gal drum of used oil has been left in the area from previous oil changes if the oil reservoir on the motor or pump is greater than 5 gal but less than 55 gal.

## 2.2 OPERATIONS DEPARTMENT

Some areas of the Auxiliary Building contained materials which could present a fire exposure to cable trays. The most severe exposure noted in this area was two boxes of plastic sample bottles destined for the Chemistry Laboratory. These were placed in the main corridor at the 18 ft level (Area 58) until they could be moved into the lab. The quantity was larger than the daily or weekly usage of the lab.

High capability for handling contaminated waste minimizes exposure to safe shutdown related cable from this source. The laundry for cleaning protective clothing also has a high throughput. During highest demand periods there have reportedly been two to three containers of protective clothing in the corridor (Area 58) for limited periods.

Containers for protective clothing and contaminated waste adjacent to step-off pads in the Auxiliary Building have spring-loaded automatic closing covers. The covers are not Factory Mutual approved and are of a type that could jam open if the container is against a wall.

## 2.3 MAINTENANCE DEPARTMENT

Maintenance Department personnel are instructed to perform specific tasks by a plant work order (PWO). The job may be scheduled maintenance or a request for repair from Operations Personnel. Whatever the nature, the work order must be processed by generating equipment maintenance (GEMs) planners before it is assigned to a maintenance crew. GEMs planners have access to information such as quantity and type of lubricant used and could be expected to include this information on the work order. This could be used to provide the fire protection staff with information on expected transient combustible loadings so that action may be taken to provide protection if necessary.

Any oil change operation other than in radiation controlled areas of the plant may result in oil remaining in the general area for longer than necessary. If the reservoir on the pump or motor is larger than 5 gal and smaller than 55 gal, oil may be put into a 55 gal drum and left there rather than bringing the drum to the oil storage or disposal area.

Most maintenance departments do their own touch-up painting. Large scale painting is done by a private contractor.

Touch up painting generally involves a one gallon can of paint and a one quart container of solvent. Application is generally by brush.

Large scale painting operations are carried out by a private contractor under the direction of the maintenance department. Quantities of paint involved for the various plant areas are as follows.

1) Auxiliary Building - One gal of paint and two quarts of solvent. The quantity is limited due to the limited area that can be painted and still allow personnel access.

2) Containment - Five gal of paint and 5 gal of solvent in a safety can. The quantity is limited due to the short life of the two component epoxy coating when mixed.

3) Other Plant Areas - Larger quantities of paint are used since the paint is of a different type and surfaces do not always have to be accessible. The maximum expected quantity of 25 gal of paint and 5 gal of solvent is used in the Turbine Building.

2.3.1 Electrical

Work performed by this group involves maintenance of electric motors and troubleshooting electric circuits.

Combustibles involved are oil, paint (including varnish), solvent, grease, cable and rags.

Ignition sources involved in their activities are small oxy-acetylene torches used to free couplings so that motors may be removed for overhaul.

Painting done by the Electrical Department is chiefly touch-up operations. Estimates of quantities range to approximately 1/2 gal contained in a one gal can if applied by brush or 1 quart if applied by spray gun. It is also assumed that 1 qt of solvent is used for cleaning surfaces in preparation for painting. Further description of activities involving this group is as follows.

1) Auxiliary Building - Maintenance of oil lubricated motors presents the greatest potential for introduction of transient combustibles. The small size of most motor lubrication systems should limit exposure. Oil lubrication systems are generally 1 gal or less. Oil is drained into containers. For small quantities an open container may be used. For larger quantities a 5 gal

can or 55 gal drum may be used. Used oil is removed through one of the Health Physics checkpoints, usually at the west end of the Auxiliary Building at the 18.0 ft level. The oil is then taken to a tank east of Units 1 and 2 or to the oil storage area. New oil may be brought to the area in 5 gal cans either before or after used oil has been drained. Personnel ususally work on one motor at a time. However, work may be done in conjunction with Mechanical Maintenance Department maintenance on the pump driven by the motor.

2) Containment - During an outage, oil is changed in all three reactor coolant pump motors by pumping used oil to 55 gal drums outside containment and refilling from new oil drums also located outside containment.

During an outage there may be a maximum of 900 gal of oil near the equipment hatch of the Containment Buildings (Areas 90 and 125). This is the equivalent of three reactor coolant pump motors of used oil and a supply of new oil for one motor. The oil may be there from one to three days, until Health Physics personnel clear it for disposal. In unusual situations oil may be changed in one reactor coolant pump in containment. When this occurs used oil is drained into drums below the motor and new oil is brought into containment in 55 gal drums.

3) Radwaste Building - Some speciality work must be performed due to the length of time it takes to obtain replacement motors. Motors may be rewound and a varnish coating applied to the windings. The operation is carried out infrequently (several years since last motor rewound). A 200 gal dip tank has been purchased for this purpose and is located in the Radwaste Building. The tank does not have a fusible link- operated lid and may not be equipped with other safeguards one would normally expect in an operation of this type. This is an area where fire protection review prior to tank purchase would have been beneficial.

4) Other Plant Areas - The largest quantities involve the steam generator feed pumps. Oil is changed one pump at a time. Oil is brought to the area in a 55 gal drum. Used oil is drained into an empty 55 gal drum and removed to a tank east of Units 1 and 2.

2.3.2 <u>Mechanical Maintenance</u>

Work performed by this group involves maintenance of pumps, fans,

hydraulic couplings, gear operators for valves and painting operations.

Combustibles involved in this work include oil, mineral spirits, isopropyl alcohol, grease, paint, rags, protective clothing and plastic bags for contaminated tools. Potential ignition sources include oxy-acetylene torches.

Further description of activities involving transient combustibles for the Auxiliary Building and Containment are as follows.

1) Auxiliary Building - Maintenance of pumps, hydraulic couplings, gear boxes, valve operators, etc. result in oil and solvents brought into the area. Oil is obtained from the oil storage area (Area 77). New oil may be transported in 5 gal cans. Mineral spirits in excess of a few gallons is transported in safety cans. Pumps may be flushed with oil. Gear boxes and valve operators may be flushed with mineral spirits before being refilled with oil. Excess oil and solvent is returned to the oil storage area. Used oil and solvent may be taken to the oil storage area, to a disposal tank east of Units 1 and 2 or to a 55 gal drum near the intake structure then to the disposal tank. Most equipment uses from 1 qt to 1 gal of oil. Maintenance of the charging pumps in Areas 45 and 55 represent the highest potential transient combustible loading. Approximately 50 gal of oil is used in the pump and gear box. Two barrels of oil may be brought into the main corridor (Area 58) to refill pump and gear box.

2) Containment - The largest oil transfer operation involves refilling gear cases on the polar crane. There is approxiamately 40 gal of oil in two gear cases. Oil is transported in 5 gal containers. Other operations in containment involve oil changes of 1 gal or less.

3) Other Plant Areas - Largest oil demand is represented by the auxiliary feed water pumps and air compressors. Each pump requires 20 gal. Each compressor requires 30 gal. Used oil is pumped into empty 55 gal drums. New oil is pumped from 55 gal drums obtained from Area 77.

2.3.3 Instrumentation and Control

This group repairs, calibrates, and replaces instrumentation as necessary.

Combustibles involved are isopropyl alcohol (in plastic bottles), oil, plastic tubing, cardboard and plastic packing materials.

Their work does not normally involve ignition sources other than that inherent in equipment in the area.

Instruments to be replaced are brought from Stores to the I&C Lab, checked out, and installed. Packing material is normally removed at either Stores or the I&C Lab. Instruments susceptible to mechanical shock damage may be kept in protective wrapping until installation. The amount of combustibles involved in any one operation would be 1 pt of alcohol, 1 pt of penetrating oil, 25 ft of plastic tubing and approximately 1 lb of cardboard or plastic packing material. A special effort is made to eliminate packing material used in radiation controlled areas such as the Auxiliary Building and Containment.

1) Containment - Oil is changed in approximately 15 gear boxes for flux mapping devices. Each gear box holds 1 gal. The operation takes one week with oil changes performed in a maximum of two gear boxes at one time.

2) Other Plant Areas - No appreciable difference in quantity of type of combustibles.

## 2.4 FLORIDA POWER AND LIGHT CONSTRUCTION

Most contractor personnel on site are managed by FP&L Construction. As such they are obligated to follow FP&L procedures including the transient combustible control program. A description of the work to be performed is contained in a plant change modification (PCM) which in most cases is available for review before the job is started. Review would permit the plant fire protection staff to determine areas involved and obtain an idea of quantities and types of combustibles in these areas.

Work performed by this group has involved painting operations on new construction, installing motor operated valves, cable, earthquake restraints, and piping.

Combustibles involved include paint, solvents, cardboard boxes, cable, cable reels, protective clothing, rags and plastic bags for containment of tools and waste.

Wood used for scaffolding and other purposes is pressure impregnated fire retardant wood.

Potential ignition sources include cutting, welding and grinding.

Further description of activities involving transient combustibles in plant areas are as follows.

1) Auxiliary Building - Cable may be run in trays in preparation for modifications that will be completed during an outage. When more than five cables are run in a tray, FP&L has instructed their contractor to coat the cable with Flammastic.

Painting is done for installed equipment. A primer coat is applied to equipment outside the Auxiliary Building. A 1 gal can of paint and a 1 qt can of solvent may then be brought into the area for touch-up painting after the equipment is installed. This may occur in any area of the Auxiliary Building.

2) Containment - Combustibles introduced by FP&L Construction have been greatly reduced by the conversion to fire retardant inpregnated lumber for scaffolding. A stockpile of fire retardant inpregnated lumber is available.

3) Other Plant Areas - This group will tend to have a greater impact on fire protection systems. Major construction projects frequently result in unavoidable impairments to fixed fire protection systems and detection systems. For this reason it is important that this group maintain a close working relationship with the fire protection supervisor. This appears to be the case and no change is suggested.

## 2.5 PLANT FIRE PROTECTION STAFF

The plant fire protection staff presently involves three personnel. The fire protection supervisor is dedicated to fire protection on a full time basis. He reports directly to the maintenance supervisor but has the option of communicating directly with the nuclear plant manager. A second individual assists him on a part-time basis with the responsibility of inspecting fire extinguishers, hose houses, and Plant Fire Brigade equipment. A third individual, also on a part time basis, is responsible for training the Plant Fire Brigade. He is assigned to the Training Section of the Operations Department.

A plant fire protection staff which involves three people working under three different immediate supervisors for two different departments may find it difficult to develop a coordinated fire protection program. The plant manager, rather than the fire protection supervisor, is directly responsible for plant fire protection. Demands on the plant manager's time and lack of detailed fire protection experience increase the possibility that problems

that overlap will not receive the attention they deserve.

During the first visit, a valve controlling the water spray system on a main transformer was found shut without notification of the fire protection supervisor. During the second visit, a valve controlling sprinklers protecting the ground floor level of the Turbine Building had been tagged out for repair, also without the knowledge of the fire protection supervisor.

The first incident was attributed to the method of reporting the shut valve. The reporting method involved notification of the nuclear watch engineer, who would notify the plant manager, who, in turn, would notify the fire protection supervisor. The method of reporting had been changed by the second visit to call for direct notification of the fire protection supervisor by the nuclear watch engineer. However, there is no backup and if the supervisor is not in the office when called by the nuclear watch engineer, he is not notified.

Fixed fire protection and detection systems are inspected, tested, and maintained by personnel from Mechanical Maintenance, Electrical and I&C Departments. The fire protection supervisor is consulted on a courtesy basis. Unless consulted, he has no role in suggesting improvements in inspection, test or maintenance programs. If a defect is found in the course of testing the fire protection system, it is either corrected immediately or a PWO is filled out.

## 2.6 QUALITY ASSURANCE DEPARTMENT

This department is ultimately responsible for determining whether a program has been properly implemented. One individual in this department has had fire protection training. There are no guidelines to enable him to determine what quantity of combustibles presents an exposure hazard to safe shutdown related cable.

# III
# RECOMMENDATIONS

The following recommendations are intended to be implemented at all times, including periods when the plant is not in operation. No smoking regulations, for example, are difficult to enforce if exceptions are made.

## 3.1 ADMINISTRATIVE

### 3.1.1 Plant Fire Protection Staff

1) A staff dedicated to plant fire protection should be established. The plant fire protection staff should be responsible for all phases of fire protection including the following.

a) Training (see Recommendation 4);

b) Inspection and testing of fire protection equipment;

c) Inspection of plant areas for transient combustible loading (see Recommendation 5);

d) Review of work orders for all safety related areas.

e) Review of work orders in any area where quantities of combustibles exceed 5 gal of flammable or combustible liquids.

f) Approval of cutting and welding procedures;

g) Approval of acceptable alternate forms of protection in the event there must be a deviation from any of the General Recommendations.

2) The plant fire protection supervisor should have the authority to communicate with other department supervisors on an equal level and directly with the plant manager if necessary.

3) The individual in charge of plant fire protection or the assistant shall be notified immediately of any impairment to the fire protection system.

4) Training programs should be established to include all personnel working on site (including contractor personnel) within ten days of arrival. These programs should be repeated for personnel working in safety related areas at a frequency of once per year thereafter. Training should include the following:

a) Transient combustible loading;

b) Identification of areas containing safe shutdown related circuits;

c) Use of portable extinguishing equipment;

d) Method of reporting a fire.

5) The fire inspection is intended to detect and correct any condition or activity that could result in fire damage to safe shutdown related circuits.

a) One fire inspection should be conducted each shift in safe shutdown related areas. Areas that require protective clothing should be inspected once a day if maintenance activities are being performed in these areas. One fire inspection should be conducted each week in other plant areas.

b) Fire inspections should be documented by a report submitted to the person in charge of plant fire protection for that shift. A sample report form is attached (see Figure 1). An indication of the status of each item should be made. Inspections should include

1) Combustible loading - what combustibles were found in the area, which department is responsible for them.

2) Work activity in the above area - if spark producing operations such as welding, cutting, or grinding are in progress, is a fire watch in place and properly equipped.

3) Fire protection equipment - are fire doors, fire stops, portable extinguishers, hose stations, fixed systems, listed trash containers, etc. in these areas in service.

c) The fire inspector should have the authority to stop work procedures or activities considered hazardous.

d) If a hazardous operation is detected that cannot be corrected, it should be immediately reported to the person in charge of fire protection for that shift. He in turn should have the authority to contact the appropriate maintenance personnel, operations personnel, or the plant manager, if necessary, to correct the situation.

6) The plant fire protection staff should be notified when work is completed in a safe shutdown related area so the area can be inspected immediately. If work involved cable trays, the trays should be inspected for combustibles.

3.1.2 <u>Maintenance Department</u>

1) GEMs planners for all sections in the Maintenance Department should review each scheduled maintenance program to determine the following:

a) Will the operation occur in a room or area identified as containing safety related circuitry;

b) The amount of combustibles introduced into an area.

2) All work orders occuring in rooms or areas identified as containing safety related circuitry or in other areas involving 5 gal or more of flammable or combustible liquids or five combustible boxes should then be forwarded to the plant fire protection staff for review.

3.1.3 Quality Assurance

1) One member of the Quality Assurance Department should be qualified to make a fire inspection.

3.2 GENERAL RECOMMENDATIONS

1) All rooms or areas containing safe shutdown related circuitry should be marked so they can be readily identified by plant personnel. Where safe shutdown related cable passes through an area, the floor directly below the tray(s) or conduit(s) should be marked.

2) There should be no storage of combustible material in areas indicated above.

3) Areas should be provided in all major buildings for storage of combustibles needed in the day-to-day operation of the plant. These areas should be provided with automatic sprinkler protection and cut off from other plant areas by fire resistive barriers.

4) Factory Mutual approved containers should be used for disposal of combustible material.

5) "No Smoking" should be enforced at all times in all rooms containing safe shutdown related circuits except the area in front of the control panels in the control room.

6) All wood used on site should be approved impregnated fire-retardant treated lumber or plywood. For limited use the individual in charge of fire protection may permit the use of lumber coated with an approved fire-retardant coating.

7) All flammable and combustible liquids should be dispensed from an attended central storage area. This area shall be locked when not attended.

8) Safety cans should be used for all flammable liquids. Safety cans should be used for combustible liquids where quantities handled permit. Oil should be pumped from a safe area where quantities handled do not permit the use of safety cans such as when refilling reactor coolant pump motors.

9) The size of the safety can should be limited to 1 qt for the following areas.

a) Control Room

b) Cable Penetration rooms

c) Cable Spreading Room

d) Battery Rooms

e) Switchgear Rooms.

10) The size of the safety can may be 5 gal in all other areas.

11) All flammable liquid containers should be numbered. They should be accounted for once each 24 hour period.

12) All containers should either be returned to the flammable liquid storeroom or placed in listed flammable liquid storage cabinets when not in use.

13) Used oil should be removed from the area to the central storage area in covered containers before new oil is brought into the area.

14) Factory Mutual approved flammable liquid storage cabinets should be provided where it is not practical to return to Stores. Cabinets should not be located in areas containing safe shutdown related circuitry.

15) All drums should be labeled with actual contents. Drums containing flammable or combustible liquids should be marked with a hazard identification system which would include recommended extinguishing agents and flash point of liquid.

16) Welding, cutting or grinding should not be allowed other than in specially designated areas unless a permit has been obtained and a continuous fire watch provided.

**FIRE PREVENTION INSPECTION** (SAMPLE FORM) Figure 1

**INSTRUCTIONS:** Fill out form while making inspection. Send completed form to your supervisor for necessary action.

| INSPECTOR'S NAME | INSPECTOR'S SIGNATURE | DATE |
|---|---|---|
| PLANT<br>F P & L TURKEY POINT UNITS 3 & 4 | LOCATION<br>FIRE AREA ________ | TIME<br>AM<br>PM |

**GENERAL**

| | | | |
|---|---|---|---|
| COMBUSTIBLES IN AREA | ☐ YES ☐ NO | IF YES, AMOUNT & TYPE | |
| IS WORK BEING DONE IN AREA | ☐ YES ☐ NO | IF YES - PWO NO. - ________ CWO NO. - ________ | |
| CUTTING & WELDING | ☐ YES ☐ NO | PERMIT ISSUED ☐ YES ☐ NO | FIRE WATCH PROVIDED ☐ YES ☐ NO |
| | PRECAUTIONS TAKEN | | |
| SMOKING REGULATIONS | VIOLATIONS NOTED | | |

**FIXED SYSTEMS - HALON**

| | | |
|---|---|---|
| OPERATIONAL STATUS AT CONTROL PANEL | ☐ ON ☐ OFF | IF OFF, DESCRIBE PRECAUTION |
| IS PRESSURE IN OPERATING RANGE | ☐ YES ☐ NO | |

**FIXED SYSTEMS - WATER**

| | | | |
|---|---|---|---|
| VALVE NO. | | AREA CONTROLLED | ☐ OPEN ☐ SHUT ☐ LOCKED ☐ SEALED |
| VALVE NO. | | AREA CONTROLLED | ☐ OPEN ☐ SHUT ☐ LOCKED ☐ SEALED |

**HOSE STATIONS**

| | | | |
|---|---|---|---|
| INSIDE HOSE STATION NO. | | PROPERLY EQUIPPED | ACCESSIBLE ☐ YES ☐ NO |
| INSIDE HOSE STATION NO. | | PROPERLY EQUIPPED | ACCESSIBLE ☐ YES ☐ NO |

**PORTABLE EXTINGUISHERS**

| | | | |
|---|---|---|---|
| PORTABLE EXTINGUISHER NO. | | CHARGED ☐ YES ☐ NO | ACCESSIBLE ☐ YES ☐ NO |
| PORTABLE EXTINGUISHER NO. | | CHARGED ☐ YES ☐ NO | ACCESSIBLE ☐ YES ☐ NO |
| PORTABLE EXTINGUISHER NO. | | CHARGED ☐ YES ☐ NO | ACCESSIBLE ☐ YES ☐ NO |
| PORTABLE EXTINGUISHER NO. | | CHARGED ☐ YES ☐ NO | ACCESSIBLE ☐ YES ☐ NO |
| PORTABLE EXTINGUISHER NO. | | CHARGED ☐ YES ☐ NO | ACCESSIBLE ☐ YES ☐ NO |

**FIRE BARRIERS**

| | | | |
|---|---|---|---|
| FIRE DOOR NO. | | CONDITION | OBSTRUCTED ☐ YES ☐ NO |
| FIRE DOOR NO. | | CONDITION | OBSTRUCTED ☐ YES ☐ NO |

**RECOMMENDATIONS**

TABLE 1

MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| | | | Total | | Electrical Dept | | | | Mechanical Dept | | | | Misc | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Area(1) | Name | Combustible | Min | Max Expect | Min | Max Expect | From Area | Thru Area(2) | Min | Max Expect | From Area | Thru Area(2) | Min | Max Expect | From Area | Thru Area(2) |
| 1,2,3 | Holdup Tank<br>A,B,C | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 4 | Aux Bldg Corridor<br>10' & Below | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 5 | Chemical Drain<br>Tank<br>Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | 1.5 gal | 6 gal | | | | | 1.5 gal | 6 gal | 77 | 79,58 | | | | |
| 6,7 | Gas Comp Rm.<br>Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 8 | Waste Holdup Tank<br>Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 9 | Laundry Tank<br>Chem Drain Tank<br>Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | 1.5 qts | 5.5 gal | | | | | 1.5 qts | 5.5 gal | 77 | 79,58,5 | | | | |
| 10 | Pipe Way<br>Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | 5 gal | 10 gal | 5 gal | 10 gal | 77 | 79,58 | | | | | | | | |
| 11 | Residual Heat Exch<br>Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 12,13 | RHR Sump & Pump<br>Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | 5 gal | 10 gal | 5 gal | 10 gal | 77 | 79,58,10 | | | | | | | | |

TABLE 1

MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| | | | Total | | Electrical Dept | | | | Mechanical Dept | | | | Misc | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Area | Name | Combustible | Min | Max Expect | Min | Max Expect | From Area | Thru Area | Min | Max Expect | From Area | Thru Area | Min | Max Expect | From Area | Thru Area |
| 14 | Residual Heat Exchangers Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 15,16 | See 12, 13 | | | | | | | | | | | | | | | |
| 17 | Spent Resin Storage Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 18 | Area Under Evaporators Aux Bldg 10' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 19 | Elec Penetration Enclosure Cable Pit | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 20 | Elec Penetration Room | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 21 | Instrument Shop Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | 1 gal | 5 gal | | | | | | | | | | 1 gal | 5 gal | Storage 88,84,58 |
| 22 | Radioactive Lab Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | 1 gal | 5 gal | | | | | | | | | | 1 gal | 5 gal | Storage 88,84,58 |
| 23,24 | Gas Decay Tank Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |

TABLE 1

MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| Fire Area | Name | Combustible | Total Min | Total Max Expect | Electrical Dept Min | Electrical Dept Max Expect | Electrical Dept From Area | Electrical Dept Thru Area | Mechanical Dept Min | Mechanical Dept Max Expect | Mechanical Dept From Area | Mechanical Dept Thru Area | Misc Min | Misc Max Expect | Misc From Area | Misc Thru Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | Machine Shop Aux Bldg 18' EL | Solvent Paint Oil | 2 gal | 10 gal | | | | | 2 gal | 10 gal | 77 | 77,79 58 | | | | |
| 26 | See 20 | | | | | | | | | | | | | | | |
| 27 | See 19 | | | | | | | | | | | | | | | |
| 28 | Fan Room Aux Bldg 18' EL | Solvent Paint Oil | 1 qt | 20 gal | | | | | 1 qt | 20 gal | 77 | 79,58 | | | | |
| 29 | Spent Fuel Pit | Solvent Paint Oil | 5 gal | 10 gal | | | | | 5 gal | 10 gal | 77 | 125,123 111 | | | | |
| 30 | Pipe & Valve Rm Aux Bldg 18' EL | Solvent Paint Oil | | | | | | | | | | | | | | |
| 31 | Containment Spray Pumps Aux Bldg 18' EL | Solvent Paint Oil | 3 gal | 8 gal | | | | | 3 gal | 8 gal | 77 | 58 | | | | |
| 32 | Sample Room | Solvent Paint Oil | | | | | | | | | | | | | | |
| 33 | Waste Evap Package Aux Bldg 18' EL | Solvent | | 0.5 gal | | | | | | | | | | 0.5 gal | Paint Sto | 88,84 58 |
| | | Paint | | 1 gal | | | | | | | | | | 1 gal | Paint Sto | 88,84 58 |
| | | Oil | | | | | | | | | | | | | | |
| 34 | Boric Acid Evaporator Aux Bldg 18' EL | Solvent Paint Oil | 1 gal | 6 gal | | | | | 1 gal | 6 gal | 77 | 79,58 | | | | |

TABLE 1
MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| Fire Area | Name | Combustible | Total Min | Total Max Expect | Electrical Dept Min | Electrical Dept Max Expect | Electrical Dept From Area | Electrical Dept Thru Area | Mech Maint Dept Min | Mech Maint Dept Max Expect | Mech Maint Dept From Area | Mech Maint Dept Thru Area | Misc Min | Misc Max Expect | Misc From Area | Misc Thru Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | Valve Room | Solvent | | | | | | | | | | | | | | |
| | Aux Bldg 18' EL | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 36 | See 34 | | | | | | | | | | | | | | | |
| 37 | See 32 | | | | | | | | | | | | | | | |
| 38 | See 31 | | | | | | | | | | | | | | | |
| 39 | Concentrate | Solvent | | | | | | | | | | | | | | |
| | Holding Tank | Paint | | | | | | | | | | | | | | |
| | Aux Bld 18' EL | Oil | | | | | | | | | | | | | | |
| 40 | Pipe & Valve Rm | Solvent | | | | | | | | | | | | | | |
| | Aux Bld 18' EL | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 41 | Boric Acid Tanks | Solvent | | | | | | | | | | | | | | |
| | Aux Bldg 18' EL | Paint | | | | | | | | | | | | | | |
| | | Oil | 1 qt | 6.2 gal | | | | | 1 qt | 6.2 gal | 77 | 79,58 | | | | |
| 42 | Spent Fuel Pit | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 43 | SFP-Pump, Heat | Solvent | | | | | | | | | | | | | | |
| | Exch. Filter, | Paint | | | | | | | | | | | | | | |
| | Demin | Oil | 5 gal | 10 gal | | | | | 5 gal | 10 gal | 77 | Outside | | | | |
| | Aux Bldg 18' EL | | | | | | | | | | | | | | | |
| 44 | New Fuel Storage | Solvent | | 0.5 gal | | | | | | | | | | 0.5 gal | Paint Sto | 88,84,58 |
| | Aux Bldg | Paint | | 1 gal | | | | | | | | | | 1 gal | Paint Sto | 88,84,58 |
| | | Oil | | | | | | | | | | | | | | |
| 45 | Charging Pump Rm | Solvent | | 0.5 gal | | | | | | | | | | 0.5 gal | Paint Sto | 88,84,58 |
| | Aux Bldg 18' EL | Paint | | 1 gal | | | | | | | | | | 1 gal | Paint Sto | 88,84,58 |
| | | Oil | 40 gal | 150 gal | | | | | 40 gal | 150 gal | 77 | 58 | | | | |

MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| Fire Area | Name | Combustible | Total Min | Total Max Expect | Electrical Dept Min | Electrical Dept Max Expect | Electrical Dept From Area | Electrical Dept Thru Area | Mech Maint Dept Min | Mech Maint Dept Max Expect | Mech Maint Dept From Area | Mech Maint Dept Thru Area | Misc Min | Misc Max Expect | Misc From Area | Misc Thru Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46 | Laundry<br>Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 47 | Component Cooling<br>Pump & Heat Exch<br>Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | 1 gal | 6 gal | | | | | 1 gal | 6 gal | 77 | 79,58 | | | | |
| 48 | Purification<br>Demin<br>Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 49 | Radwaste Demin<br>Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 50 | See 48 | | | | | | | | | | | | | | | |
| 51 | Monitor Tank Pump<br>Room & Filter Area<br>Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | 1 qt | 5.2 gal | | | | | 1 qt | 5.2 gal | 77 | 79,58 | | | | |
| 52 | Safety Injection<br>Pumps<br>Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | 2 qts | 5.5 gal | | | | | 2 qts | 5.5 gal | 77 | 79,58 | | | | |
| 53 | Polishing Demin<br>Aux Bldg 18' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 54 | See 47 | | | | | | | | | | | | | | | |
| 55 | See 45 | | | | | | | | | | | | | | | |
| 56 | See 44 | | | | | | | | | | | | | | | |
| 57 | See 43 | | | | | | | | | | | | | | | |

TABLE 1
MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| Fire Area | Name | Combustible | Total Min | Total Max Expect | Electrical Dept Min | Electrical Dept Max Expect | Electrical Dept From Area | Electrical Dept Thru Area | Mech Maint Dept Min | Mech Maint Dept Max Expect | Mech Maint Dept From Area | Mech Maint Dept Thru Area | Misc Min | Misc Max Expect | Misc From Area | Misc Thru Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 58 | Aux Bldg Corridor EL 18' | Solvent | | 0.5 gal | | | | | | | | | | 0.5 gal | Paint Sto | 88,84 |
| | | Paint | | 1 gal | | | | | | | | | | 1 gal | Paint Sto | 88,84 |
| | | Oil | 55 gal | 170 gal | 5 gal | 10 gal | 77 | 58 | 50 gal | 160 gal | 77 | 125,123 | | | | |
| 59,60 | Containment | Solvent | 1 qt | 5 gal | | | | | 1 qt | | | | | 5 gal | Paint Sto | |
| | | Paint | 5 gal | 7 gal | | | | | 5 gal | | | | | 7 gal | Paint Sto | |
| | | Oil | 8 gal | 400 gal | 5 gal | 350 gal | 77 | 79 or 88,89,84 | 1 gal | 50 gal | 77 | 79,58 | 2 gal | 7 gal | 77 | 79,58 |
| 61 | Reactor Control Rod Equip Rm Control Bldg 18'EL | Solvent | | 0.5 gal | | | | | | | | | | 0.5 gal | Paint Sto | 88,84 |
| | | Paint | | 1 gal | | | | | | | | | | 1 gal | Paint Sto | 88,84 |
| | | Oil | | | | | | | | | | | | | | |
| 62 | Health Physics, & Locker Rm Control Bldg 18'EL | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 63 | See 61 | | | | | | | | | | | | | | | |
| 64 | Vestibule Elevator Control Bldg 18' EL | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 66 | Steam Generator Feed Pumps Turbine Bldg 18' EL | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | 40 gal | 150 gal | | | | | 40 gal | 95 gal | 77 | 79 or 88,89 | | (3)55 gal | N/A | N/A |
| 67,68 | 4160V Switchgear Turbine Bldg 18' EL | Solvent | | 0.5 gal | | | | | | | | | | 0.5 gal | Paint Sto | 88,84 |
| | | Paint | | 1 gal | | | | | | | | | | 1 gal | Paint Sto | 88,84 |
| | | Oil | | | | | | | | | | | | | | |
| 69 | See 66 | | | | | | | | | | | | | | | |
| 70,71 | See 67 | | | | | | | | | | | | | | | |

TABLE 1
MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| Fire Area | Name | Combustible | Total Min | Total Max Expect | Electrical Dept Min | Electrical Dept Max Expect | Electrical Dept From Area | Electrical Dept Thru Area | Mech Maint Dept Min | Mech Maint Dept Max Expect | Mech Maint Dept From Area | Mech Maint Dept Thru Area | Misc Min | Misc Max Expect | Misc From Area | Misc Thru Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 72,73 | Emergency Diesel Generator | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | (5)Oil | | | | | | | | | | | | | | |
| 74,75 | Emergency Diesel Generator Day Tank Room | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 76 | Cooling Water H.E. Pump & Oil Reservoir | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | 1 gal | 810 gal | 1 gal | 6 gal | 77 | - | | | | | | (4)800 gal | N/A | N/A |
| 77 | Laydown Area Condensate TRF Pump & Motor | Solvent | | 225 gal | | | | | | | | | | (6)225 gal | N/A | N/A |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | 5,000 gal | | | | | | | | | | (6)5,000 gal | N/A | N/A |
| 78 | Air Compressor GRD Floor | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | 37 gal | 155 gal | 7 gal | 70 gal | 77 | 79 | 30 gal | 140 gal | 79,66 | | | (3)55 gal | N/A | N/A |
| 79 | GRD Floor Vestibule #3 Containment | Solvent | | 5 gal | | | | | | | | | | 5 gal | Paint Sto | 88,89,84 |
| | | Paint | | 25 gal | | | | | | | | | | 25 gal | Paint Sto | 88,89,84 |
| | | Oil | | 55 gal | | | | | | | | | | (3)55 gal | N/A | N/A |
| 80 | Main Condensers | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 81 | #4 Main TRF-Turbine Lube Oil-Start-up TRF | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | 1 gal | 6 gal | 1 gal | 6 gal | 77 | Outside | | | | | | | | |
| 82 | Aux TRF Area | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | 55 gal | | | | | | | | | | (3)55 gal | | |

TABLE 1
MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| Fire Area | Name | Combustible | Total Min | Total Max Expect | Electrical Dept Min | Electrical Dept Max Expect | Electrical Dept From Area | Electrical Dept Thru Area | Mech Maint Dept Min | Mech Maint Dept Max Expect | Mech Maint Dept From Area | Mech Maint Dept Thru Area | Misc Min | Misc Max Expect | Misc From Area | Misc Thru Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 83 | See 78 | | | | | | | | | | | | | | | |
| 84 | Aux Feedwater Pump Area | Solvent | | 5 gal | | | | | | | | | | 5 gal | Paint Sto | 88,89 |
| | | Paint | | 25 gal | | | | | | | | | | 25 gal | Paint Sto | 88,89 |
| | | Oil | 20 gal | 130 gal | | | | | 20 gal | 75 gal | 77 | 88,89 | | (3)55 gal | N/A | N/A |
| 85 | See 80 | | | | | | | | | | | | | | | |
| 86 | See 81 | | | | | | | | | | | | | | | |
| 87 | See 82 | | | | | | | | | | | | | | | |
| 88 | 4KV Switchgear, Lo Pressure Feed-water Heater | Solvent | | 5 gal | | | | | | | | | | 5 gal | Paint Sto | Outside |
| | | Paint | | 25 gal | | | | | | | | | | 25 gal | Paint Sto | Outside |
| | | Oil | | 55 gal | | | | | | | | | | (3)55 gal | N/A | N/A |
| 89 | Condensate Stge Area | Solvent | | 5 gal | | | | | | | | | | 5 gal | Paint Sto | 88 |
| | | Paint | | 25 gal | | | | | | | | | | 25 gal | Paint Sto | 88 |
| | | Oil | | 55 gal | | | | | | | | | | (3)55 gal | N/A | N/A |
| 90 | Emergency Diesel Gen. Oil Stge Tank | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 91,92 | Condensate Pumps | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | 22 gal | 77 gal | 22 gal | 77 gal | 77 | 88,79 | | | | | | | | |
| 93,94 95,96 | 480V Load Centers Turbine Bldg 30' EL | Solvent | | 0.5 gal | | | | | | | | | | 0.5 gal | Paint Sto | 88,84 |
| | | Paint | | 1 gal | | | | | | | | | | 1 gal | Paint Sto | 88,84 |
| | | Oil | | | | | | | | | | | | | | |
| 97 | HVAC Equip Room Control Bldg 30' EL | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |

TABLE 1
MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| | | | | Total | Electrical Dept | | | | Mech Maint Dept | | | | Misc | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Area | Name | Combustible | Min | Max Expect | Min | Max Expect | From Area | Thru Area | Min | Max Expect | From Area | Thru Area | Min | Max Expect | From Area | Thru Area |
| 98 | Cable Spread R<br>Control Bldg<br>30' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 99,100 | Load Freq Cont Panel<br>Control Bldg<br>30' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 101 | RPI Inverter &<br>MG Sets<br>Control Bldg<br>30' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 102,103 | Battery Rack<br>Control Bldg<br>30' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 104 | See 101 | | | | | | | | | | | | | | | |
| 105 | Mezzanine Deck<br>Turbine Bldg<br>30' EL | Solvent<br>Paint<br>Oil | | 5 gal<br>25 gal | | | | | | | | | | 5 gal<br>25 gal | Paint Sto<br>Paint Sto | 88,84<br>88,84 |
| 106 | Control Room<br>Control Bldg<br>30' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 107 | Purge Supply Fan Room<br>Control Bldg<br>30' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 108 | Inverter Room<br>Control Bldg<br>42' EL | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 109,110 | See 102,103 | | | | | | | | | | | | | | | |
| 111,112 | Volume Control Tank | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |

TABLE 1
MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| | | | Total | | Electrical Dept | | | | Mech Maint Dept | | | | Misc | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Area | Name | Combustible | Min | Max Expect | Min | Max Expect | From Area | Thru Area | Min | Max Expect | From Area | Thru Area | Min | Max Expect | From Area | Thru Area |
| 113 | Penetration Area | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 114,115 | Main Steam Header Area | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 116 | See 113 | | | | | | | | | | | | | | | |
| 117 | Turbine Area | Solvent | | 5 gal | | | | | | | | | | 5 gal | Paint Sto | 88,84 |
| | | Paint | | 25 gal | | | | | | | | | | 25 gal | Paint Sto | 88,84 |
| | | Oil | | | | | | | | | | | | | | |
| 118 | Roof Area of Aux Bldg | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 119,120 | Intake Structure | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | 20 gal | 190 gal | 20 gal | 190 gal | 77 | 125,123 | | | | | | | | |
| 121 | Intake Laydown Area | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 123 | Refueling Water Stge Area | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | | | | | | | | | | | | | | |
| 124 | Outside Area | Solvent | | | | | | | | | | | | | | |
| | | Paint | | | | | | | | | | | | | | |
| | | Oil | 1 gal | 6 gal | | | | | 1 gal | 6 gal | 77 | 125,123 | | | | |

TABLE 1
MINIMUM AND EXPECTED MAXIMUM TRANSIENT COMBUSTIBLE LOADING
BY AREA FOR MAINTENANCE AND FP&L CONSTRUCTION

| | | | | Total | | Electrical Dept | | | | Mech Maint Dept | | | | Misc | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Area | Name | Combustible | Min | Max Expect | Min | Max Expect | From Area | Thru Area | Min | Max Expect | From Area | Thru Area | Min | Max Expect | From Area | Thru Area |
| 125 | Land Area S of Unit 4 | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 126 | Radwaste Bldg | Solvent<br>Paint<br>Oil | 1 gal | 100 gal | - | 100 gal | Paint Sto | Outside | 1 gal | 6 gal | 77 | 125 | | | | |
| 131 | Diesel Gen Cooling Area | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |
| 132 | Control Bldg Stairwell | Solvent<br>Paint<br>Oil | | | | | | | | | | | | | | |

(1) Where fire areas are similar, they are combined. For example Fire Areas 12, 13, 15 and 16 all have Residual Heat Removal (RHR) pump and motor of same size with same type of maintenance work.
(2) If two routes can be used to reach a fire area, the following applies: a) If one route is inside the plant building and one is outside, the inside route is indicated. b) If both routes are inside plant buildings both are included.
(3) It is assumed that there is a 55 gal drum of used oil from a previous oil change.
(4) Oil tank for mobile air compressor and possible 55 gal drum of used oil.
(5) Oil transfered by pump between diesel generator crankcase oil systems and drums outside the building.
(6) Oil and solvent will reportedly be moved out of this area shortly.

# APPENDIX A - FIRE MODEL DESCRIPTION

## APPENDIX A.1

## BASIS FOR HEAT RELEASE RATES

This appendix provides the basis for the fuel heat release rates utilized in fire models described in this analysis. The quantities reported herein and the underlying concepts are from the combustion literature and reflect the current state of knowledge in the fire sciences. In areas of uncertainty, conservative assumptions are made so as to ensure that the integrity of the analytical method is maintained.

The heat release rate associated with a fire is related to the fuel's mass loss rate (pyrolysis) and the heat of combustion (Tewarson, Ref. 1) by the following relationship:

$$\dot{Q}_T'' = \dot{m}_b'' H_T$$

where

$\dot{Q}_T''$ = Total theoretical heat release rate

$\dot{m}_b''$ = Mass loss rate in burning

$\dot{H}_T''$ = Total theoretical heat of combustion

The mass loss rate itself is a variable which in a realistic sense is dependent upon multiple factors such as fire stage, gaseous temperature and fuel type. In general, the mass loss rate may be described by the net heat flux delivered to the fuel's surface and its heat of gasification.

Appendix A.1, Basis for Heat Release Rates

$$\dot{m}_b'' = \frac{\dot{q}_n''}{L}$$

where

$\dot{q}_n''$ = Net heat flux received by the fuel

L = Heat required to generate a unit mass of fuel vapors

The dependency of the mass loss rate on the net heat flux delivered to the fuel surface and the associated feedback effects illustrates the historical difficulty of deriving a meaningful and precise model of flame behavior. The net heat flux itself represents a heat balance at the fuel surface and is given as the difference between the total heat flux received by the fuel and that flux lost through a variety of processes. This balance under steady-state conditions may be modified, however, by such factors as the relative concentration of oxygen entrained in the combustion zone, the externally applied heat flux and the optical path length of the gases. The principal effect of these considerations becomes evident in the actual heat of combustion which reflects different oxidation reactions.

At a detailed level these multiple parameters are all interrelated. However, it is possible to select a single parameter for

the purpose of illustrating the sensitivity of the heat release rate to ventilation. That single parameter would be the fraction of stoichiometric oxygen to fuel ratio given by:

$$\phi = \frac{\dot{M}''_{O_2}(\alpha)}{\dot{m}''_b K_{O_2}}$$

where

$\phi$ = fraction of stoichiometric oxygen to fuel ratio

$\alpha$ = fraction of oxygen entrained in combustion

$K_{O_2}$ = stoichiometric mass oxygen to fuel ratio

$\dot{M}''_{O_2}$ = mass flow rate of oxygen to fire vicinity

The effect of variation of this parameter on combustion may be illustrated for the case of polymethylmethacrylate over a range of values of the stoichiometric oxygen/fuel fraction:

Appendix A.1, Basis for Heat Release Rates

| $\phi$ | Fuel Condition | Chemical Reactions | Combustion Efficiency | $H_A$ (kJ/g) |
|---|---|---|---|---|
| $\geq 1.0$ | Lean | $C_5H_8O_2 + 6O_2 \rightarrow 5CO_2 + 4H_2O$ | 100 | 24.9 |
| 0.81 | Lean | $C_5H_8O_2 + 4.9O_2 \rightarrow 4CO_2 + 35H_2O$ | 80 | 19.9 |
| 0.63 | Rich | $C_5H_8O_2 + 3.8O_2 \rightarrow 4CO_2 + 3.5H_2O + 0.25CO_2 + 0.25CH_4 + 0.75C$ | 60 | 14.9 |
| 0.42 | Rich | $C_5H_8O_2 + 2.5O_2 \rightarrow 2CO_2 + 2H_2O + CO + CH_4 + C$ | 35 | 8.7 |

As may be evident from this table, oxygen and combustion efficiency have a significant effect on the overall heat release rate. Moreover, it should be noted that lower combustion efficiencies produce increasing amounts of carbon which lead to higher smoke rates, lower optical transmission path lengths, and higher soot concentrations, thereby reducing even further the effect of the released heat on a target material.

The stoichiometric oxygen/fuel fraction affects heat release rates through its influence on the value of $\chi_i$ in the standard equation:

Appendix A.1, Basis for Heat Release Rates

$$\dot{Q}_i'' = \chi_i \; \phi \left( \frac{H_T}{L} \right) \dot{q}_n''$$

where

$\chi_i$ = fraction of total theoretical heat release rate associated with mode i

This equation and the influence of $\chi$ on its results is the fundamental relationship for bounding the rate at which energy is released in a fire. The remainder of this Appendix will focus on each of the following three elements in developing an appropriate rate for the fuels used in this analysis:

$\chi_i$ - fraction of energy released in mode i

$m_b = \frac{\dot{q}_n''}{L}$ - fuel mass loss rate

$H_A$ - actual heat of combustion

The objective of the discussion will be to provide a scientific basis for selecting bounding values for each parameter in subsequent analyses.

The close relationship between parameters and the associated feedback effects was presented earlier in this appendix where the inherent difficulties in precisely modeling fires was demonstrated. Ideally, if bounding values for $X_i$, $\dot{m}_b''$, and $H_A$ could be selected, then one may be assured that the heat release rate is adequately bounded through the assumption of a suitably intense fire. In order to achieve this goal, it is important to relate the three parameters of interest to experimental data and sensitivities. For the purpose of illustrating a general concept, the case of acetone will be discussed beginning with the mass loss rate.

The mass loss rate for a liquid hydrocarbon was previously given by:

$$\dot{m}_b'' = \frac{\dot{q}_n''}{L} \quad \text{[from Tewarson}^{(1)}\text{]}$$

where

$$\dot{q}_n'' = \dot{q}_e'' + \dot{q}_{fr}'' + \dot{q}_{fc}'' + \dot{q}_o'' - \dot{q}_l''$$

$\dot{q}_e''$ = external heat flux incident on the fuel

$\dot{q}_{fr}''$ = flame radiative heat flux incident on the fuel

$\dot{q}_{fc}''$ = flame convective heat flux incident on the fuel

$\dot{q}_o''$ = other heat flux incident on the fuel

$\dot{q}_l''$ = heat flux lost

For small fires, $\dot{q}''_{fc} >> \dot{q}''_{fr}$ while for larger fires, $\dot{q}''_{fr} >> \dot{q}''_{fc}$ indicating the dominance of turbulence.

In the region where radiative heat flux to the fuel's surface is significant, it has been found on the basis of experimentation that all important parameters are monotomically dependent on oxygen concentration [Tewarson(4)]. The affected parameters include:

1) Those parameters with slight oxygen dependency
   - Actual heat of combustion ($H_A$)
   - $CO_2$ yield ($Y_{CO_2}$)
2) Those parameters that decrease with increasing oxygen concentration
   - Convective heat of combustion ($H_C$)
   - Convective heat flux incident on the fuel ($\dot{q}''_{fc}$)
   - CO yield ($Y_{CO}$)
   - Optical path length - fuel vapor concentration ratio
3) Those parameters that increase with increasing oxygen concentration
   - Radiative heat of combustion ($H_R$)
   - Fuel vaporization rate ($\dot{m}''_b$)
   - Radiative heat flux incident on the fuel ($\dot{q}''_{fr}$)

As oxygen concentration increases, these effects all approach limiting values. From this important result, it is apparent that if a conservative assumption is made for ventilation, i.e., that ideal fuel-oxygen ratios above a minimum value (>0.5 mole fraction $O_2$) is always postulated to exist, then it is possible to bound the value for a liquid

hydrocarbon's heat release rate. Further, one also obtains asymptotic values for the fuel steady state mass loss rate as a function of fire area and the associated heats of combustion (radiative, convective, and actual). From this result, the remaining parameter is the value of $X_i$. The method of determination for this parameter will be illustrated for the case of acetone, although the nature of the selected hydrocarbon is unimportant.

It has been shown experimentally that the mass loss rate for most liquid hydrocarbons approaches an asymptotic limit at higher rates of $\dot{q}''_n$ [Tewarson[4]], especially for aromatic i.e., benzene-like compounds [Tewarson[3]]. In particular, Tewarson[1] demonstrated that acetone, an aliphatic ketone, exhibits characteristics similar to such aromatic liquids which suggests the validity of the asymptotic limit assumption for its fuel vaporization rate. This characteristic limit appears to be related to the maintenance of a constant $\dot{q}''_n$ ratio as surface radiation achieves a dominant role in fuel vaporization. For most hydrocarbons, this limit is bounded by vaporization rates of 40 g/m$^2$-s, a mass flux supported by experimental data by Tewarson[3,5], where a value of 30g/m$^2$-s is suggested, and by Blinov and Khudiakov[7]. The steady-state fuel vaporization rate used in this analysis is 40 g/m$^2$-s.

With this parameter in mind, it is necessary at this point to focus on the heat of combustion associated with the fuel; in this case, acetone. Using a bomb calorimeter which accounts for idealized heat measurement resulting from total molecular dissociation, Weast (2) reports a theoretical heat of combustion ($H_T$) of 426.8 kG-cal/GMW

or 30.8 kJ/g. Turning to the experimental literature for the purpose of obtaining a value of $X_A$, Tewarson[2] reports a value of $H_T/L=36$ for acetone, while Tewarson[1] reports $H_T/L= 47.48$. This suggests that $X_A$ has a laboratory value of 0.76. On this basis, the following heats of combustion may be calculated:

| | |
|---|---|
| Actual Heat of Combustion | 23.4 kJ/g |
| Theoretical Heat of Combustion | 30.8 kJ/g |

These calculated values may be compared to experimental data obtained by Tewarson[6] for acetone:

| | |
|---|---|
| Actual Heat of Combustion | 21.71 kJ/g |
| Theoretical Heat of Combustion | 28.49 kJ/g |

Recognizing the relatively consistent values obtained under different circumstances and assumptions, this analysis utilizes the higher heats of combustion for purposes of conservatism.

It should be noted at this point that Tewarson[6] also reports the following data for acetone in the experiments performed:

| | |
|---|---|
| Actual Heat Release Rate | 262 $kW/m^2$ |
| Actual | 0.762 |
| Convective | 0.56 |
| Radiative Luminous | 0.20 |
| Highly Luminous | 0.37 |

It is apparent from a review of this data that a fuel vaporization rate for acetone of 12.1 $g/m^2$ was characteristic of the tests reported in Tewarson[6]. This vaporization rate may be best described as

nonturbulent or transitory, a condition which would be expected to occur at lower oxygen concentrations where flame convection is the dominant mechanism for fuel vaporization. In larger fires where flow is truly turbulent, it has been seen [Tewarson[4]] that radiation begins to dominate convective heat release. Utilizing the higher value of 37 percent for the radiative component associated with highly luminous flames, the following values are assumed for acetone:

| | |
|---|---|
| Actual | 0.76 |
| Radiative | 0.37 |
| Convective | 0.39 |

This yields the following results for acetone:

| | |
|---|---|
| Heat of Combustion (kJ/g) | |
| Convective | 12.0 |
| Radiative | 11.4 |
| Actual | 23.4 |
| Complete Combustion | 30.8 |
| Vaporization Rate ($g/m^2$-s) | |
| Highly Luminous Flame | 40.0 |
| Heat Release Rate ($kW/m^2$) | |
| Convective | 480.0 |
| Radiative | 456.0 |
| Actual | 936.0 |

Appendix A.1, Basis for Heat Release Rates

In a similar fashion, one may obtain heat release rate data for other fuels. For lubricating oil, Tewarson[4] reports the following data as representative for typical high-temperature hydrocarbons:

| | Laboratory Scale | Large Scale |
|---|---|---|
| Heat of Combustion (kJ/g) | | |
| Convective | 18.2 | - |
| Radiative | 20.4 | 16.3 |
| Actual | 38.6 | - |
| Complete Combustion | 46.3 | - |
| Vaporization Rate ($g/m^2$-s) | | |
| Highly Luminous Flame | 40.0 | 26.8 |
| Heat Release Rate ($kW/m^2$) | | |
| Convective | 728.0 | 534.0 |
| Radiative | 816.0 | 415.0 |
| Actual | 1544.0 | 949.0 |

Appendix A.1, Basis for Heat Release Rates

Tewarson[4] reports the following data for heptane:

| | Laboratory Scale | Large Scale |
|---|---|---|
| Heat of Combustion (kJ/g) | | |
| Convective | 21.6 | – |
| Radiative | 17.4 | 14.4 |
| Actual | 39.0 | – |
| Complete Combustion | 44.6 | – |
| Vaporization Rate ($g/m^2$-s) | | |
| Highly Luminous Flame | 70.0 | 70.1 |
| Heat Release Rate ($kW/m^2$) | | |
| Convective | 1512.0 | 1514.0 (est) |
| Radiative | 1218.0 | 1009.0 (est) |
| Actual | 2730.0 | 2523.0 (est) |

The analysis utilizes the laboratory scale turbulent values for fuel vaporization rate and heat release rates in calculating the effects of exposure fires on electrical cables and plant equipment. The impact of this practice is that this effectively assumes that the most efficient combustion achievable in the laboratory occurs in general plant areas as well.

Appendix A.1, Basis for Heat Release Rates

References:


1.) A. Tewarson, "Heat Release Rate in Fires," Fire and Materials, V4, pp. 185-191 (1980).

2) R.C. Weast, Editor, "Handbok of Chemistry and Physics," 61st Edition (1980-81), Chemical Rubber Company, Cleveland, OH, 1980.

3) A. Tewarson, "Physico-Chemical and Combustion/Pyrolysis of Polymeric Materials," Report RC80-T-9, Prepared for U.S. Department of Commerce, National Bureau of Standards, Center for Fire Research by Factory Mutual Research Corporation, Norwood, MA, November, 1980.

4) A. Tewarson, "Fire Behavior of Transformer Dielectric Insulating Fluids," DOT-TSC-1703, Prepared for U.S. Department of Transportation, Transportation Systems Center, by Factory Mutual Research Corporation, Norwood, MA, September, 1979.

5) A. Tewarson and R.F. Pion, "A Laboratory-Scale Test Method for the Measurement of Flammability Parameters," FMRC 22524, Factory Mutual Research Corporation, Norwood, MA, October, 1977.

6) A. Tewarson, "Experimental Evaluation of Flammability Parameters of Polymeric Materials," Report FMRC J.1.1A6R1, Prepared for Products Research Committee, National Bureau of Standards, by Factory Mutual Research Corporation, Norwood, MA, October, 1977.

7) V.I. Blinov and G.N. Khudiakov, "Diffusion Burning of Liquids," Moscow Academy of Sciences (1961).

# APPENDIX A.2

## STRATIFICATION

The stratification model used in this section has its origins in work performed by J.S. Newman and J.P. Hill of Factory Mutual Research Corporation (FMRC) on behalf of the Electric Power Research Institute (EPRI)(Ref. 1). This EPRI research related the radiative and convective heat flux associated with stratified layers of hot gases developed in an enclosure fire to the room's dimensions, the height above the floor, the fuel's flammabilty parameters and the ventilation rate. Data was obtained in a series of experiments involving fourteen methanol and heptane enclosure fires at elevations ranging from 30 to 98 percent of the ceiling height for up to twelve room air changes per hour. Among the general observations, FMRC scientists noted the following:

1) Varying the location of the pan fire within the enclosure had no appreciable effect on the measured heat fluxes or gas temperatures at any given position. This suggests the lack of sensitivity of stratified heat flux to horizontal separation.

2) Differences in gas temperature or heat flux measurements at the same vertical position at different locations were, in general, inconsequential and within the variation expected from the measuring instrument.

3) In terms of horizontal variation, measurements indicate a tendency for the enclosure corners to be slightly cooler and receive lower total heat fluxes than at other locations within the enclosure.

4) The ventilation rate does not appear to have a dominant effect on gas temperatures or heat fluxes within the enclosure, with ventilation rates below approximately one and one-half room changes per hour having virtually no effect.

5) The total heat flux measured at any point in the enclosure is approximately 5 to 10 percent radiative and 90 to 95 percent convective for all conditions investigated independent of fuel. Since the heat flux data collected was for an exposed sphere, this suggests predicted values which would actually be conservative for cylindrical cable bundles found in cable trays.

6) Because of the observed stratification, the application of these empirical results would be appropriate for any room shape as long as the floor area of the particular room is greater than or equal to the floor area of a comparable room of the same height with dimensions of 2:1:1.

Newman and Hill reported empirically-derived, spatially-dependent transient and steady state heat fluxes. Figure A.2-1 illustrates the course of heat flux over time following ignition. The transient heat flux was shown to be related to a time constant unique to each fuel that was obtained by a power curve fit to the fire diameter. Heskestad[2] provides the basis for such a response in the early stages of a fire.

Correlations of the data were obtained by Newman and Hill[1] and are reproduced below:

$$\frac{\dot{q}''_{ss}\,H^2}{\dot{Q}''_T\,A}\left[\frac{h}{H}\right]^{-1/2} = 0.24 - \frac{4.73\,\dot{V}_f}{H^{5/2}} \quad \text{(Steady State)}$$

$$\frac{\dot{q}''_t}{\dot{q}''_{ss}}\left[\frac{h}{H}\right]^{-1/2} = \left[0.52 + \frac{13\,\dot{V}_f}{H^{5/2}}\right]\left[\frac{t}{\tau}\right]^{0.9} \quad \text{(Transient)}$$

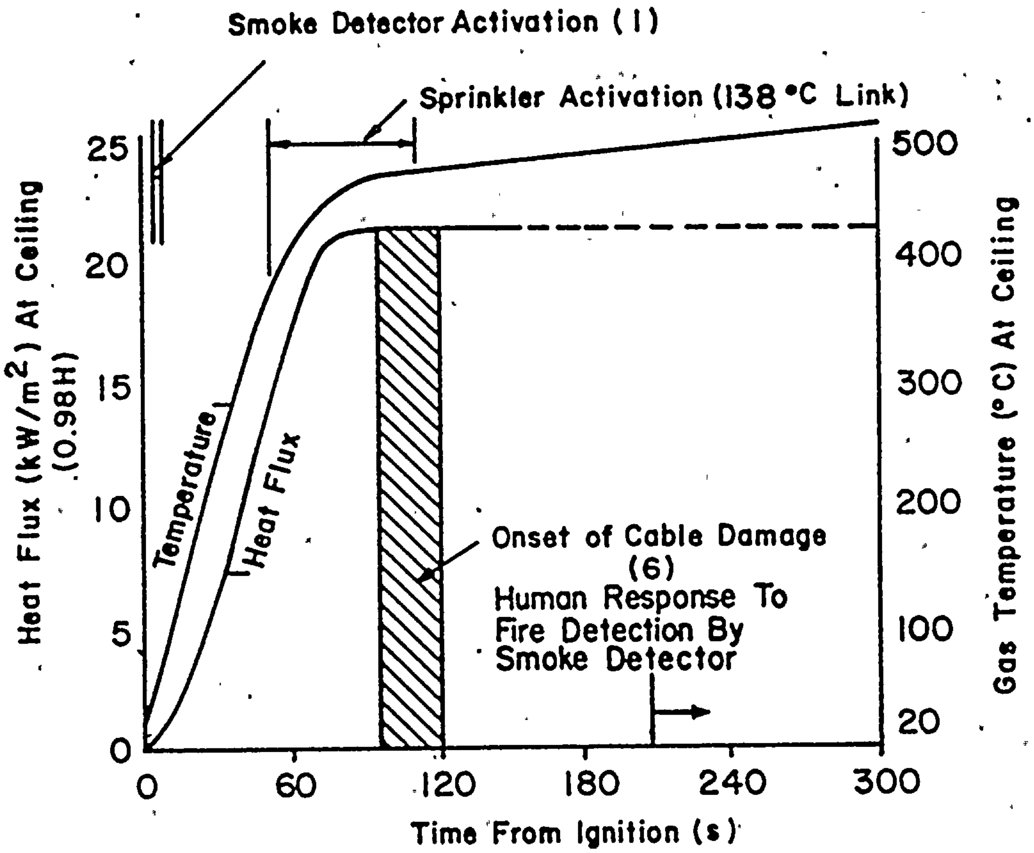


Figure A.2-1. Heat Flux and Gas Temperature at Ceiling (Station 4) versus Time from Ignition for Test EP008

Reproduced from Newman, J.S. and Hill, J.P., "Assessment of Exposure Fire Hazards to Cable Trays", EPRI-NP-1675, Electric Power Research Institute, Palo Alto, CA, January 1981

Appendix A.2, Stratification

These results were reviewed for accuracy against the original data in the EPRI report presented in Table 3-4 of Newman and Hill[1], which is reproduced here as Table A.2-1. Plotting the reported data onto Newman and Hill's Figure 3-2 (reproduced herein as Figure A.2-2) suggests that the original EPRI correlation defines a poorly behaved function with respect to the ventilation component such that with higher ventilation rates, a refrigeration effect may be noted. In reality, while higher ventilation rates will in general have a disruptive effect on any enclosure fire to the point where some mitigation is possible, it was felt that use of the EPRI correlations would be nonconservative at some points. It should be noted, however, that for relatively small exposure fires which are not ventilation-limited, the fire severity is reduced as ventilation increases. This point is discussed in some detail by T.Z. Harmathy[2,3].

Nevertheless, to provide assurance that the function remains well behaved in a conservative fashion and that the experimental data provides bounding results, a modified correlation was obtained as follows:

$$\dot{q}''_{ss} = \begin{cases} 0.7854\,\dot{Q}''_T\,\dfrac{D^2}{H^2}\left\{\dfrac{0.05585}{(1.193-\frac{h}{H})^{1/2}}\cdot\left\{0.01161-\dfrac{0.01031}{(2.13-\frac{h}{H})^{1/2}}\right\}^{-0.153}\right\}; \\ \qquad \dot{V}_f \le H^{5/2}\left\{0.01161 - 0.01031\,(2.13-\frac{h}{H})^{-1/2}\right\} \\ 0.7854\,\dot{Q}''_T\,\dfrac{D^2}{H^2}\left\{\dfrac{0.05585}{(1.193-\frac{h}{H})^{1/2}}\cdot\left(\dfrac{\dot{V}_f}{H^{2.5}}\right)^{-0.153}\right\}; \\ \qquad \dot{V}_f > H^{5/2}\left\{0.01161 - 0.01031\,(2.13-\frac{h}{H})^{-1/2}\right\} \\ \dot{q}''_t = \dot{q}''_{ss}\,(\frac{t}{\tau})^{0.9}\,(\frac{h}{H})^{1/2}\left\{0.52+\dfrac{13\,\dot{V}_f}{H^{5/2}}\right\}; \quad \dot{q}''_t \le \dot{q}''_{ss} \end{cases}$$

TABLE A.2-1

GAS TEMPERATURES, GAS VELOCITIES AND TOTAL HEAT FLUXES VERSUS POSITION FOR ENCLOSURE FIRE TEST EP008 (70 SECONDS AFTER IGNITION)

| Station | Vertical Position | Gas Temperature (°C) | Gas Velocity (m/s) | Total Heat Flux (kW/m$^2$) | Percent Radiative |
|---|---|---|---|---|---|
| 1 | 0.98H | 387 | 5.0 | 20.4 | 7.9 |
| 2 | | 458 | 6.4 | 24.9 | 9.4 |
| 3 | | 429 | 5.1 | 20.5 | 6.5 |
| 4 | | 457 | 5.3 | 23.1 | 7.9 |
| 5 | | 406 | 2.8 | 17.1 | 7.1 |
| 1 | 0.90H | 364 | 1.5 | 12.5 | 6.5 |
| 2 | | 356 | 1.9 | 12.2 | 6.8 |
| 3 | | 328 | 2.1 | 11.8 | 5.2 |
| 4 | | 342 | 1.9 | 12.5 | 6.0 |
| 5 | | 385 | 1.4 | 13.4 | 7.1 |
| 1 | 0.70H | 315 | 1.5 | 11.0 | 7.4 |
| 2 | | 294 | 1.5 | 9.7 | 4.3 |
| 3 | | 299 | 1.5 | 10.0 | 7.3 |
| 4 | | 297 | 1.9 | 11.0 | 7.6 |
| 5 | | 311 | 1.1 | 10.1 | 9.9 |
| 1 | 0.50H | 269 | 2.4 | 10.9 | 8.9 |
| 2 | | 268 | 2.7 | 10.9 | 9.1 |
| 3 | | 267 | 1.7 | 9.1 | 5.6 |
| 4 | | 258 | 1.3 | 7.9 | 3.9 |
| 5 | | 256 | 0.8 | 7.1 | 5.7 |
| 1 | 0.30H | 232 | 1.7 | 8.0 | 5.0 |
| 2 | | 241 | 2.8 | 9.2 | 4.7 |
| 3 | | 218 | 2.2 | 7.7 | 5.8 |
| 4 | | 222 | 1.7 | 6.1 | 7.5 |
| 5 | | 217 | 0.5 | 4.7 | 5.0 |

Reproduced from Newman, J.S. and Hill, J.P., "Assessment of Exposure Fire Hazards to Cable Trays", EPRI-NP-1675, Electric Power Research Institute, Palo Alto, CA, January, 1981

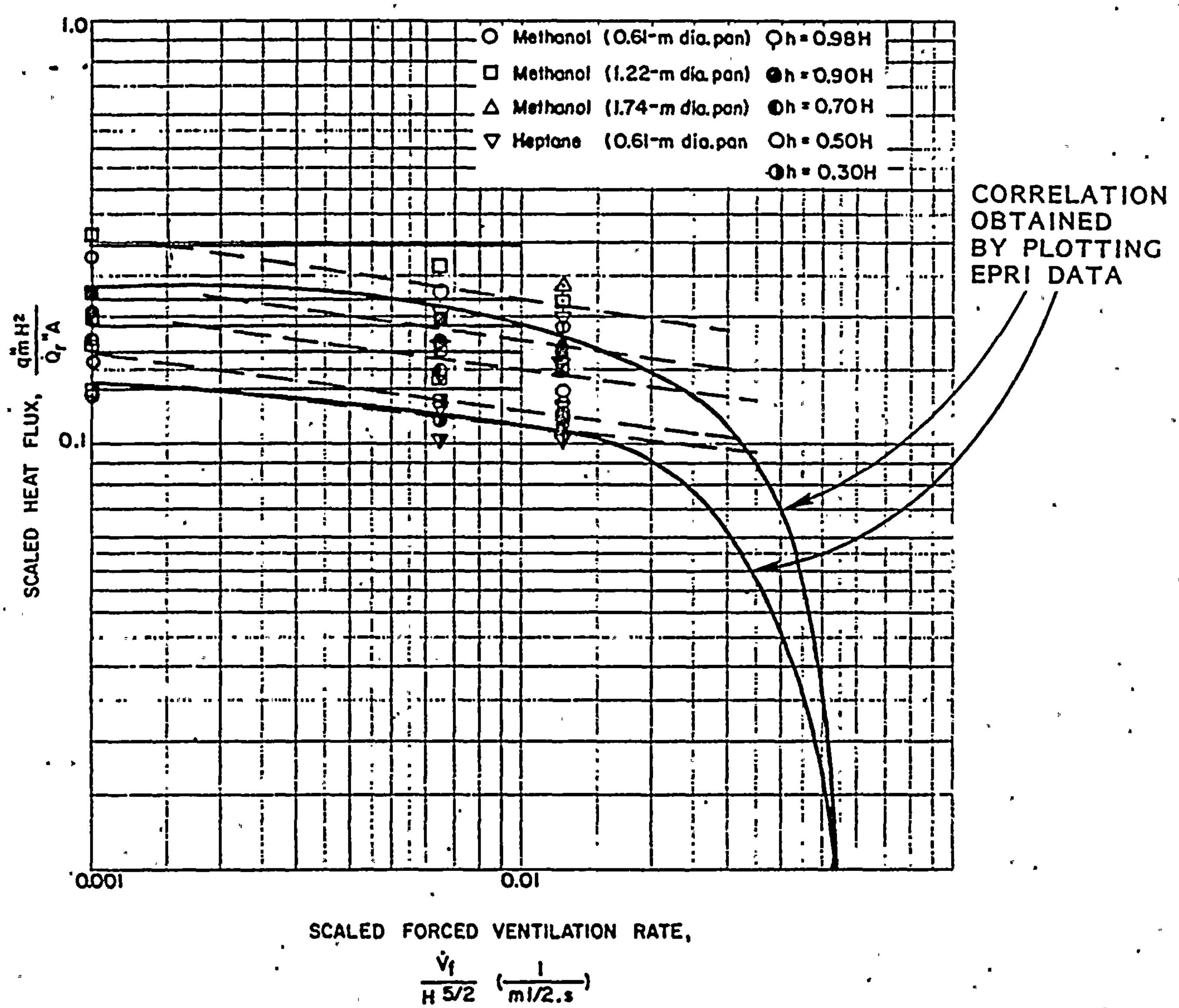


Figure A.2-2. Scaled Heat Flux versus Scaled Forced Ventilation Rate

Reproduced from Newman, J.S. and Hill, J.P., "Assessment of Exposure Fire Hazards to Cable Trays", EPRI-NP-1675, Electric Power Research Institute, Palo Alto, CA, January 1981

Utilizing these revised correlations, the analysis applies classical optimization techniques for nonlinear functions to determine the minimum fuel volumes and associated goemetries (i.e., fire area and spill depth) necessary to exceed the damage criteria for the cables of concern at the elevations of interest within an enclosure.

Appendix A-2, Stratification

References:


(1) J.S. Newman and J.P. Hill, "Assessment of Exposure Fire Hazards to Cable Trays", EPRI-NP-1675, Electric Power Research Institute, Palo Alto, CA, January, 1981.

(2) G. Heskestad and M.A. Delichatsius, "The Initial Convective Flow in Fire", Report RC79-T-2, Factory Mutual Research Corporation, Norwood, MA, January, 1979.

(3) T.Z. Harmathy, "Some Overlooked Aspects of the Severity of Compartment Fires", Fire Safety Journal, 3(1980/1981), pp. 261-271.

(4) T.Z. Harmathy, Effect of the Nature of Fuel on the Characteristics of Fully Developed Compartment Fires", Fire and Materials, V3, N3 (1979), pp. 49-60.

## APPENDIX A.3

## DIFFUSION PLUMES

A low-level fire in an enclosure develops a turbulent, buoyant, diffusion plume which flows upward towards the ceiling or the first horizontal surface. Driving the upward flow of hot gases are the gravitational forces acting on the difference in density between the plume and its ambient environment, a condition which poses a problem for the analyst to consider. An understanding of the physics of such plumes is essential to the modeling of their effects on immersed materials and components. Fortunately, recent developments as discussed in the literature allow for the prediction of the effects of such plumes.

The history of the modeling of turbulent buoyant diffusion plumes is fairly recent. An early description of the flow of buoyant plumes published in 1941 is attributable to Schmidt [Ref. 1]. In a series of experiments involving convective plumes of air above small sources, Schmidt noted the tendency of buoyant plumes to exhibit conical patterns in turbulent vertical flow. Assuming symmetry conditions existed, Schmidt generated velocity and temperature profiles for constant ambient temperatures involving point and line sources and verified their accuracy against experimental data.

Batchelor[2] extended Schmidt's results to both stratified and uniform environments in a manner similar to Rouse et al.[3] These classical relationships are reproduced below:

$$U = F_a^{1/3}\, z^{-1/3}\, f_1\left(\frac{r}{z}\right)$$

$$g' = F_a^{1/3}\, z^{-5/3}\, f_2\left(\frac{r}{z}\right)$$

$$d = \lambda z$$

where

$F_a$ = buoyancy/unit time $\Big|_{\text{source}}$

$= 2\pi \int_0^\infty U\, g' r\, dr$

$g' \equiv$ buoyancy $= g \dfrac{\Delta\rho}{\rho_a}$

$z$ = height above source

$r \equiv$ radial distance from plume axis or centerline

$g$ = acceleration of gravity

$\Delta\rho$ = density difference between local and ambient gas

$\rho_a$ = ambient density

$U$ = mean vertical velocity in plume

$d$ = plume radius

$\lambda$ = dimensionless constant

Appendix A.3, Diffusion Plumes

In defining these relationships, the forms of $f_1(r/z)$ and $f_2(r/z)$ were initially undetermined although it may be apparent that boundary conditions require that they be at once continuous and well-behaved. This consideration was confirmed through a series of experiments by Rouse, et al.[3], involving hot air in a large room by where it was demonstrated that both the mean temperature and the velocity profiles were essentially Gaussian. On this basis, Batchelor's relationships become:

$$U \doteq 4.7 F_a^{1/3} z^{-1/3} e^{-\left(\frac{96r^2}{z^2}\right)}$$

$$g' = 11 F_a^{1/3} z^{-5/3} e^{-\left(\frac{71r^2}{z^2}\right)}$$

At this point, the development of a theory for buoyant diffusion plumes is limited by the mixing length theories which form the basis for the similarity solution approach taken by Batchelor[2]. These assumptions imply a loss of generality of Batchelor's functions for plumes diffusing into nonuniform gas temperatures. However, this difficulty is overcome through the use of an entrainment assumption attributable to Taylor[4] for air blast phenomena associated with nuclear detonations. This very fundamental assumption relates the mean inflow velocity across a plume edge to the local mean vertical velocity primarily through entrainment. Morton, et al.[5], applied this assumption to the study of convection currents.

Appendix A.3, Diffusion Plumes

As reported in Stavrianidis[6], three principal assumptions are made by Morton, et al.[5]

1) The largest local variations of density in the field of motion are small in comparison to some chosen reference density.

2) The mechanics of entrainment can be represented fully by taking a mean radial inflow velocity across some suitably defined "mean outer boundary" as proportional to the mean vertical velocity on the plume axis at that height. Equivalently,

$$V = E_o U_o$$

where

$E_o$ = 0.1 from Stavrianidis[6] and Turner[2]

$U_o$ = mean vertical velocity on plume centerline

3) The mean profiles of longitudinal velocity, temperature, and density are similar in shape at all elevations in the plume.

These relationships apply to weakly buoyant plumes. Extension of the theory to strongly buoyant plumes initially leads to a redefinition of the local entrainment function due to Morton[8]:

$$E = \left(\frac{\rho}{\rho_a}\right)^{1/2} E_o$$

With this modification for the local entrainment function, solution of the general plume conservation equations for the case of the strongly buoyant plume was shown by Morton to be essentially equivalent to that of the weakly buoyant plume with larger convective heat

release rates. Heskestad[9] subsequently confirmed this generality inside the flame envelope in a series of experiments.

With this background, it is apparent that turbulent, buoyant, diffusion plumes could be described mathematically in terms of convective heat release rates and position above the source. Stavrianidis[6] extended this basis in a series of experiments involving large-scale hydrocarbon fires which measured the actual heat release rate in the plume. The redefined plume laws correlated to Stavrianidis' data yield, independent of fuel type:

$$\overline{\Delta T} = 0.092 Q_c^{2/3} (z-z_o)^{-5/3} e^{-\left(\frac{71r^2}{z^2}\right)}$$

$$U = 1.20 Q_c^{1/3} (z-z_o)^{-1/3} e^{-\left(\frac{96r^2}{z^2}\right)}$$

where

$\overline{\Delta T}$ = normalized excess temperature on plume centerline

$= \dfrac{T - T_a}{T_a}$

$T$ = mean plume temperature

$T_a$ = ambient temperature

$Q_c$ = actual convective heat release rate

$z$ = height above physical source

$z_o$ = height of virtual source above physical source

Stavrianidis demonstrated the validity of these correlations well into the flame envelope to a point of divergence noted for plume gas temperatures. The data reveals a constant maximum value for temperature of 1235°K for heptane, methanol, and silicone oil fires. The point of divergence is defined as the critical height, a function solely of the convective heat release rate, and given by:

$$z_c = 0.13Q_c^{2/5} + z_o$$

The determination of the height of the vertical source is given by:

$$z_o = 7.54F^{1/5}\left(\frac{\dot{m}^2 S^3}{\alpha_c H_c}\right)^{1/5} - 0.15Q_c^{2/5}$$

where

$$F = \frac{c_p T_a}{\rho_a^2 g}$$

$\dot{m}$ = fuel vaporization rate

$$\alpha_c = \frac{Q_c}{\dot{m}H_T}$$

$H_c$ = convective heat of combustion

$H_T$ = theoretical heat of combustion

S = stoichiometric fuel-oxygen ratio

Appendix A.3, Diffusion Plumes

With these experimentally derived relationships, it is possible to calculate a number of parameters of interest relative to the exposure fire problem, in particular:

1) Plume temperatures above a pool fire,

2) Gas velocities above a pool fire,

3) Heat flux delivered to a point above a pool fire,

4) Radiative heat flux associated with luminous flames.

Each of these calculations is of value in the quantative fire hazards analysis contained in this report. This appendix will cover those aspects related to the heat flux associated with diffusion plumes.

The problem of plume impingement is treated in this analysis in three distinct approaches:

1) Stagnation heat flux associated with direct plume impingement on a horizontal surface.

2) Cross flow heat flux to a cylinder (cable) associated with immersion in a turbulent buoyant plume.

3) Parallel flow along a plate associated with immersion in a turbulent buoyant plume.

Axisymmetric fire-induced flow beneath a flat horizontal surface such as a ceiling has been discussed in the literature for some time. Early work includes that of Pickard et al.[10] and Thomas[11]. The theory, however, did not progress to the level of generality until Alpert[12] developed a basis for the accurate prediction of turbulent ceiling jets as a function of the heat release rate and distance to the ceiling. Alpert's analytical work, which was verified

through experiments, demonstrated the validity of using small-scale models to predict the behavior of large-scale ceiling jets.

The basis for Alpert's work includes the top-hat source profiles of Morton et al.[5] and the Gaussian temperature/velocity profiles of Rouse et al.[3] Alpert's model views the ceiling jet as a boundary layer divided into two regions: an outer region where entrainment occurs as a result of turbulent mixing and a viscous essentially laminar sublayer at the horizontal surface. Data taken in Alpert's experiments indicates a decline in entrainment by an order of magnitude three to four ceiling heights from the fire axis. A significant decline in ceiling temperature as well as an increase in jet thickness is also noted three to five ceiling heights from the fire axis. Finally, the stagnation region is considered to extend radially outward to a distance of approximately 20 percent of the ceiling height prior to transitioning to a uniform stratified layer. Semi-Gaussian profiles are assumed for the transition or turning region.

You and Faeth[13] extend Alpert's work and determine a heat flux within the stagnation region ($r/h < 0.2$) as a function of gas properties and the fire's heat release rate:

$$\frac{\dot{q}'' H^2}{\dot{Q}} = 31.2 \ Pr^{-3/5} \ Ra^{-1/6}$$

when

$Pr$ = Prandtl number (~0.7)

$Ra$ = Rayleigh number

$$= \frac{g\beta\dot{Q}H^2}{\rho C_p \nu^3} \quad (10^9 < Ra < 10^{14})$$

$$\frac{H_f}{H} > 1.5$$

$H$ = ceiling height

$H_f$ = free flame height

$g$ = gravitational constant

$\beta$ = coefficient of columetric expansion

$\rho$ = density

$\nu$ = ceiling radial velocity for the jet

$\dot{q}''$ = heat flux

$c_p$ = heat capacity

$$\frac{\dot{q}''H^2}{\dot{Q}} = 0.04 \left(\frac{r}{H}\right)^{-1/3}$$

$$\text{for} \quad 10^{10} < Ra < 2 \times 10^{13}$$

$$Pr \sim 0.7$$

$$\frac{H_f}{H} < 0.6$$

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APPENDIX A.4

RADIATION

Radiation can be a significant contributor to the overall heat flux produced as a result of a fire and must be accounted for in properly modeling exposure fires in nuclear power plants. This appendix discusses the approach taken in this report for modeling the effects of radiation from such fires.

The combustion of organic materials such as liquid hydrocarbons is an exothermic reaction. The energy released as a result of such reactions leads to the generation of a high temperature turbulent buoyant diffusion-plume consisting of both gaseous byproducts of combustion and soot particles. The energy contained within this plume is transferred to the environment through two processes: (1) convection associated with momentum of the plume and (2) radiation from the plume.

Molecules in an excited state transfer energy via radiation principally through band emission. For the fundamental products of combustion, i.e., $CO_2$, CO, $H_2O$ and soot, such emission tends to be concentrated in the visible and infrared regions typically less than 15μ (Ref. 1). The energy transferred by radiation over these wavelengths depends on a number of parameters including average temperature of the source and its constancy.

Historically, fire models and the discipline of fire protection engineering have addressed radiation in considering the effects of an initial exposure fire. Radiant heating has been found to be a dominant mechanism in the development of large-scale conflagrations. This focus

is inherently reflected in the use of temperature as a standard of measurement in tests determining fire resistance. Typical of this genre are the standards published by the National Fire Protection Association for qualifying barriers and doors for commercial structures and the E-152 Test issued by the American Society for Testing and Materials[2,3]. These tests are essentially oven tests employing radiant heaters in an attempt to model the dominant heat transfer process in large scale conflagrations involving residential and commercial structures consisting of and containing high densities of combustible material.

The early application of classical radiative heat transfer techniques to the problem of determining safe horizontal separation distances for building fires is documented in reports issued in the post-war period by British and Japanese investigators[4,5]. These and later reports published in the 1950s and 1960s retained the concept of horizontal separation as a principal means of protecting adjacent combustible material (i.e., neighboring buildings) from the intensive effects of major building fires where radiant heat transfer in the open air is the dominant mechanism for damage. During this period, applications of principles for modeling radiant heating, well known in other scientific disciplines, were also made to such distinct problems as the effects of fire-induced flows through windows and doors on adjacent structures, effects of wind on flames, the sensitivity of radiant energy to different flame temperatures and the impact of various wall materials. The conclusions from such studies tended to emphasize the difficulty of developing generalized empirical relationships

independent of scientifically based theory and the importance of understanding the effects of material flammability parameters in modeling the radiative effects of fire.

At a more fundamental level, the effects of radiation may be tied to the gaseous dynamics associated with the fire plume itself. With its dominant contributions in both the visible and infrared regions of the electromagnetic spectra, the natural focus for a radiation model therefore becomes one based on the material flammability parameters and, in particular, the height of the visible portion of the turbulent buoyant diffusion plume. In this regard, F.R. Steward's work,[6], assumes an important role in providing a comprehensive statement of the dynamics of fire plumes for subsequent researchers[6].

Later work by Dayan and Tien[7] builds on Steward's research in developing a radiant heat flux model which offers excellent agreement with experimental data[7]. This model assumes good mixing associated with combustion conditions in the burning zone so as to provide an essentially uniform gaseous temperature and chemical species concentration in a cylindrical form. The use of a cylindrical form does not appear to suffer a loss of generality relative to some other shape such as one which is either conical or hyperbolic and, in fact, may well be a more accurate representative of average fire conditions. Of greater significance than fire shape in the modeling of radiant heating is that of soot and gaseous temperature.

Soot and gaseous temperature directly affect the emissivity associated with the luminous flames of a fire. This effect is seen

in the following form of the Stefan-Boltzmann law:

$$\dot{Q} = \varepsilon \sigma T^4$$

where

$\dot{Q}$ = Radiant energy transfer rate

$\varepsilon$ = Emissivity (dimensionless)

$\sigma$ = Stefan-Boltzmann constant

$T$ = Absolute blackbody temperature

The emissivity of a flame essentially determines the proportion of energy released in the form of radiant energy. The individual components of the total emissivity may be broken up as follows:

$$\varepsilon = \varepsilon_g + \varepsilon_s$$

where

$\varepsilon$ = Total emissivity associated with the fire

$\varepsilon_g$ = Emissivity of the hot gas within the burning zone

$\varepsilon_s$ = Emissivity of the luminous soot within the burning zone

Felske and Tien provide an analytical basis supported by experimental data for understanding the parametric relationships of gaseous and soot emissivity(1). This understanding is a further development of an earlier description provided by Hottel and Sarofim(8). In particular, the relationship of emissivity to spectral wavelength is given for the dominant emission species of water vapor, carbon dioxide and soot. This relationship is strongly affected by the partial pressures of the products of combustion. As in the case of other, well-behaved spectral functions, the use of an effective value for emissivity is supported by the data and may be provided over the range of sensitivity. This range occurs at wavelengths shorter than

the 15μ and for infrared band and contains over 96 percent of the total black body radiation emitted in a fire.

Focusing on gaseous emissivity for the moment, with the assumption of near-optimal fluid mixing and thermal conditions in a fire, combustion may be assumed to involve the following typical reaction:

$$(CH_2)_X + (\tfrac{3}{2})\ X\ O_2 \rightarrow X\ CO_2 + X\ H_2O$$

Under ideal conditions, the partial pressure of $CO_2$ is 0.131 atm, given a standard environment where the partial pressure of oxygen is 0.21 atm and the partial pressure of nitrogen-argon is 0.79 atm. From Hottel and Sarofim[8] and Hadvig[10], the gaseous emissivity is described by:

$$\varepsilon_g T_g = 600.0\ (P_{CO_2} L_m)^{0.412}$$

where

$L_m$ = Mean beam length

$T_g$ = Gaseous temperature

$P_{CO_2}$ = Partial pressure of $CO_2$

For the case of an essentially infinite cylinder (i.e., an electrical cable):

$$L_m = 0.94\ D$$

where

D = Cylinder diameter

This yields the following for the emissivity of a hot gas:

$$\epsilon_g = \frac{[600]\,[0.131]\cdot(0.94D)]}{T_g}$$

The gaseous temperature is assumed to be a uniform 1255°K (1800°F) based on the work of Stavrianidis using pool fires consisting of heptane and acetone as fuel(9).

As in the case of gaseous emissivity, the contribution of soot to total emissivity may also be characterized effectively by a single value. Here again, Felske and Tien(1) develop a view consistent with earlier work by Hottel and Sarofim(8). This view suggests that the mainstream of conditions involving the burning of liquid hydrocarbons, i.e., generally lower gaseous temperatures and longer volume of reaction path lengths associated with fairly efficient (energetic) combustion, the emissivity of soot may be bounded for the majority of cases. In these circumstances, a value of 0.1 for the soot emissivity becomes limiting.

With this perspective, a cylindrical fire model is utilized to analyze the effects of radiant heating on the material of interest. The burning zone is described by a more current analytical model for turbulent buoyant diffusion plumes strongly supported by excellent correlations with experimental data obtained under controlled conditions involving fairly large scale acetone and heptane fires(9). This model is described in more detail in Appendix A.2.

Appendix A.4, Radiation

The radiant heat flux to an electrical cable from a postulated fire is therefore given by:

$$\dot{q}'' = \left(5.67 \times 10^{-12} T_g^{\,4} + \frac{1.435 \times 10^{-8} D^{0.412}}{T_g} T_g^{\,4}\right) F_{21}$$

where

$\dot{q}''$ = Radiant heat flux incident on a cable

D = Cable diameter

$T_g$ = Gaseous temperature = 1200°K (1800°F)

$F_{21}$ = Configuration factor describing the fraction of heat flux delivered to a point by a radiant right cylinder

This expression is accurate to within 5 percent for a gaseous temperature range of 1000°K-1600°K.

Appendix A.4, Radiation

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## APPENDIX A.5

## THERMAL SHIELDS

This appendix presents an analytical treatment of the efficacy of baffles when used as thermal shields for the purpose of diverting hot fire gases from direct impingement upon electrical cables. The results of this analysis provide a basis for determining the size such baffles need to be in order to protect a vertical stack of trays from convective heating associated with transient combustible exposure fires.

In fire protection reviews performed subsequent to the Browns Ferry fire, licensees considered the guidelines of BTP APCSB9.5-1 Appendix A. This document assumes a flexible and multilayered approach to backfitting fire protection measures to operating power plants. Such measures include the use of flame retardant coatings, suppression and baffles used as thermal shields. As a result of this process many operating plants upgraded their overall fire protection capability as documented in the Safety Evaluation Report (SER) issued by the NRC Staff.

The BTP Appendix A fire hazards analysis led to the implementation of significant modifications at operating plants. The value of such modifications was questioned, however, by the Commission in the issuance of 10CFR50 Appendix R in November 1980. While the Commission explicity highlighted the issue of flame retardant coatings, it may be inferred that the value of thermal shields was also subject to question. As in the case of coatings, the question turned to the lack of available data.

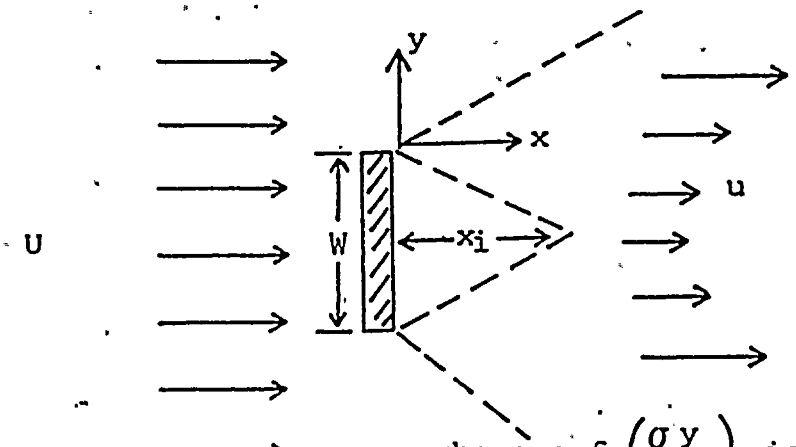
Appendix A.5 Thermal Shields

Phenomenological testing of baffles as thermal shields had been performed at Factory Mutual Research Corporation under the sponsorship of the Electric Power Research Institute [Newman and Hill[1]]. In one test in a series involving the use of sprinklers and baffles, a fire was ignited in a 1.2 meter diameter circular pan containing 17 gallons of No. 2 fuel oil located 1.8 meter beneath an electrical cable tray protected solely by a 13 mm (0.5 in.) thick baffle composed of refractory material. Temperatures recorded beneath the baffle were generally in excess of 700°C. After immersion in the 3.7 meter high flames for over 15 minutes before the fire self-extinguished, an examination of the electrical cables showed no visual evidence of charring nor was there a loss of conductor continuity for a 70 Vdc signal at any time during the test.

Physical tests of this type are indicative of the performance of baffles in protecting cable trays against the effects of exposure fires. The process involves the disruption of turbulent flow by a blunt body and may be modeled using standard fluid dynamics computer codes with detailed results available throughout the simulated flow field. This report, however, utilizes a data correlation based on a theoretically coherent analysis of the turbulent mixing associated with the wake developed by the baffle. The treatment is by Schlichting[2] who reports on velocity distribution generated in the mixing zones produced by blunt objects. The original data is reported by Tanner[3].

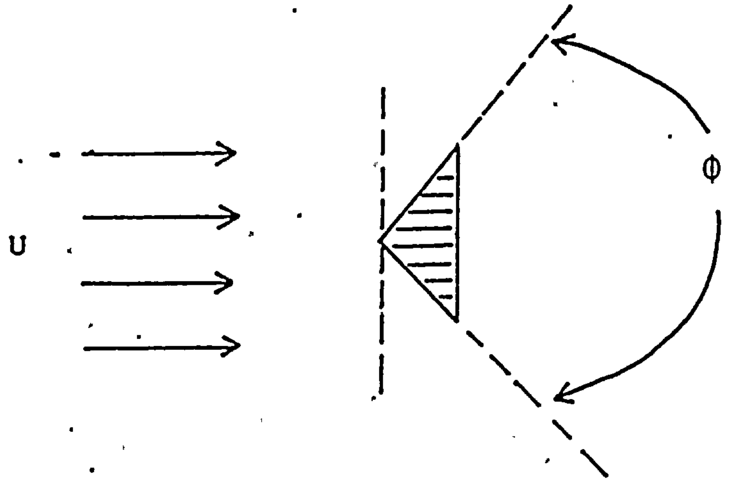
As discussed in Schlichting[2] for a baffle of width, w, located within a flow field characterized by an average velocity, U, the wake velocity at any point in the mixing zone is given by:

$$u = U \frac{1 \pm \text{erf}\left(\frac{\sigma y}{x}\right)}{2}$$




where, $\text{erf}\left(\frac{\sigma y}{x}\right)$ is the error function of $\frac{\sigma y}{x}$

Based on experimental work by Tanner[3], σ is defined to be a function of the angle, ϕ, of the leading edge of the object in the flow:




| φ | σ |
|---|---|
| 0° | 14 |
| 30° | 10 |
| 60° | 9 |
| 120° | 8 |
| 180° | 7 |

Therefore, a baffle analysis uses a value for σ equal to 7.

If the protected zone boundary is defined to be bounded by

$$\frac{u}{U} = 0.20$$

the width of the associated baffle in terms of the downstream extent of the protected zone is given by:

$$0.20 = \frac{1 - \text{erf}\left(\frac{7W}{2X_{0.2}}\right)}{2}$$

$$\text{erf}\left[\frac{7W}{2X_{0.2}}\right] = 0.60$$

$$\frac{7W}{2X_{0.2}} = 0.5951$$

$$W = 0.17\ X_{0.2}$$

The choice of $\frac{u}{U} = 0.20$ was based on the assumption that the heat flux and the velocity will be reduced to 20 percent of the free stream value. Actually, the mixing will further reduce the heat flux by lowering fluid temperatures downstream of the baffle. The relationship between W and $X_{0.2}$ identifies the area within which the velocities are below 20 percent of the free stream velocity. Thus, to create a protected zone around a vertical stack of trays approximately 6 ft. in height, this analysis suggests the installation of a baffle below the lowest tray with a width of at least 13 in. or the width of the tray, whichever is larger. However, the presence of the trays in the wake will lengthen the extent of the protected zone by inhibiting mixing layer growth. Therefore, the baffle width suggested in this analysis will be more than adequate to protect the stack of trays.

It is concluded on this basis that the barrier effect contributed by a vertical stack of closed-sided cable trays combined with the wake effect of a baffle will reduce the convective heat fluxes incident on cables within the trays due to an exposure fire directly beneath the trays, thereby preventing the onset of cable damage.

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APPENDIX B - FACTORY MUTUAL TEST REPORT

# PROGRESS REPORT

SMALL SCALE TESTING OF
FLAME-RETARDANT COATED CABLES

by

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## I OBJECTIVE

The study objective is to evaluate quantitatively the effectiveness of flame retardant cable coatings (Flamemastic 71-A and 77) to reduce the hazards associated with cable subjected to an exposure fire.

## II EXPERIMENTAL APPROACH

In this study the experimental approach was very similar to that used in the Electrical Power Research Institute (EPRI) study performed at Factory Mutual Research Corporation (FMRC)[1,2]. Experimental data were obtained for coated and uncoated cable samples for 1) ignition; 2) cable damage; 3) electrical integrity; and 4) generation rates of fuel vapors, heat and combustion products; and optical transmission through "smoke." Coating effectiveness was then determined from analysis of the data for coated and uncoated cable samples.

Experiments were performed in the Factory Mutual Small-Scale Combustibility Apparatus, shown in Figure 1, and described in detail in refs. 1 and 2.

Cable samples, about 6 cm in length, were placed vertically inside the apparatus (at the location indicated as fuel in Figure 1), and surrounded by a quartz tube. Dry air was introduced at the bottom of the quartz tube at a flow rate of ~ 0.003 $m^3/s$ which is adequate to maintain overventilated fire conditions. Some experiments were also performed under natural air flow conditions, in which case the quartz tube was removed and there was no forced air flow into the apparatus.

The cable samples were held in a vertical position by two wires attached to a rod on the load platform. The load platform was connected to a load cell, for monitoring the generation rates of fuel vapors.

A small premixed $C_2H_4$-air pilot flame (~ 2.5 cm in length) was present about 1 cm above the top surface of the cable sample for the initiation of piloted ignition. For autoignition experiments, the pilot flame was removed. In the experiments, time to ignition was measured as a function of external heat flux.

The samples were exposed to external heat flux by four coaxially placed radiant heaters as shown in Figure 1. The radiant heaters are tungsten quartz lamps, with a peak emission of 1.5 μ at full power. The heat flux from the heaters at the sample location was precalibrated. By applying a thin layer of

graphite powder to coated and uncoated cable samples and exposing them to the external heat flux from the radiant heaters, the absorptivity of the coated and uncoated cables was found to be close to unity. The cable samples were also exposed to a 10 cm diameter methanol pool fire with samples completely inside the flame.

All products generated from the pyrolysis/combustion of cable samples were captured in the sampling duct together with ambient air, and measurements were made for total mass and volumetric flow rates of product-air mixture; gas temperature and ambient temperature; optical transmission through "smoke" and concentrations of CO, $CO_2$, and total gaseous hydrocarbons. The outputs from the instrumentation were monitored by a MINC mini-computer.

## III CABLE SAMPLES

A total of ten cable samples were examined. Two types of coatings were used - Flamemastic 71-A and 77 for all the power and control cables. A scheme was developed to identify the cable samples, conductor/wire size, and generic nature of the insulation/jacket material; this is shown in Tables I through III. The first number identifies the manufacturer as shown in Table I; the second number indicates the number of individually insulated conductors and the wire size of each conductor as shown in Table II; and the third number is the insulation/jacket material as shown in Table III.

Detailed description of the cable samples is given in Table IV. The average cable diameter and insulation and jacket thicknesses were measured at four different places along the length of the cable by a vernier slide caliper and averaged. Effective surface area was calculated from measured diameter and length. The linear density was calculated from measured cable weight and length. The weight of insulation/jacket materials was calculated from measured total cable sample weight and the weight of the sample without the conductor.

The cables were coated by dipping the samples into well-stirred flamemastic paint such that the thickness of the coating was about 1.6 mm (~ 0.063 in.) under dry conditions. In cases where the coating thickness was considerably less than ~ 1.6 mm, additional coating was applied with a fine paint brush. In cases where the coating thickness was considerably greater than ~ 1.6 mm, a fine emery paper

was used to remove the excess coating. Samples 2-5x16-5 and 2-1x0000-5 were coated with Flamemastic 77 and the rest of the power and control cables were coated with Flamemastic 71A. After drying the coated samples for at least 24 hours at controlled room temperature and humidity, the diameter was measured at four different places along the cable length using a vernier slide caliper, and an average was taken. Table V lists the average diameters of the uncoated and coated cable samples and the average thickness of the coating.

## IV EXPERIMENTAL DATA

### 4.1 IGNITION

Ignition experiments were performed for piloted and autoignition under natural and forced air flow conditions and time to ignition was measured as a function of external heat flux. The data are listed in Table VI. Figures 2 and 3 are plots of the inverse of time to piloted ignition as a function of external heat flux. The uncoated cables samples show large decrease in time to ignition, whereas the coated samples show a gradual decrease in time to ignition as external heat flux is increased.

### 4.2 CABLE DAMAGE

Two techniques were used for the quantification of cable damage: The insulation/jacket vaporization technique, and the insulation resistance technique.

#### 4.2.1 Insulation/Jacket Vaporization Technique

In this technique, the optical transmission through fuel vapors under pyrolysis conditions (forced $N_2$ flow) was used as an indicator of the vaporization process. By measuring the optical transmission as a function of time and by linear extrapolation to the time axis, the time for the initiation of the vaporization process (or damage) was determined; data are listed in Table VI.

#### 4.2.2 Insulation Resistance Technique

In a new technique suggested by Florida Power and Light Company, the insulation resistance was measured for a cable sample, exposed to external heat

flux for various time periods. The technique was established by using cable sample No. 1-3x12-4 with and without the coating. A sample ~ 0.25-m long was used in a vertical position, ~ 0.15 m of which was exposed to an external heat flux of 48 $kW/m^2$, under forced air flow without a pilot flame. Seven experiments for uncoated cable and four experiments for coated cable samples were performed; in each experiment the exposure time period was varied. Samples were allowed to cool for ~ 24 hours at ~ 40% R.H. and ~ 20°C ambient temperature. The insulation resistance between the conductors was then measured, using a Simpson Insulation Tester (Model 401). Data are listed in Table VII and indicate that change in resistance occurs just before the ignition; very different from the initiation of fuel generation indicated by the insulation/jacket vaporization technique (see Tables VI and VII). The insulation resistance technique thus appears to be very simple and sensitive for electrical failure (see Tables VI and VII), but less sensitive as a technique for quantifying damage.

## 4.3 ELECTRICAL INTEGRITY TECHNIQUE

A schematic of the setup used for electrical integrity is shown in Figure 4. Figure 5 shows a test setup for a 3-conductor cable. In this technique, the cable sample is placed horizontally on an aluminum platform (which is the middle section of the cable); ~ 1.3-m long cable samples are used, where ~ 0.3-m length is exposed to the heat flux and ~ 0.5-m length cable at each end is left outside the heat flux zone and clamped to terminal strips, where all the resistors are located.

The conductors are interconnected in series with known resistors, such that voltage drop is the same at the end of each conductor. At the end of the last resistor, a variable resistor is connected as shown in Figures 4 and 5. Power is applied such that the voltage drop across each resistor is about 70 V dc. With this arrangement, shorting between conductors or conductors to ground would be indicated as a change in voltage across the variable resistor, which can be determined by the recorder. This technique is good for multi-conductor cables, but not for single-conductor cables.

The technique was used in this study, where the experiments were performed under natural air flow conditions with a pilot flame. The time at which a

rapid change occurred in voltage across the variable resistor was measured and was defined as time to electrical failure: data are listed in Table VI for coated and uncoated cable samples.

It appears that insulation resistance technique described in Section 4.2.2 is better to quantify electrical failure than the electrical integrity technique used in this study.

## 4.4 POOL FIRE EXPOSURE

Pool fire exposure experiments were performed under natural air flow conditions, using 75 ml of methanol in a ~ 10-cm diameter pyrex dish (actual heat release rate ≈ 170 $kW/m^2$). After steady-state combustion conditions were established (~ 120 s) for the pool fires, the cable sample (~ 6-m long) was placed inside the flame, ~ 1 cm above the pool and exposed for ~ 600 s. The time to ignition, however, could not be determined because of difficulty in determining the time for sustained ignition. The only data obtained from these exposures were the amount of combustibles consumed by exposing coated and uncoated cable samples, as well as the coating on the bare conductors; data are listed in Table VIII, including maximum estimated heat flux from the methanol flame to the cable sample. The data from external heat flux exposure of the samples are also included in Table VIII. The data indicate that the effects of heat flux exposure of the cable samples to the pool fire of methanol and external radiant heaters are similar in terms of consumption of combustibles.

## 4.5 GENERATION RATES OF FUEL VAPORS, HEAT, AND COMBUSTION PRODUCTS AND OPTICAL TRANSMISSION THROUGH "SMOKE"

Heat release rate, product generation rates (for CO, $CO_2$, and total gaseous hydrocarbons) and optical transmission through "smoke" were determined for the combustion of coated and uncoated cables exposed to an external heat flux of 48 $kW/m^2$ with an air flow rate of 0.003 $m^3/s$ which is adequate to maintain overventilated fire conditions. (Test conditions were the same as used in the ignition experiments.) The actual heat release rate was calculated from the following equation:

$$\dot{Q}''_A = 15\ \dot{G}''_{CO_2} + 16\ \dot{G}''_{CO} \quad (1)$$

where $\dot{Q}''_A$ is the actual heat release rate (kW/m$^2$); $\dot{G}''_{CO_2}$ is the generation rate of $CO_2$ (g/m$^2$s); and $\dot{G}''_{CO}$ is the generation rate of CO (g/m$^2$s).

The convective heat release rate $\dot{Q}''_c$ was calculated from the following equation:

$$\dot{Q}''_c = \dot{m}''_T\ C_p\ (T_g - T_a) \quad (2)$$

where $\dot{Q}''_c$ is in kW/m$^2$; $\dot{m}''_T$ = total mass flow rate of product-air mixture (g/m$^2$s); $C_p$ = specific heat of air at the gas temperature (kJ/gK); and $T_g$ = gas temperature. The radiative heat release rate, $\dot{Q}''_R$, was then calculated from the difference between $\dot{Q}''_A$ and $\dot{Q}''_c$. The product generation rate was calculated from:

$$\dot{G}''_j = \dot{V}_T\ C_j\ \rho_j/a \quad (3)$$

where $C_j$ is the concentration of the product j (volume fraction); $\dot{V}_T$ = total volumetric flow rate (m$^3$/s); $\rho_j$ is the density of the product j at the gas temperature and pressure in the duct (g/m$^3$); and a = surface area of the cable sample (m$^2$).

The optical transmission through "smoke" is calculated as follows:

$$D = \frac{1}{\ell}\ \ell n\ (I_o/I) \quad (4)$$

where D = optical density per unit length (m$^{-1}$); $\ell$ = optical path length; I = optical transmission through ambient air (mv); I = optical transmission through the mixture of products and ambient air (mv). The fuel vapor generation rate is calculated from the measured load cell data.

Table IX lists the data for the generation rates of fuel vapors, heat, and combustion products and optical transmission through "smoke".

## V ANALYSIS

### 5.1 CRITICAL FLUX AND ENERGY ASSOCIATED WITH CABLE DAMAGE, IGNITION, AND ELECTRICAL FAILURE

The total energy, E, associated with cable damage, ignition, and electrical failure is equal to time x external heat flux. If heat losses are

comparable to the external heat flux, E varies with the flux; if heat losses are considerably smaller than the external heat flux, E approaches a constant value, provided the surface processes remain invariant. This is shown in Figures 6 and 7 for piloted ignition and damage, where 1/E is plotted as a function of $\dot{q}''_e$ (external heat flux) under forced air flow conditions. In the figures, it can be noted that when $\dot{q}''_e$ is between ~ 12 to 16 $kW/m^2$ for uncoated cables and ~ 14 to 18 $kW/m^2$ for coated cables, 1/E ≈ 0, which indicates that the average critical flux for coated and uncoated cables is about 16 and 14 $kW/m^2$ respectively. As $\dot{q}''_e$ is increased, E decreases (or 1/E increases) and above ~ 50 $kW/m^2$, E approaches an asymptotic value for most of the samples. Thus above about 50 $kW/m^2$, E becomes almost independent of $\dot{q}''_e$. The asymptotic value of E is defined as the energy (for damage or piloted ignition). The values of E obtained in this fashion for the piloted ignition ($E_{ig}$), are listed in Table X for the forced air flow conditions. The average critical heat flux data are also included in the table. It can be noted that the graphical technique used for obtaining $E_{ig}$ values needs sufficient experimental data points, and thus is a very lengthy technique. Instead of the graphical technique, in this study we have used the technique of energy ratios.

Since the critical heat flux, $\dot{q}''_{cr}$, remains approximately the same for various processes, as determined in this study and our previous studies[1,2], we can express the ratio of the energies for two processes as equal to the ratio of times for the initiation of the processes; further, we can assume that the ratio of the energies is independent of air flow conditions. We can thus write:

$$\frac{(E_{ig})_{\text{piloted, natural air flow}}}{(E_{ig})_{\text{piloted, forced air flow}}} \simeq \frac{(t_{ig})_{\text{piloted, natural air flow}}}{(t_{ig})_{\text{piloted, forced air flow}}} \tag{5}$$

$$\frac{(E_{damage})_{\text{forced air flow}}}{(E_{ig})_{\text{piloted, forced air flow}}} \simeq \frac{(t_{damage})_{\text{forced air flow}}}{(t_{ig})_{\text{piloted, forced air flow}}} \tag{6}$$

$$\frac{(E_{ig})_{\text{auto, forced air flow}}}{(E_{ig})_{\text{piloted, forced air flow}}} \simeq \frac{(t_{ig})_{\text{auto, forced air flow}}}{(t_{ig})_{\text{piloted, forced air flow}}} \tag{7}$$

$$\frac{(E_{\text{electrical failure}})_{\text{natural air flow}}}{(E_{ig})_{\text{piloted, natural air flow}}} \simeq \frac{(t_{\text{electrical failure}})_{\text{natural air flow}}}{(t_{ig})_{\text{piloted, natural air flow}}} \tag{8}$$

$$\frac{(E_{\text{damage}})_{\text{natural air flow}}}{(E_{ig})_{\text{piloted, natural air flow}}} \approx \frac{(E_{\text{damage}})_{\text{forced air flow}}}{(E_{ig})_{\text{piloted, forced air flow}}} \tag{9}$$

$$\frac{(E_{\text{electrical failure}})_{\text{forced air flow}}}{(E_{ig})_{\text{piloted, forced air flow}}} \approx \frac{(E_{\text{electrical failure}})_{\text{natural air flow}}}{(E_{ig})_{\text{piloted, natural air flow}}} \tag{10}$$

where $t_i$ is the time for the initiation of process, i; and $E_i$ is the energy under natural or forced air flow conditions. E values calculated from eqs (5) to (10) are listed in Table X. Figures 8 and 9 show comparisons of E values for ignition and damage for coated and uncoated cables. Actual data are indicated by the symbols and solid lines; theoretical conditions are represented by the dashed lines, where it is assumed that coatings are ineffective. The data in Figures 8 and 9 indicate that, for ignition and damage, the coatings are effective in increasing the energies in the range of heat fluxes used in the experiments. The data thus indicate that the coatings would be expected to be effective in increasing the energies for ignition and damage in various fire scenarios.

The larger the value of E for a process, the slower is the initiation of the process. The data in Table X and Figures 8 and 9 indicate that, for the coated cables, values of E for all the processes are larger than values for the uncoated cables and thus the coatings are effective in delaying the initiation of damage, ignition, and electrical failure; it is expected that flame propagation for coated cable samples would also be slower than for uncoated samples.

If the thermal environment for a fire scenario is known or can be estimated, the data in Table X can be used to estimate the initiation of damage, electrical failure and auto and piloted ignition, and the relative rate of flame propagation.

## 5.2 COMPARISON OF GENERATION RATES OF FUEL VAPORS, HEAT AND FIRE PRODUCTS AND OPTICAL TRANSMISSION THROUGH "SMOKE" FOR COATED AND UNCOATED SAMPLES

The data listed in Table IX for the average maximum values of fuel generation rate ($G''_{fuel}$); actual, convective, and radiative heat release rates ($\dot{Q}''_A$, $\dot{Q}''_c$ and $\dot{Q}''_R$ respectively); optical density (D); and product generation rates ($\dot{G}''_j$), indicate that there is no significant difference between coated and uncoated cables. It thus appears that, at a stage where fire is burning at its maximum intensity, the coatings are expected to have an insignificant effect on the fire.

Table XI lists the data for $\dot{G}''_{fuel}$, $\dot{Q}''_A$, $\dot{Q}''_c$, $\dot{Q}''_R$, $\dot{G}''_j$, and D normalized by $\dot{q}''_e$. The ratio of $D/\dot{q}''_e$ is multiplied by the total volumetric flow rate, $\dot{V}_T$, to account for the dilution of the fire products. The data in Table XI can be used to estimate generation rates of fuel vapors, fire products, and heat and light obscuration for various fire scenarios for which thermal environmental heat flux can be estimated or is known and fires are overventilated.

The data in Table XI again indicates that the coatings are expected to be ineffective once the fire reaches its peak intensity.

## 5.3 OVERALL COMPARISON OF FIRE PROPERTIES OF COATED AND UNCOATED CABLE SAMPLES

For an overall comparison of the fire properties of coated and uncoated cable samples, ratios of individual properties of the coated and uncoated cables can be used. This is shown in Table XII; the data indicate:

1) Coatings are effective in the early stages of fire, i.e., enhancing the energies required for damage, ignition, and electrical failure.

2) Coatings are more effective in enhancing energies required for damage and piloted ignition than for autoignition and electrical failure.

3) The energies are expected to be smaller under natural air flow conditions than under forced air flow conditions.

4) The effectiveness of the coatings appears to depend on the generic nature of the cable insulation/jacket materials in terms of physical changes to the materials when exposed to heat (melting, vaporization, charring, thermal expansion, etc.).

## NOMENCLATURE

| | |
|---|---|
| $a$ | total exposed cable surface area ($m^2$) |
| $c$ | concentration of fire product (ppm) |
| $c_p$ | specific heat of air (kJ/gK) |
| $D$ | optical density per unit path length ($m^{-1}$) |
| $E$ | energy ($kJ/m^2$) |
| $\dot{G}''$ | generation rate of fuel vapors and fire products per unit exposed surface area of the cable ($g/m^2s$) |
| $I$ | optical transmission through "smoke" (mv) |
| $I_o$ | optical transmission through air (mv) |
| $\ell$ | optical path length (m) |
| $\dot{m}''_T$ | total mass flow rate of product-air mixture per unit exposed surface area of the cable ($g/m^2s$) |
| $\dot{Q}''$ | heat release rate per unit exposed surface area of the cable ($kW/m^2$) |
| $\dot{q}''_e$ | external heat flux applied to the cable sample ($kW/m^2$) |
| $\dot{q}''_{cr}$ | critical heat flux for the cable sample ($kW/m^2$) |
| $T$ | temperature (K) |
| $t$ | time (s) |
| $\dot{V}_T$ | total volumetric flow rate of product-air mixture ($m^3/s$) |
| $\rho_a$ | density of air ($g/m^3$) |

Superscripts

| | |
|---|---|
| $\cdot$ | per unit of time ($S^1$) |
| " | per unit exposed surface area of the cable sample ($m^2$) |

Subscripts

| | |
|---|---|
| A | actual |
| a | ambient |
| C | convective |
| cr | critical |
| e | external |
| g | gas |
| i | individual processes (damage, ignition, electrical failure) |
| j | individual fire products |
| R | radiative |

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1) Tewarson, A., Lee, J.L., Pion, R.F., "Categorization of Cable Flammability Part I. Laboratory Evaluation of Cable Flammability Parameters," Electric Power Research Institute, Palo Alto, California, Technical Report EPRI NP-1200, Project 1165-1, Interim Report October 1979.

2) Lee, J.L., "A Study of Damageability of Electrical Cables in Simulated Fire Environments," Electric Power Research Institute, Palo Alto, California, Technical Report EPRI NP-1767, Project 1165-1-1, Final Report March 1981.

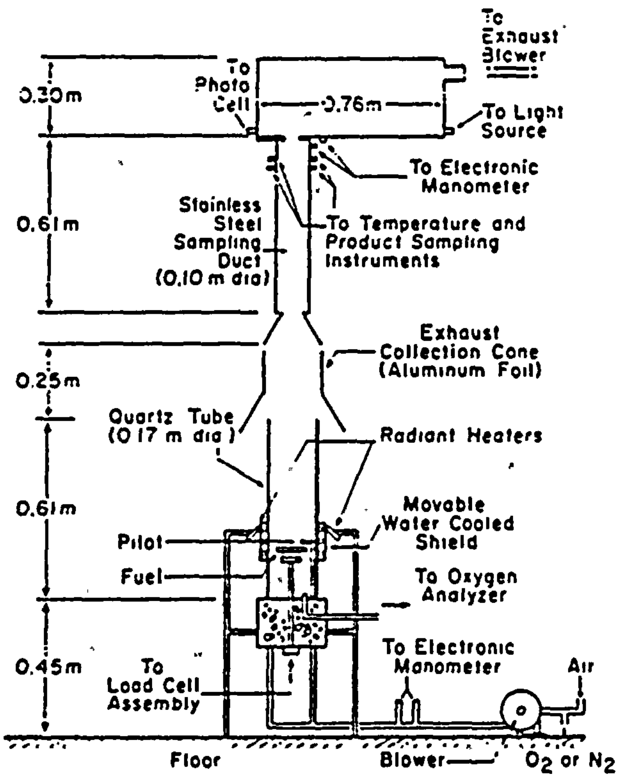


FIGURE 1 FACTORY MUTUAL COMBUSTIBILITY APPARATUS

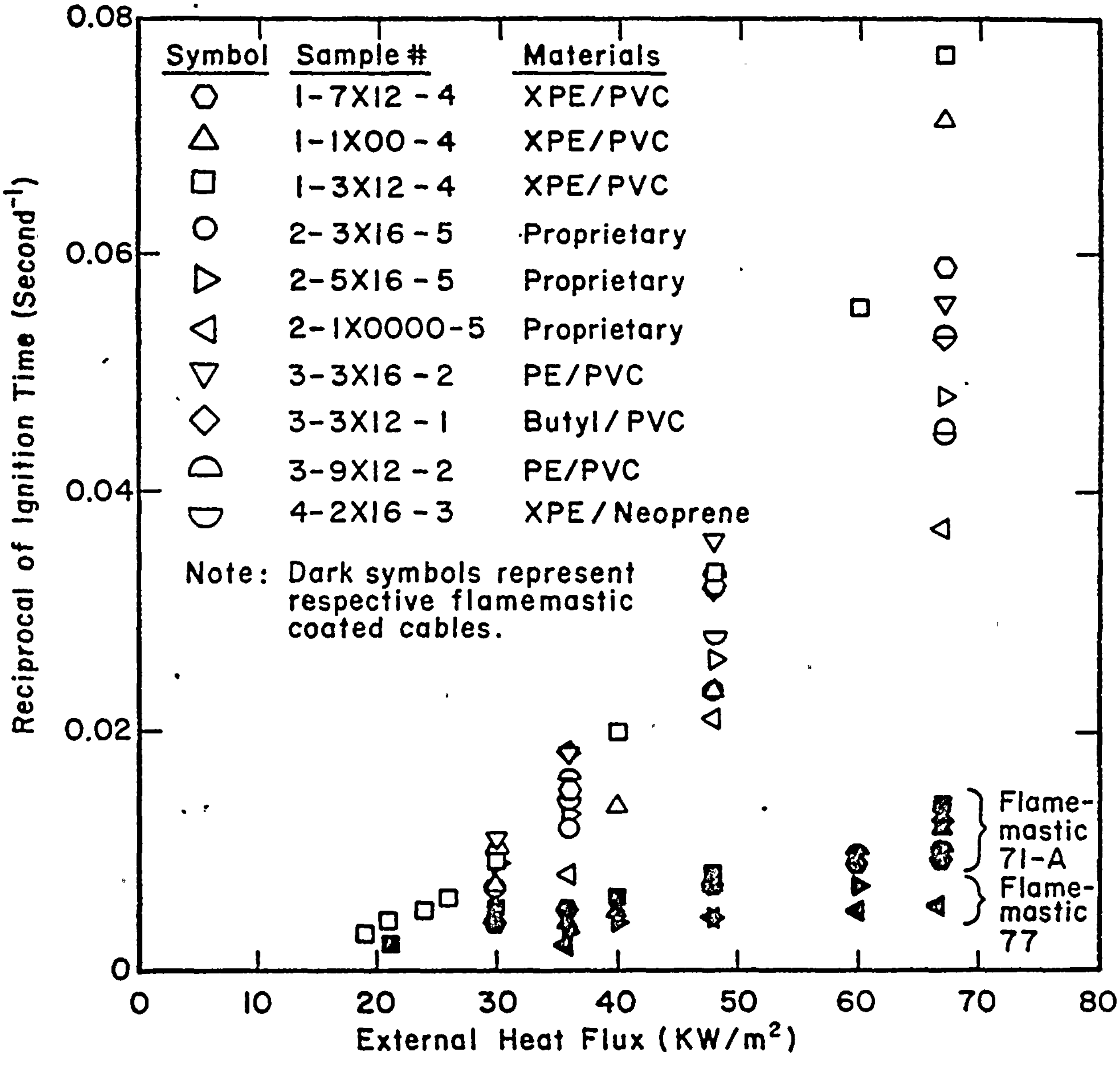


FIGURE 2 RECIPROCAL OF PILOTED IGNITION TIME FOR COATED AND UNCOATED CABLE SAMPLES AS A FUNCTION OF EXTERNAL HEAT FLUX

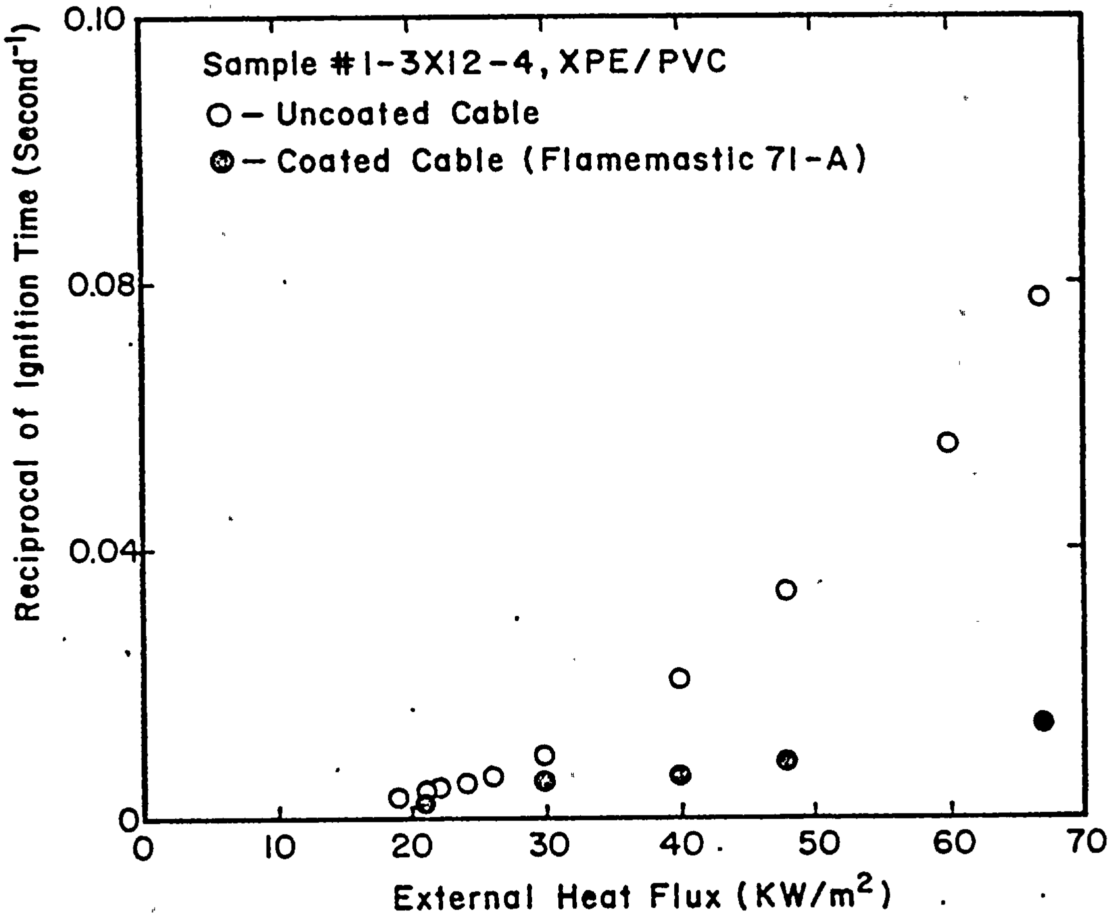


FIGURE 3 RECIPROCAL OF PILOTED IGNITION TIME FOR COATED AND UNCOATED CABLE SAMPLE NO. 1-3x12-4 AS A FUNCTION OF EXTERNAL HEAT FLUX

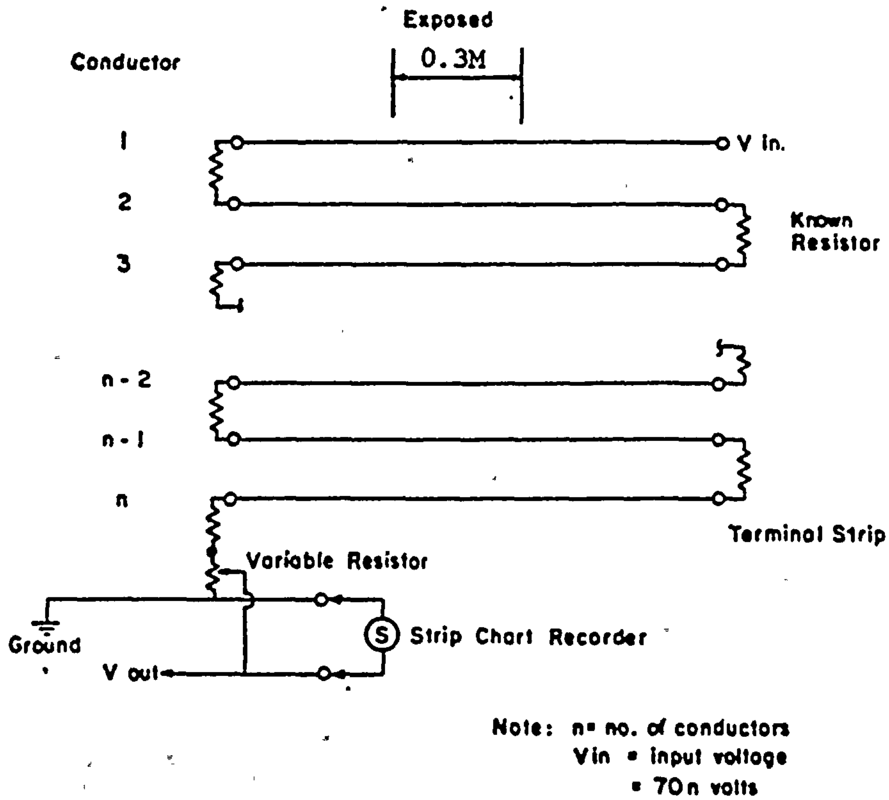


Figure 4 Schematic of Electrical Integrity Failure Experimental Setup

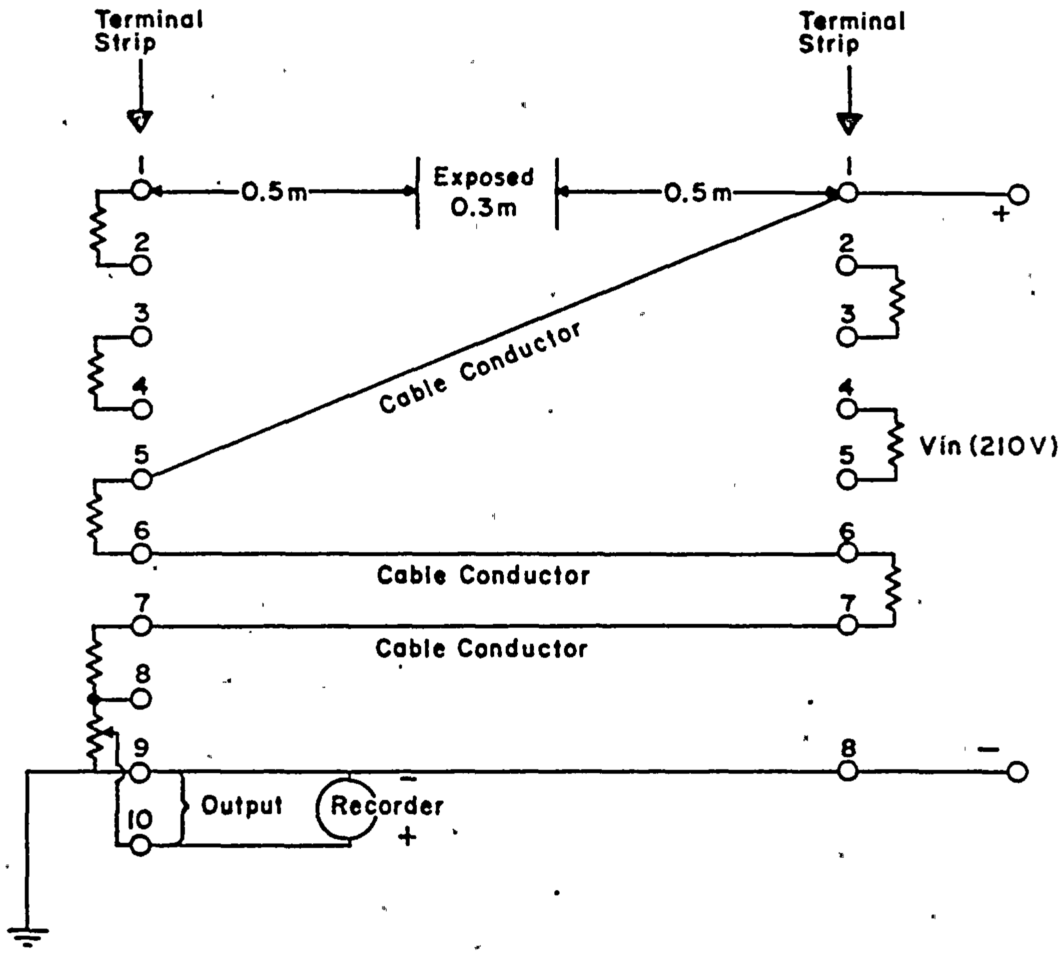


Figure 5 Electrical Integrity Failure Experimental Setup for a 3-Conductor Cable.

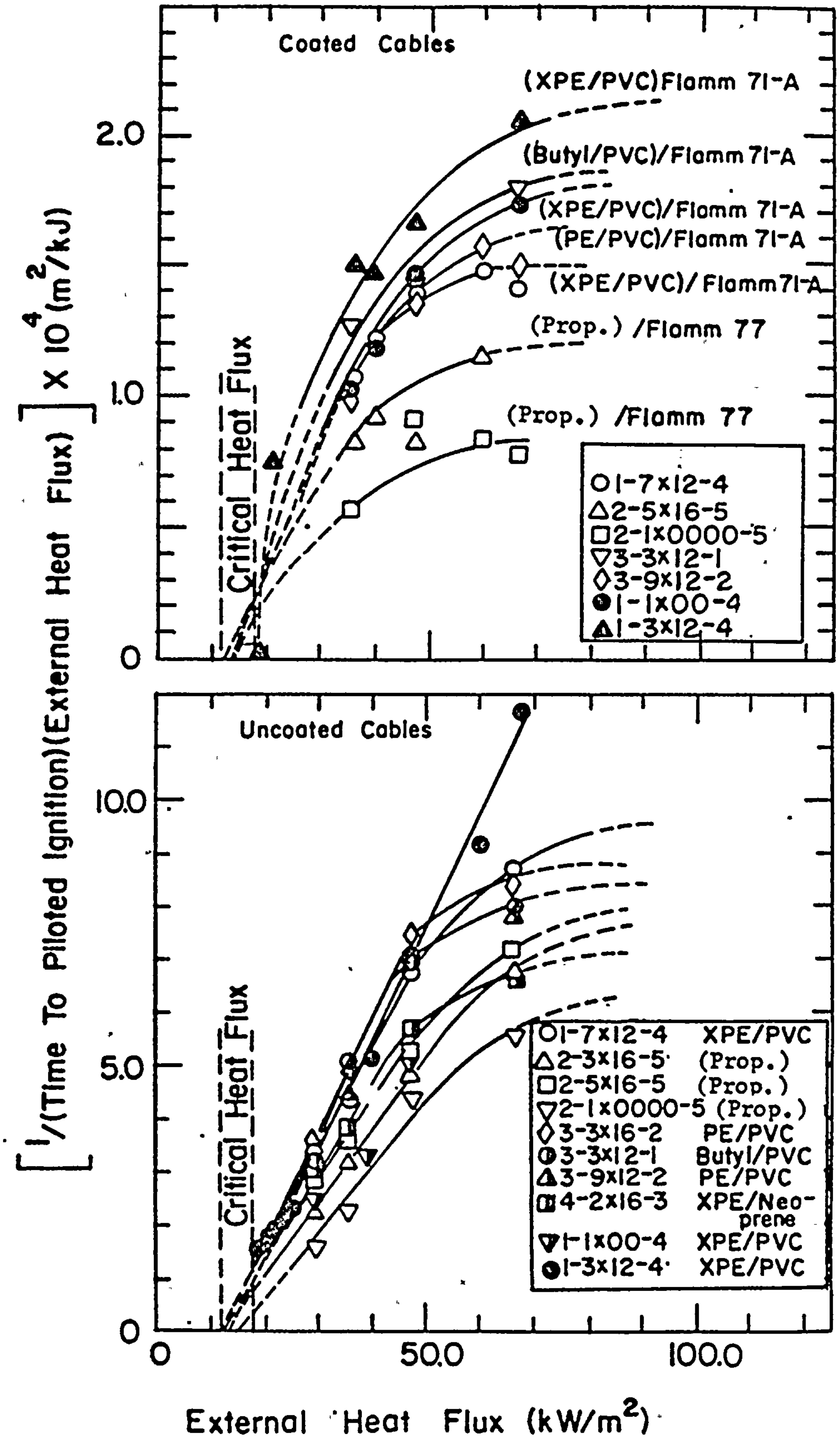


FIGURE 6. RECIPROCAL OF IGNITION ENERGY FOR COATED AND UNCOATED CABLE SAMPLES AS A FUNCTION OF EXTERNAL HEAT FLUX (Piloted ignition)

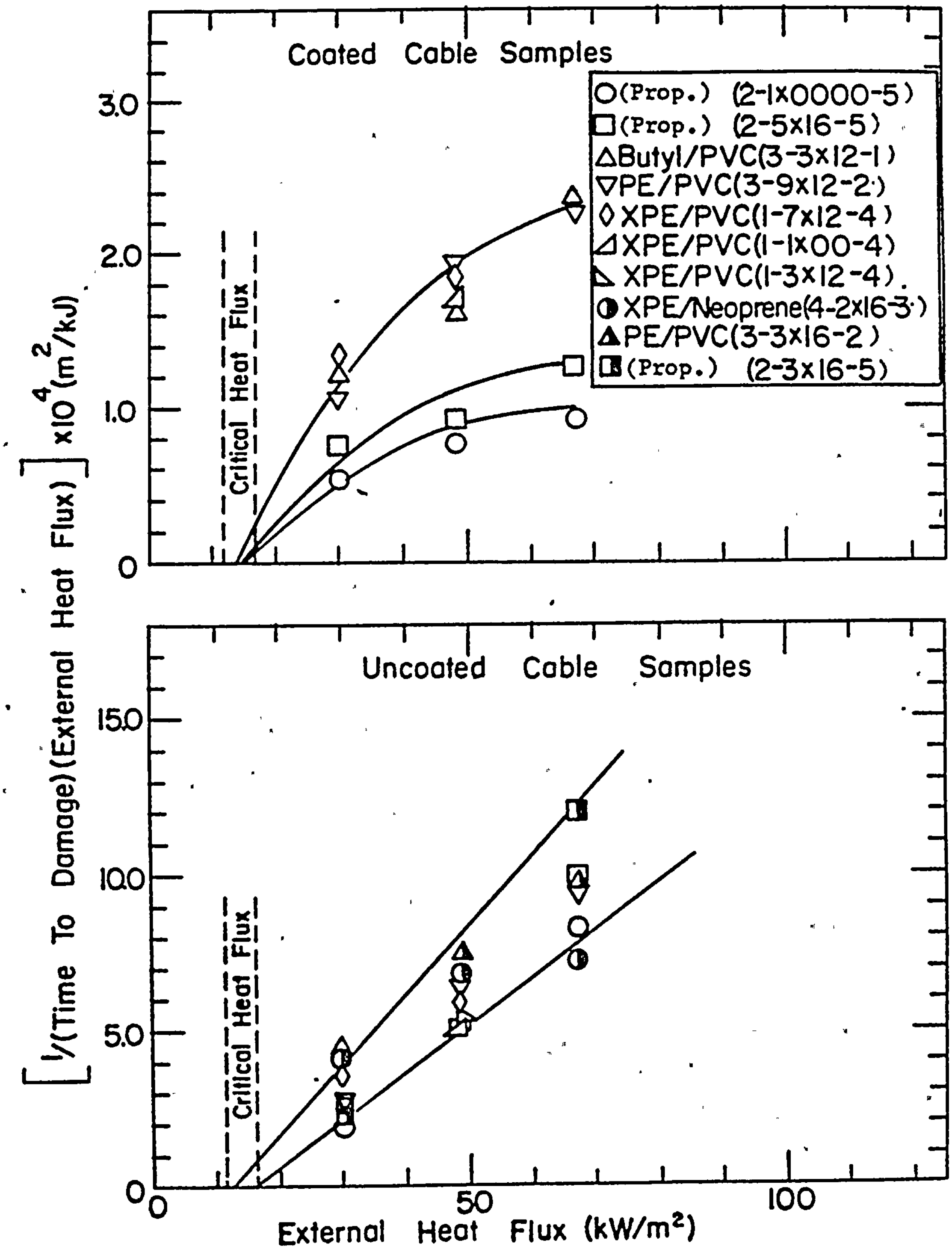


FIGURE 7. RECIPROCAL OF ENERGY FOR DAMAGE FOR COATED AND UNCOATED CABLE SAMPLES AS A FUNCTION OF EXTERNAL HEAT FLUX (Auto ignition)

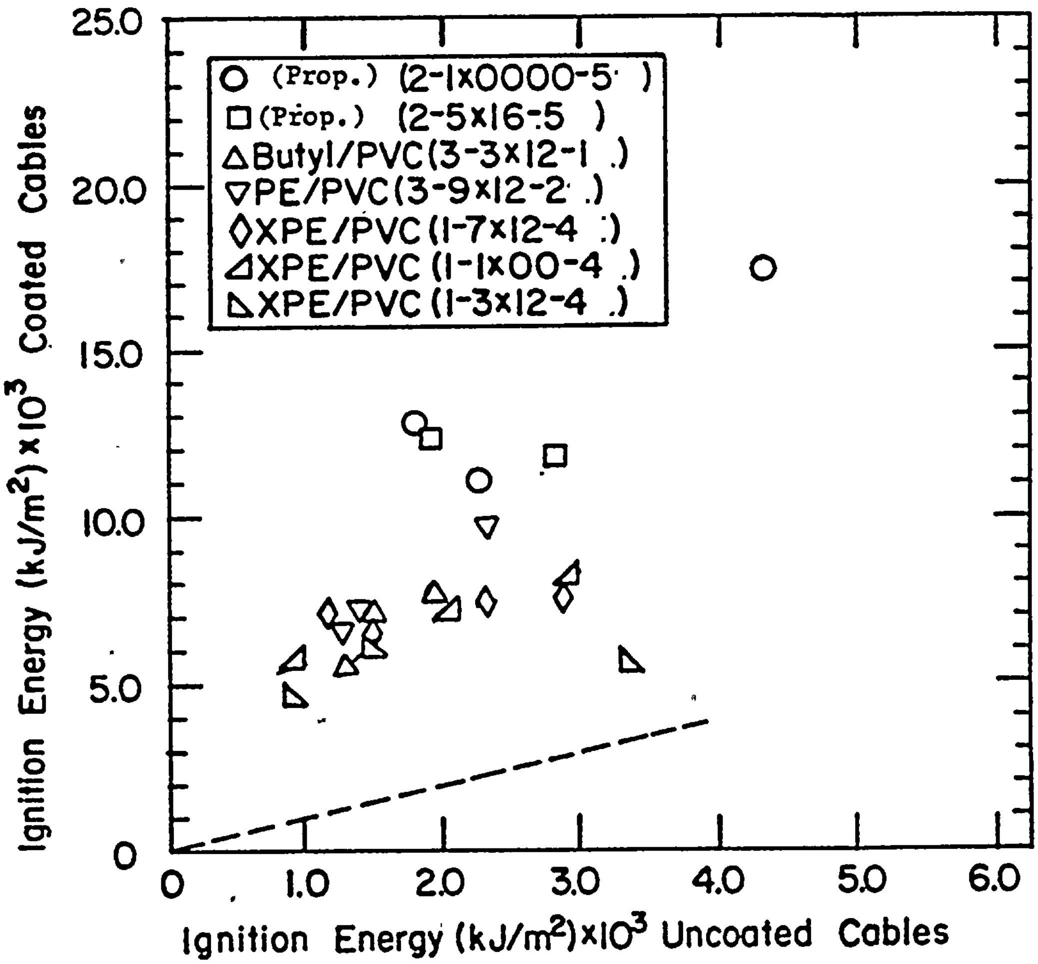


FIGURE 8. COMPARISON OF IGNITION ENERGY (Piloted ignition) FOR COATED AND UNCOATED CABLE SAMPLES
Dashed line represents theoretical condition where coatings are assumed to be ineffective.

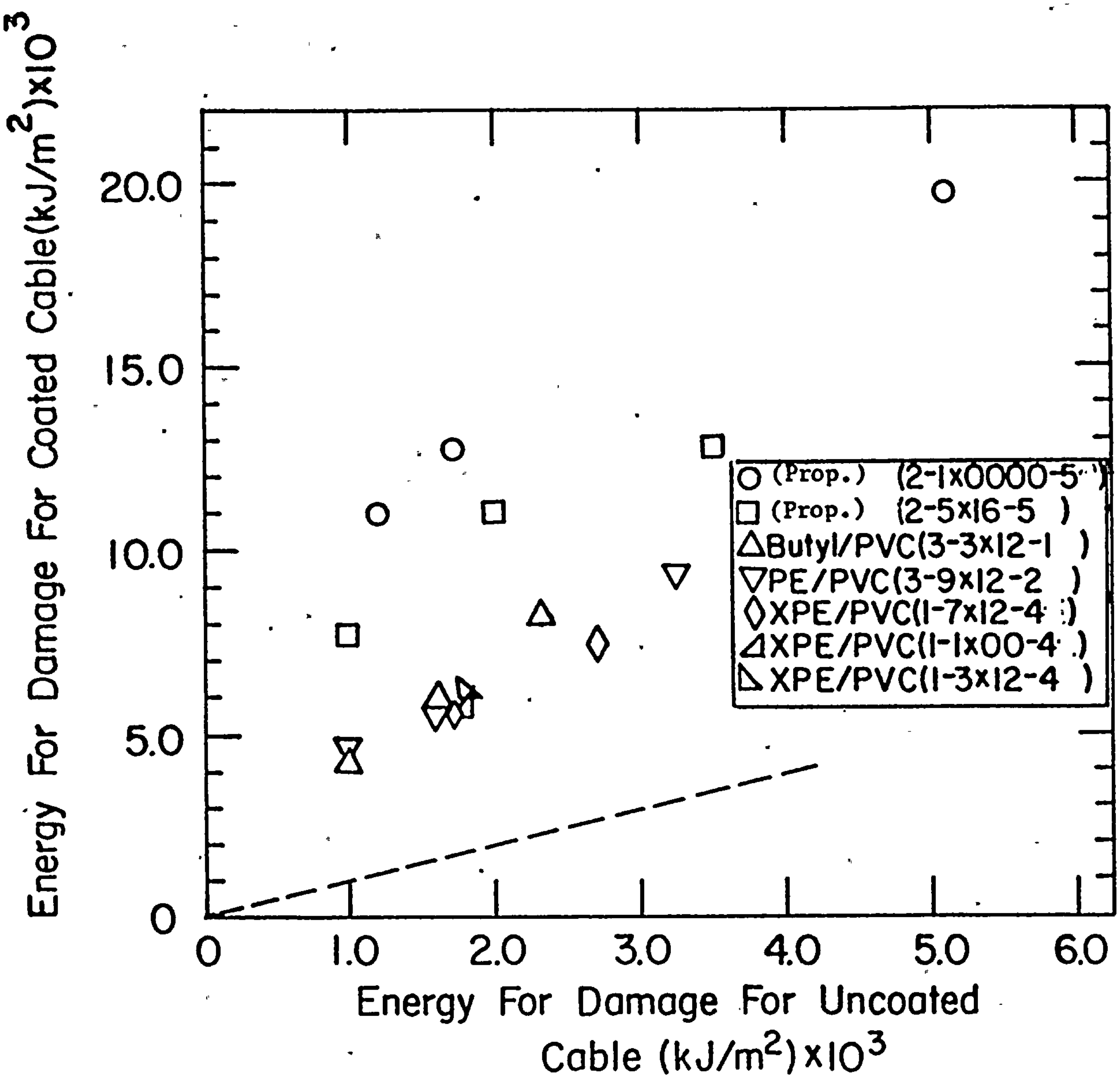


FIGURE 9. COMPARISON OF ENERGY FOR DAMAGE (Auto ignition) FOR COATED AND UNCOATED CABLE SAMPLES Dashed line represents theoretical condition where coatings are assumed to be ineffective

TABLE I

MANUFACTURER IDENTIFICATION CODE

| First Number of the Cable Identification | Manufacturer |
|---|---|
| 1- | 1 |
| 2- | 2 |
| 3- | 3 |
| 4- | 4 |

TABLE II

NUMBER OF CONDUCTORS AND WIRE GAGE IDENTIFICATION CODE

| Second Number of the Cable Identification | Number of Conductors | Wire Gage (AWG) |
|---|---|---|
| -2X16- | 2 | 16 |
| -3X16- | 3 | 16 |
| -3X12- | 3 | 12 |
| -7X12- | 7 | 12 |
| -9X12- | 9 | 12 |
| -1X00- | 1 | 2/0 |
| -1X0000- | 1 | 4/0 |

TABLE III

INSULATING MATERIAL IDENTIFICATION CODE

| Third Number of the Cable Identification | Insulation/Jacket Materials |
|---|---|
| -1- | Butyl/PVC |
| -2- | PE/PVC |
| -3- | XPE/Neoprene |
| -4- | XPE/PVC |
| -5- | Proprietary |

Abbreviations: PVC - Polyvinyl Chloride;
PE - Polyethylene
XPE - Cross-linked Polyethylene

## TABLE IV

## DETAILED DESCRIPTION OF FP&L CABLES (UNCOATED)

| Sample | Wire Size (AWG) | Cable Type | No. of Cond. | Insulation Jacket Materials | Cable Outside Diameter $D_o$ (cm) | Insulation Thickness of each Conductor (cm) | Jacket Thickness (cm) | Effective Surface Area* of the Cable (6 cm long) in Vert. Pos. ($cm^2$) | Linear Density (gm/cm) Total Cable | Linear Density (gm/cm) Insulation/Jacket Material | Insulation/Jacket Materials (% of Total Cable Wt.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-7X12-4 | 12 | Control | 7 | XPE/PVC | 1.74 | 0.140 | 0.165 | 34.92 | 4.47 | 2.32 | 52 |
| 1-1X00-4 | 2/0 | Power | 1 | XPE/PVC | 2.02 | 0.20 | 0.150 | 43.31 | 7.98 | 1.87 | 24 |
| 1-3X12-4 | 12 | Power | 3 | XPE/PVC | 1.57 | 0.125 | 0.125 | 33.11 | 2.14 | 0.89 | 58 |
| 2-3X16-5 | 16 | Instrument | 3 | Proprietary | 1.18 | 0.130 | 0.191 | 23.28 | 2.03 | 1.56 | 77 |
| 2-5X16-5 | 16 | Control | 5 | Proprietary | 1.09 | 0.064 | 0.191 | 21.40 | 2.13 | 1.49 | 70 |
| 2-1X0000-5 | 4/0 | Power | 1 | Proprietary | 2.13 | 0.178 | 0.216 | 42.39 | 12.78 | 3.31 | 26 |
| 3-3X16-2 | 16 | Instrument | 3 | PE/PVC | 0.95 | 0.089 | 0.191 | 18.54 | 1.18 | 0.79 | 67 |
| 3-3X12-1 | 12 | Power | 3 | Butyl/PVC | 1.57 | 0.178 | 0.191 | 31.39 | 3.27 | 2.37 | 73 |
| 3-9X12-2 | 12 | Control | 9 | PE/PVC | 1.90 | 0.102 | 0.191 | 38.32 | 5.10 | 2.40 | 47 |
| 4-2X16-3 | 16 | Instrument | 2 | XPE/Neoprene | 0.93 | 0.089 | 0.191 | 18.18 | 1.21 | 0.89 | 74 |

*The effective surface area of the cable in vertical position is calculated by the following formula (bottom part of the cable is not included in the calculation): $\frac{\pi}{4}(4 D_o h + D_o^2 - ND_1^2)$

where $D_o$ is the outer diameter of the cable

$D_1$ is the diameter of each conductor strand

N is the number of conductor strands

h is the height of the cable.

TABLE V

MEASURED AVERAGE DIAMETER OF COATED AND UNCOATED CABLES

| Cable Type | Number | Average Diameter (cm) Uncoated | Coated | Average Coating Thickness (cm) |
|---|---|---|---|---|
| XPE/PVC | 1-7X12-4[a] | 1.74 | 2.11 | 0.19 |
| XPE/PVC | 1-1X00-4[a] | 2.02 | 2.37 | 0.18 |
| XPE/PVC | 1-3X12-4[a] | 1.57 | 1.91 | 0.17 |
| PE/PVC | 3-9X12-2[a] | 1.90 | 2.21 | 0.16 |
| Butyl/PVC | 3-3X12-1[a] | 1.57 | 1.90 | 0.17 |
| Prop. | 2-5X16-5[b] | 1.09 | 1.44 | 0.18 |
| Prop. | 2-1X0000-5[b] | 2.13 | 2.43 | 0.15 |

[a] Coated with Flamemastic 71-A

[b] Coated with Flamemastic 77

TABLE VI

TIME TO CABLE DAMAGE, IGNITION, AND ELECTRICAL FAILURE AS A FUNCTION OF EXTERNAL HEAT FLUX

| Cable Type[a] | Number[b] | Heat Flux ($kW/m^2$) | Time (s): Forced Air Flow[c] — Damage U | Damage C | Ignition Piloted U | Ignition Piloted C | Ignition Auto U | Ignition Auto C | Natural Air Flow[d] — Piloted Ignition U | Piloted Ignition C | Electrical Failure U | Electrical Failure C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| XPE/PVC | 1-7x12-4[e] | 30 | 90 | 246 | 97 | 260 | N | N | - | - | - | 500 |
| | | 36 | - | - | 65 | 207 | - | - | - | - | - | - |
| | | 48 | 35 | 115 | 31 | 152 | 366 | 543 | 22 | 86 | 200 | 280 |
| | | 60 | - | - | - | 113 | - | - | - | - | - | - |
| | | 67 | 16 | 73 | 17 | 110 | 239 | 312 | - | - | - | - |
| | 1-1x00-4[e] | 30 | - | - | 144 | - | - | - | - | - | NF | - |
| | | 36 | - | - | - | 260 | - | - | - | - | - | - |
| | | 40 | - | - | 74 | 208 | - | - | - | - | - | - |
| | | 48 | 40 | 120 | 43 | 148 | 340 | 434 | 19 | 86 | 228 | 440 |
| | | 67 | 13 | 68 | 14 | 86 | - | - | - | - | - | - |
| | 1-3x12-4[e] | 19 | - | - | 327 | N | - | - | - | - | - | - |
| | | 21 | - | - | 264 | 630 | - | - | - | - | - | - |
| | | 22 | - | - | 231 | - | - | - | - | - | - | - |
| | | 24 | - | - | 205 | - | - | - | - | - | - | - |
| | | 26 | - | - | 164 | - | - | - | - | - | - | - |
| | | 30 | - | - | 111 | 185 | - | - | - | - | 192 | 390 |
| | | 40 | - | - | 49 | 172 | - | - | - | - | - | - |
| | | 48 | 37 | 120 | 30 | 126 | 342 | 440 | 18 | 65 | 110 | 300 |
| | | 60 | - | - | 18 | - | - | - | - | - | - | - |
| | | 67 | 12 | 58 | 13 | 73 | - | - | - | - | - | - |
| XPE/Neoprene | 4-2x16-3 | 30 | 90 | - | 98 | - | - | - | - | - | - | - |
| | | 36 | - | - | 72 | - | - | - | - | - | - | - |
| | | 48 | 30 | - | 36 | - | N | - | 31 | - | 200 | - |
| | | 67 | 21 | - | 22 | - | N | - | - | - | - | - |
| PE/PVC | 3-3x16-2 | 30 | 87 | - | 93 | - | - | - | - | - | - | - |
| | | 36 | - | - | 55 | - | - | - | - | - | - | - |
| | | 48 | 27 | - | 28 | - | N | - | 15 | - | 88 | - |
| | | 67 | 15 | - | 18 | - | 165 | - | - | - | - | - |
| | 3-9x12-2[e] | 30 | 108 | 313 | 115 | - | - | - | - | - | - | 484 |
| | | 36 | - | - | 63 | 271 | - | - | - | - | - | - |
| | | 48 | 32 | 109 | 30 | 151 | 279 | 550 | 18 | 74 | 130 | 300 |
| | | 60 | - | - | - | 105 | - | - | - | - | - | - |
| | | 67 | 15 | 65 | 19 | 101 | 181 | 343 | - | - | - | - |
| Butyl/PVC | 3-3x12-1[e] | 30 | 78 | 273 | 101 | - | N | N | - | - | - | - |
| | | 36 | - | - | 55 | 218 | - | - | - | - | - | - |
| | | 48 | 33 | 126 | 31 | 148 | N | N | 17 | 78 | 184 | 254 |
| | | 67 | 15 | 65 | 19 | 84 | N | N | - | - | - | - |
| Proprietary | 2-3x16-5 | 30 | 141 | - | 145 | - | N | - | - | - | - | - |
| | | 36 | - | - | 86 | - | - | - | - | - | - | - |
| | | 48 | 38 | - | 43 | - | N | - | 35 | - | 200 | - |
| | | 67 | 18 | - | 22 | - | N | - | - | - | - | - |
| | 2-5x16-5[f] | 30 | 117 | 426 | 115 | - | N | N | - | - | - | 480 |
| | | 36 | - | - | 78 | 330 | - | - | - | - | - | - |
| | | 40 | - | - | - | 272 | - | - | - | - | - | - |
| | | 48 | 41 | 230 | 39 | 261 | N | N | 31 | 124 | 184 | 296 |
| | | 60 | - | - | - | 143 | - | - | - | - | - | - |
| | | 67 | 15 | 115 | 21 | - | N | N | - | - | - | - |
| | 2-1x0000-5[f] | 30 | 171 | 652 | 203 | - | N | N | - | - | - | - |
| | | 36 | - | - | 119 | 486 | - | - | - | - | - | - |
| | | 48 | 36 | 266 | 47 | 231 | N | N | 40 | 167 | NF | NF |
| | | 60 | - | - | - | 207 | - | - | - | - | - | - |
| | | 67 | 18 | 165 | 27 | 191 | N | N | - | - | - | - |

U: Uncoated; C: Coated

[a] XPE: cross linked polyethylene; PVC: polyvinylchloride; PE: polyethylene; [b]See Table IV for designations;

[c]Sample surrounded by quartz tube with a forced air flow rate of ~0.003 $m^3/s$; U: uncoated; C: coated

[d]Sample without the quartz tube and without the forced air flow; [e]Coating:Flamemastic 71-A;

[f]Coating:Flammastic 77

N = No ignition occurred; NF = No electrical failure

TABLE VII

INSULATION RESISTANCE OF UNCOATED AND COATED XPE/PVC CABLE (1-3x12-4) EXPOSED TO 48 $kW/m^2$ OF EXTERNAL HEAT FLUX FOR VARIOUS TIME PERIODS[a]

| Exposure Time (s) | Average Insulation Resistance between Conductors (megohms) | |
|---|---|---|
| | Uncoated | Coated |
| 30 | ∞ | - |
| 60 | ∞ | - |
| 120 | ∞ | ∞ |
| 180 | ∞ | - |
| 240 | ∞ | ∞ |
| 300 | 20 | - |
| 360 | 0.04[c] | ∞ |
| 480 | - | 0.02[d] |

[a] Forced air flow in the absence of the pilot flame.

[b] Applied voltage 500 V dc.

[c] Time to autoignition 342 s.

[d] Time to autoignition 440 s.

TABLE VIII

CONSUMPTION OF CABLE INSULATION UNDER RADIANT AND POOL FIRE HEAT EXPOSURE

| Cable Type | Number | Heat Flux ($kW/m^2$) | Combustible Materials Consumed[d] (% of initial weight of insul/jacket mat.) Uncoated | Coated[e] |
|---|---|---|---|---|
| XPE/PVC | 1-7x12-4 [b] | 30 | 83 | 65 |
| | | 48 | 77 | 60 |
| | | 67 | 90 | 71 |
| | | ~33(Methanol)[a] | 73 | 55 |
| | 1-1x00-4 [b] | 48 | 83 | 74 |
| | | ~31(Methanol)[a] | 63 | 56 |
| | 1-3x12-4 [b] | 48 | 87 | 82 |
| | | ~34(Methanol)[a] | 69 | 63 |
| Proprietary | 2-3x16-5 | 30 | 78 | |
| | | 48 | 86 | |
| | | 67 | 81 | |
| | | ~37(Methanol)[a] | 73 | |
| | 2-5x16-5[c] | 30 | 74 | 66 |
| | | 48 | 74 | 68 |
| | | 67 | 77 | 71 |
| | | ~38(Methanol)[a] | 64 | 46 |
| | 2-1x0000-5[c] | 30 | 77 | 53 |
| | | 48 | 73 | 62 |
| | | 67 | 80 | 71 |
| | | ~30(Methanol)[a] | 67 | 34 |
| PE/PVC | 3-3x16-2 | 30 | 69 | |
| | | 48 | 74 | |
| | | 67 | 79 | |
| | | ~40(Methanol)[a] | 76 | |
| Butyl/PVC | 3-3x13-1[b] | 30 | 63 | 52 |
| | | 48 | 70 | 52 |
| | | 67 | 70 | 59 |
| | | ~34(Methanol)[a] | 70 | 48 |
| PE/PVC | 3-9x12-2[b] | 30 | 76 | 64 |
| | | 48 | 81 | 78 |
| | | 67 | 89 | 79 |
| | | ~32(Methanol)[a] | 74 | 67 |
| XPE/Neoprene | 4-2x16-3 | 30 | 74 | |
| | | 48 | 71 | |
| | | 67 | 71 | |
| | | ~40(Methanol)[a] | 68 | |

[a]75 ml of methanol burned in ~10-cm diameter Pyrex dish (Heat Release Rate = 170 $kW/m^2$) and the cable was completely inside the flame; [b]Coated with Flamemastic 71A; [c]Coated with Flamemastic 77; [d]under autoignition; [e]Corrected for mass loss of coating.

TABLE IX

AVERAGE MAXIMUM VALUES OF GENERATION RATIO OF FUEL VAPORS, HEAT AND COMBUSTION PRODUCTS AND OPTICAL TRANSMISSION THROUGH "SMOKE" FOR COATED AND UNCOATED CABLE SAMPLES[a]

| Cable Type | Number | Product Generation Rate ($g/m^2 s$) $CO_2$ | | CO | | Hydrocarbons | | Optical Density ($m^{-1}$) | | Heat Release Rate ($kW/m^2$)[b] Actual | | Conv | | Rad | | Mass Loss Rate[c] ($g/m^2 s$) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | U | C | U | C | U | C | U | C | U | C | U | C | U | C | U | C |
| XPE/PVC | 1-7x12-4 | 13.2 | 11.8 | 0.53 | 0.65 | 0.041 | 0.08 | 0.11 | 0.10 | 200 | 181 | 148 | 176 | 52 | 5 | 7 | 10 |
| | | 24.4 | 21.4 | 0.17 | 0.17 | 0.004 | 0.01 | 0.08 | 0.09 | 359 | 314 | 280 | 252 | 79 | 62 | 11 | 4 |
| | 1-1x00-4 | 13.4 | 12.7 | 0.37 | 0.24 | 0.030 | 0.03 | 0.08 | 0.09 | 201 | 188 | 118 | 179 | 83 | 9 | 10 | 8.3 |
| | | 24.3 | - | 0.23 | - | 0.010 | - | 0.05 | - | 358 | - | 252 | - | 106 | 0.7 | - | - |
| | 1-3x12-4 | 17.1 | 12.8 | 0.60 | 0.60 | 0.060 | 0.08 | 0.07 | 0.14 | 257 | 194 | 167 | 183 | 90 | 11 | 13 | 26 |
| | | 25.6 | 21.8 | 0.20 | 0.20 | 0.010 | 0.01 | 0 | 0.09 | 376 | 321 | 258 | 249 | 118 | 72 | 8.5 | 21.3 |
| XPE/Neoprene | 4-2x16-3 | 15.6 | - | 0.96 | - | 0.120 | - | 0.05 | - | 239 | - | 151 | - | 88 | - | 18 | - |
| PE/PVC | 3-3x16-2 | 24 | - | 0.65 | - | 0.051 | | 0.11 | - | 359 | - | 207 | - | 152 | - | 22 | - |
| | 3-9x12-2 | 14.3 | 14.3 | 0.44 | 0.37 | 0.040 | 0.04 | 0.13 | 0.13 | 214 | 213 | 143 | 186 | 71 | 27 | 14.2 | 12 |
| | | 35 | - | 0.41 | - | 0.040 | | 0.21 | - | 516 | - | 287 | - | 229 | - | 25 | - |
| Butyl/PVC | 3-3x12-1 | 17.7 | 15.6 | 0.71 | 0.48 | 0.070 | 0.06 | 0.14 | 0.13 | 268 | 234 | 217 | 117 | 51 | 33 | 12 | 7 |
| | | 22.8 | | 0.36 | | 0.020 | | 0.13 | | 338 | - | 295 | - | 43 | | 10 | |
| Proprietary | 2-3x16-5 | 24.6 | - | 2.9 | - | 0.340 | | 0.19 | - | 397 | - | 233 | - | 164 | | 15 | - |
| | 2-5x16-5 | 13.9 | 16.2 | 1.1 | 2.4 | 0.210 | 0.35 | 0.05 | 0.10 | 217 | 267 | 151 | 231 | 66 | 36 | 20 | 24 |
| | 2-1x0000-5 | 16 | 10.7 | 1.4 | 0.95 | 0.180 | 0.14 | 0.13 | 0.10 | 249 | 168 | 231 | 155 | 18 | 13 | 10 | 9 |

U: Uncoated; C: Coated

[a] External flux 48 $kW/m^2$; cable sample in vertical position, forced air flow rate, ~0.003 $m^3/s$; in the presence of a pilot flame

[b] Heat losses to the sampling duct corrected from fata for natural gas/air flame and methanol pool fires

[c] Some uncertainty due to coatings and char falling off, and insufficient amounts of combustibles

TABLE X

CRITICAL FLUX AND ENERGY ASSOCIATED WITH CABLE DAMAGE, IGNITION AND ELECTRICAL FAILURE

| Cable Type | Number | Average Critical Heat Flux (kW/m$^2$) | | Energy (kJ/m$^2$) | | | | | | | | | | | | | | | | Average Combustible Materials Consumed[b] (% of initial weight of insulation/jacket materials) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Forced Air Flow | | | | | | | | | | Natural Air Flow | | | | | | | |
| | | | | Damage[b] | | Ignition Piloted | | Ignition Auto | | Electrical Failure[a] | | Damage[c] | | Ignition[a] | | Electrical Failure[a] | | | | | |
| | | U | C | U | C | U | C | U | C | U | C | U | C | U | C | U | C | | | U | C |
| XPE/PVC | 1-7x12-4 | 14 | 16 | 1030 | 4450 | 1100 | 6700 | 15500 | 19000 | 10000 | 21800 | 730 | 2520 | 780 | 3800 | 7100 | 12400 | | | 78 | 71 |
| | 1-1x00-4 | 14 | 16 | 870 | 4430 | 940 | 5600 | 7430 | 16420 | 11300 | 28600 | 390 | 1980 | 420 | 3300 | 5000 | 16900 | | | 83 | 74 |
| | 1-3x12-4 | 14 | 16 | 800 | 3810 | 870 | 4800 | 9920 | ∞ | 5200 | 22100 | 480 | 1990 | 520 | 2500 | 3200 | 11500 | | | 87 | 82 |
| XPE/Neoprene | 4-2x16-3 | 14 | - | 1330 | - | 1400 | - | ∞ | - | 9100 | - | 1150 | - | 1200 | - | 7700 | - | | | 72 | - |
| PE/PVC | 3-3x16-2 | 14 | - | 920 | - | 1100 | - | 10100 | - | 6500 | - | 500 | - | 600 | - | 3500 | - | | | 74 | - |
| | 3-9x12-2 | 14 | 16 | 950 | 3930 | 1200 | 6100 | 11400 | 20700 | 8600 | 25000 | 570 | 1930 | 720 | 3000 | 5200 | 12200 | | | 82 | 74 |
| Butyl/PVC | 3-3x12-1 | 14 | 16 | 950 | 4200 | 1200 | 5400 | ∞ | ∞ | 13000 | 17800 | 520 | 2160 | 660 | 2800 | 7100 | 9100 | | | 68 | 54 |
| Proprietary | 2-3x16-5 | 14 | - | 1060 | - | 1300 | - | ∞ | - | 7400 | - | 900 | - | 1100 | - | 6300 | - | | | 82 | - |
| | 2-5x16-5 | 14 | 16 | 890 | 7310 | 1250 | 8300 | ∞ | ∞ | 7400 | 19800 | 710 | 3440 | 990 | 3900 | 5900 | 9300 | | | 75 | 68 |
| | 2-1x0000-5 | 14 | 16 | 1070 | 10540 | 1600 | 12200 | ∞ | ∞ | ∞ | ∞ | 910 | 7600 | 1360 | 8800 | | | | | 77 | 62 |

[a]Under piloted ignition

[b]Under autoignition

C: Coated cables; U: Uncoated cables

∞: No ignition

[c] Calculated

TABLE XI

GENERATION RATES OF FUEL VAPORS, HEAT AND FIRE PRODUCTS AND OPTICAL TRANSMISSION THROUGH "SMOKE" NORMALIZED BY EXTERNAL HEAT FLUX[a]

| Cable Type | Number | $\dot{G}_j''/\dot{q}_e''$ (g/kJ) x $10^3$ $CO_2$ U | $CO_2$ C | CO U | CO C | Hydrocarbons U | Hydrocarbons C | $\frac{D \times \dot{V}_T}{\dot{q}_e''}$ ($m^4$/kJ) x $10^3$ U | C | $\dot{Q}_{Actual}''/\dot{q}_e''$ U | C | $\dot{Q}_{conv}''/\dot{q}_e''$ U | C | $\dot{Q}_{rad}''/\dot{q}_e''$ U | C | $\dot{G}_{fuel}''/\dot{q}_e''$ (g/kJ) U | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| XPE/PVC | 1-7X12-4 | 275 | 246 | 11 | 14 | 1 | 2 | 0.06 | 0.06 | 4.2 | 3.8 | 3.1 | 3.7 | 1.1 | 0.10 | 0.14 | 0.20 |
| | | 508 | 446 | 3 | 4 | 0.08 | 0.21 | 0.04 | 0.05 | 7.5 | 6.5 | 5.8 | 5.3 | 1.7 | 1.3 | 0.22 | 0.08 |
| | 1-1X00-4 | 279 | 265 | 8 | 5 | 1 | 1 | 0.04 | 0.05 | 4.2 | 3.9 | 2.5 | 3.7 | 1.7 | 0.19 | 0.21 | 0.17 |
| | | 506 | - | 5 | - | 0.21 | - | 0.03 | - | 7.5 | - | 5.3 | - | 2.2 | - | 0.02 | - |
| | 1-3X12-4-1 | 356 | 267 | 13 | 13 | 1 | 2 | 0.04 | 0.08 | 5.4 | 4.0 | 3.5 | 3.8 | 1.9 | 0.23 | 0.27 | 0.54 |
| | | 533 | 454 | 4 | 4 | 0.21 | 0.21 | - | 0.05 | 7.8 | 6.7 | 5.4 | 5.2 | 2.5 | 1.50 | 0.18 | 0.44 |
| XPE/ Neoprene | 4-2X16-3 | 325 | - | 20 | - | 3 | - | 0.03 | - | 5.0 | - | 3.2 | - | 1.8 | - | 0.38 | - |
| PE/PVC | 3-3X16-2 | 500 | - | 9 | - | 1 | - | 0.06 | - | 7.5 | - | 4.3 | - | 3.2 | - | 0.46 | - |
| | 3-9X12-2 | 298 | 298 | 9 | 8 | 1 | 1 | 0.07 | 0.07 | 4.5 | 4.4 | 3.0 | 3.9 | 1.5 | 0.56 | 0.30 | 0.25 |
| | | 729 | - | 9 | - | 1 | - | 0.11 | - | 10.8 | - | 6.0 | - | 4.8 | - | 0.52 | - |
| Butyl/PVC | 3-3X12-1 | 369 | 325 | 15 | 10 | 1 | 1 | 0.08 | 0.07 | 5.6 | 4.9 | 4.5 | 2.4 | 1.1 | 0.69 | 0.24 | 0.15 |
| | | 475 | - | 8 | - | 0.42 | - | 0.07 | - | 7.0 | - | 6.2 | - | 0.90 | - | 0.22 | - |
| | 2-3X16-5 | 531 | - | 60 | - | 7 | - | 0.10 | - | 8.3 | - | 4.9 | - | 3.4 | - | 0.31 | - |
| Prop. | 2-5X16-5 | 290 | 338 | 24 | 50 | 4 | 7 | 0.03 | 0.05 | 4.5 | 5.6 | 3.2 | 4.8 | 1.4 | 0.75 | 0.42 | 0.50 |
| | 2-1X0000-5 | 333 | 223 | 29 | 20 | 4 | 3 | 0.07 | 0.05 | 5.2 | 3.5 | 4.8 | 3.2 | 0.40 | 0.27 | 0.21 | 0.19 |

U = uncoated

C = coated

$\dot{G}_j''$ = generation rate of fire products

$\dot{q}_e''$ = external heat flux

D = optical density

$\dot{V}_T$ = total volumetric flow rate of product-air mixture

$\dot{Q}_i''$ = heat release rate

$\dot{G}_{fuel}''$ = generation rate of fuel vapors

TABLE XII

OVERALL COMPARISON OF FIRE PROPERTIES OF THE COATED AND UNCOATED CABLE SAMPLES[a]

| Ratio of Fire Properties for Coated and Uncoated Cable Samples | 1-7X12-4-1[b] XPE/PVC | 1-1X00-4-1[b] XPE/PVC | 1-3X12-4-1[b] XPE/PVC | 3-9X12-2-1[b] PE/PVC | 3-3X12-1-1[b] Btyl/PVC | 2-5X16-5-1[c] Prop. | 2-1X0000-5-1[c] Prop. |
|---|---|---|---|---|---|---|---|
| **Energy Ratio (forced air flow)** | | | | | | | |
| a. Damage | 4.32 | 5.10 | 4.76 | 4.14 | 4.42 | 8.21 | 9.85 |
| Ignition (piloted) | 6.10 | 5.96 | 5.52 | 5.10 | 4.50 | 6.64 | 7.63 |
| Ignition (auto) | 1.23 | 2.21 | ∞ | 1.82 | ∞ | ∞ | ∞ |
| d. Electrical Failure | 2.18 | 2.53 | 4.25 | 2.91 | 1.37 | 2.68 | ∞ |
| **Energy Ratio (natural air flow)** | | | | | | | |
| a. Damage | 3.45 | 5.10 | 4.15 | 3.39 | 4.15 | 4.85 | 8.35 |
| b. Ignition (piloted) | 4.87 | 7.86 | 4.81 | 4.17 | 4.24 | 3.94 | 6.50 |
| c. Electrical Failure | 1.75 | 3.38 | 3.60 | 2.35 | 1.28 | 1.58 | ∞ |
| **Ratio of Product Generation Rates** | | | | | | | |
| $CO_2$ | 0.894<br>0.877 | 0.948<br>- | 0.750<br>0.852 | 1.00<br>- | 0.881<br>- | 1.165 | 0.669 |
| CO | 1.226<br>1.030 | 0.650<br>- | 1.00<br>1.00 | 0.841<br>- | 0.676<br>- | 2.124 | 0.679 |
| Hydrocarbon | 1.950<br>2.50 | 1.00<br>- | 1.333<br>1.00 | 1.00<br>- | 0.857<br>- | 1.667 | 0.778 |
| **Ratio of Optical Density per Unit Path Length** | 0.971<br>1.139 | 1.125<br>- | 2.00<br>- | 1.00<br>- | 0.930<br>- | 2.00 | 0.746 |
| **Ratio of Heat Release Rates** | | | | | | | |
| Actual | 0.905<br>0.875 | 0.935<br>- | 0.755<br>0.854 | 0.995<br>- | 0.873<br>- | 1.230 | 0.675 |
| Convective | 1.190<br>0.900 | 1.520<br>- | 1.096<br>0.965 | 1.300<br>- | 0.540<br>- | 1.530 | 0.670 |
| Radiative | 0.096<br>0.785 | 0.108<br>- | 0.122<br>0.610 | 0.380<br>- | 0.650<br>- | 0.545 | 0.722 |

[a] using the ratios of fire properties of coated and uncoated cable samples

coated with Flamemastic 71-A

[c] coated with Flamemastic 77

# APPENDIX C - FACTORY MUTUAL COMBUSTIBLE CONTROL PROGRAM

# APPENDIX D – PROPOSED MODIFICATIONS, DESIGN DESCRIPTIONS, DRAWINGS AND SCHEDULES

## APPENDIX D

### Table of Contents

1. <u>Design Descriptions for Proposed Automatic Fire Suppression Systems and Penetration Seals.</u> For those areas where FPL proposes to install a fixed suppression system, either halon or sprinklers shall be provided. A brief design description of each system is included.

2. <u>Fire Area Drawings Showing Damper Locations, Fire Door Locations, Areas to be Provided with Fixed Fire Supression Systems, and Fire Area Boundaries to be Upgraded to Fire Rated Barriers</u> - See Attachment 1 for the following drawings:

   FIG D-1
   FIG D-2
   FIG D-3
   FIG D-4

3. <u>Electrical Drawings Showing Cable Tray Baffles</u> - See Attachment 1 for the following drawings:

   FIG E-1
   FIG E-2
   FIG E-3
   FIG E-4
   FIG E-5
   FIG E-6
   FIG E-7
   FIG E-8
   FIG E-9
   FIG E-10
   FIG E-11
   FIG E-12
   FIG E-13

## DESIGN DESCRIPTIONS FOR PROPOSED AUTOMATIC FIRE SUPPRESSION SYSTEMS AND PENETRATION SEALS

### Sprinklers

Automatic sprinklers will be installed below the electrical cable trays. The system will be a pre-action type, hydraulically, calculated to provide a density of 0.3 GPM/sq.ft. over any, including the most hydraulically remote area. Actuation of the pre-action valve will be by thermal detectors in the sprinklered area. The detection system will be supervised and provide local annunciation as well as alarm indication in the plant Control Room. The pre-action system will utilize closed sprinkler heads and nitrogen pressurization. Low nitrogen pressure will be supervised at the main fire protection panel. Valve tamper and water flow alarms will be provided.

### Halon

An automatic, total flooding Halon 131 extinguishing system will be installed in the Cable Spreading Room and possibly other areas. Actuation will be by ionization type smoke detectors in the room, cross zoned to provide an early warning plus actuation of dampers to isolate the room and contain the Halon discharge. Interlocks will be provided to avoid Halon discharge prior to actuation of dampers. The status of the system and detectors will be supervised and local alarms and annunciation in the plant Control Room will be provided.

## Penetration Seals

Penetrations of electrical trays and conduits, piping, instrumentation lines and HVAC ducts through the designated Fire Barriers and Barrier floors will be provided with qualified penetration barrier fire stop assemblies having an hourly rating commensurate with that of the required barrier rating.

# APPENDIX E - PHOTOGRAPHIC PRESENTATION OF EPRI CABLE TRAY TESTING, NP-1675

## APPENDIX E

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1. Data Sheet Describing Tests Performed
2. FIG. E-1 - Pre-Test: Two Cable Trays With and Without Baffle
3. FIG. E-2 - Post-Test: Cable Tray With No Protection
4. FIG. E-3 - Post-Test: Cable Tray With Sprinkler Protection
5. FIG. E-4 - Post-Test: Cable Tray With Baffle Protection

## Data From EPRI NP - 1675

### Cable Tray

- Open ladder tray mounted 6' from floor
- EPR/Hyperlon cable (IEEE-383)

### Exposure Fire

- 4' diameter pan-top 1' from floor
- 17 gal. #2 fuel oil
- Approximately 15 minutes burn time
- Visible flames 13' to 17'

### Tray Protection

- Test 28 - no protection
- Test 24 - sprinkler, ½ inch, 160$^{o}$F, .25 gpm/ ft$^2$, mounted 6 inches from 20 ft ceiling, on after 117 seconds
- Test 27 - ½ inch mineral board wired to bottom of tray with no over lap.

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# APPENDIX G – REFERENCES

FIG F-7 LUBRICATING OIL EXTINGUISHING A HYDROCARBON FIRE

FIG F-5 ATTEMPT TO IGNITE LUBRICATING OIL WITH BURNING ACETONE SOAKED RAGS AND FLARES

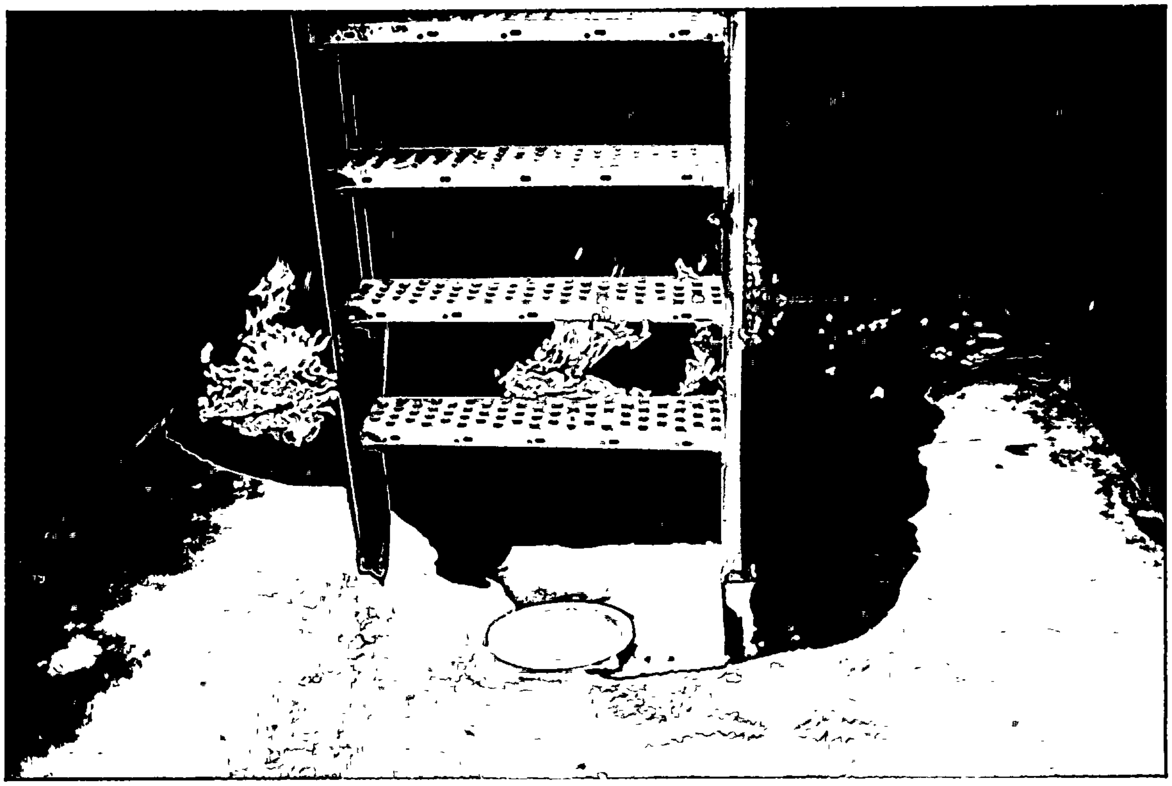

FIG F-6 SAME AS FIG F-5

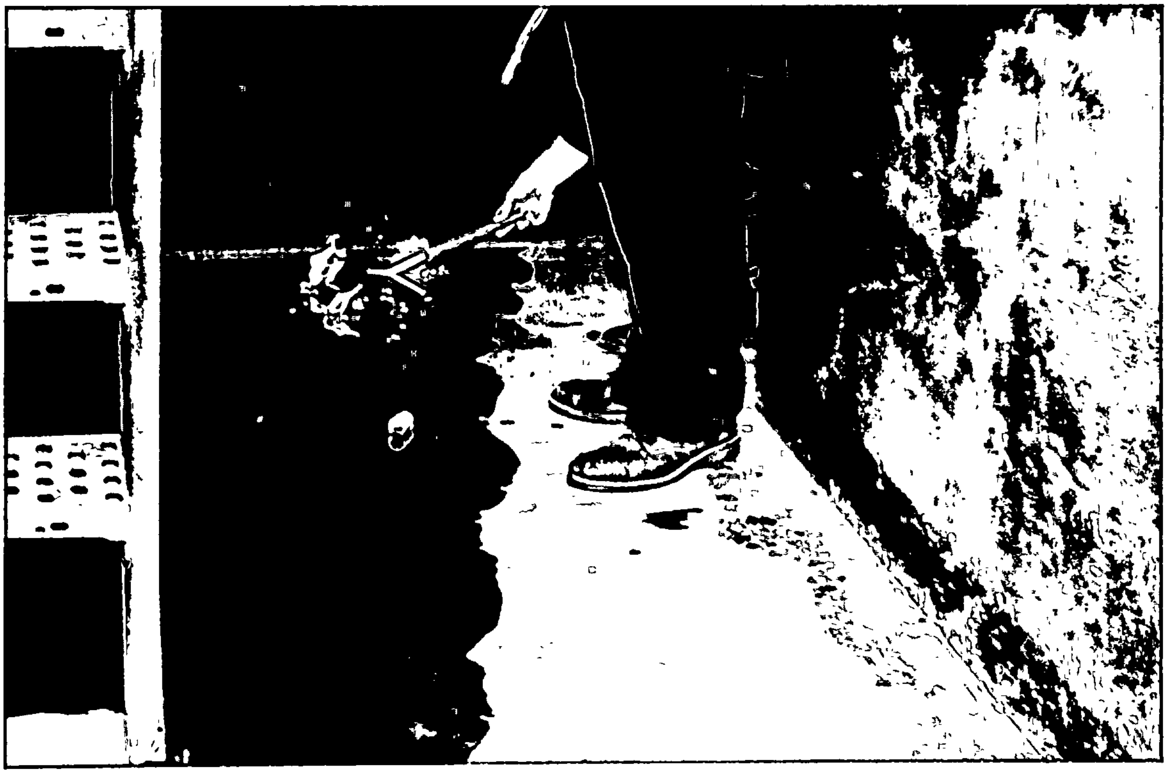

FIG F-3 ADDITIONAL ATTEMPT TO IGNITE LUBRICATING OIL WITH FLARE (FLAMES ARE FROM THE FIRST FLARE)

FIG F-4 ATTEMPT TO IGNITE LUBRICATING OIL BY POURING AND IGNITING ACETONE ON THE OIL

FIG F-1 ATTEMPT TO IGNITE LUBRICATING OIL WITH FLARE

FIG F-2 POURING LUBRICATING OIL ON FLOOR AND SUBSEQUENT SPREAD

APPENDIX F

Table of Contents

1. FIG. F-1 - Attempt to Light Lubricating Oil with Flare

2. FIG. F-2 - Pouring Lubricating Oil on Floor and Subsequent Spread

3. FIG. F-3 - Additional Attempt to Ignite Lubricating Oil With Flare (Flames Are From the First Flare)

4. FIG. F-4 - Attempt to Ignite Lubricating Oil By Pouring and Igniting Acetone Oil On the Oil

5. FIG. F-5 - Attempt to Ignite Lubricating Oil With Buring Acetone Soaked Rags and Flares

6. FIG. F-6 - Same as FIG. F-5

7. FIG. F-7 - Lubricating Oil Extinguishing a Hydrocarbon Fire

# APPENDIX F - PHOTOGRAPHIC PRESENTATION OF FPL FIRE TESTS WITH LUBRICATING OIL

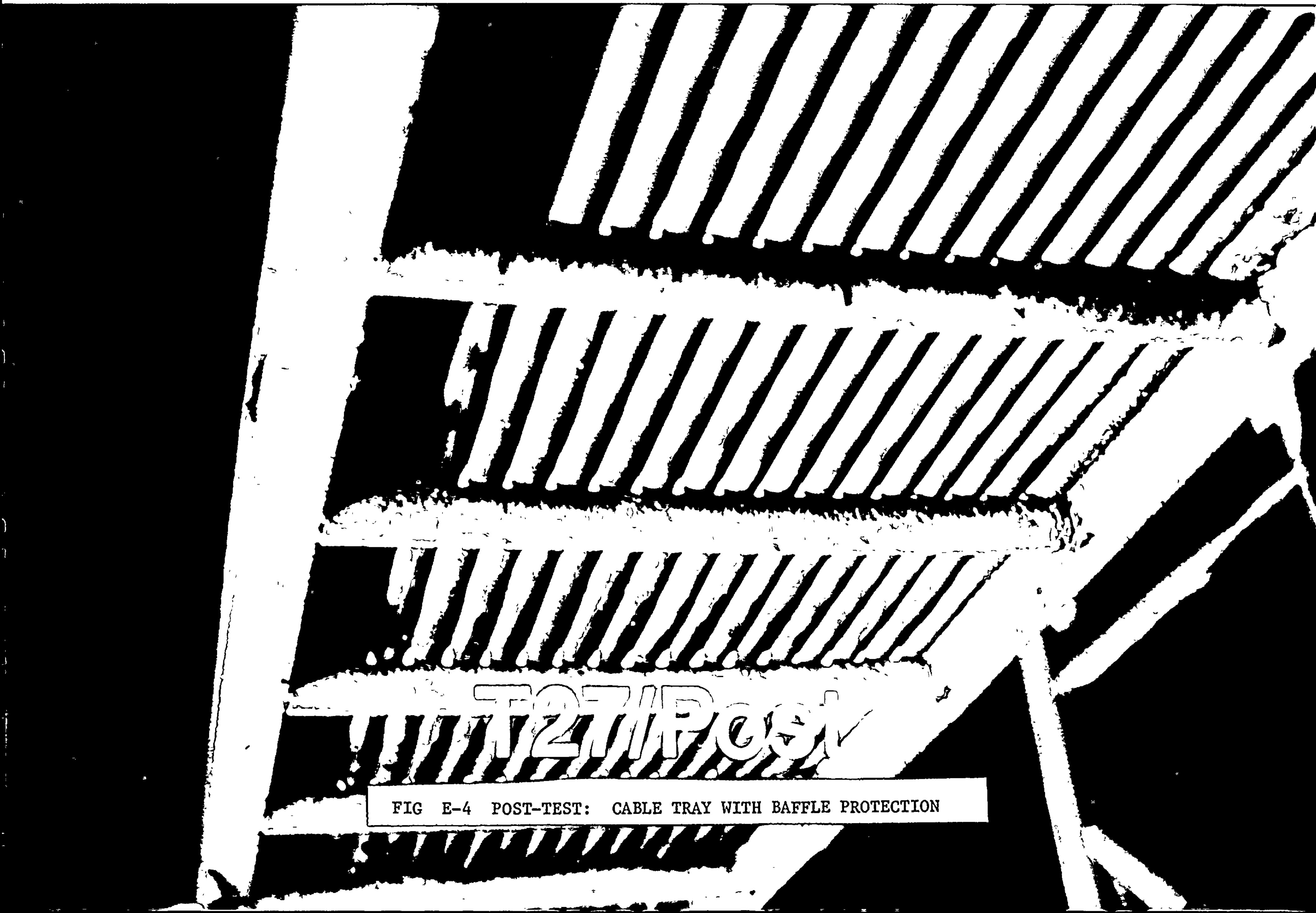


FIG E-4 POST-TEST: CABLE TRAY WITH BAFFLE PROTECTION

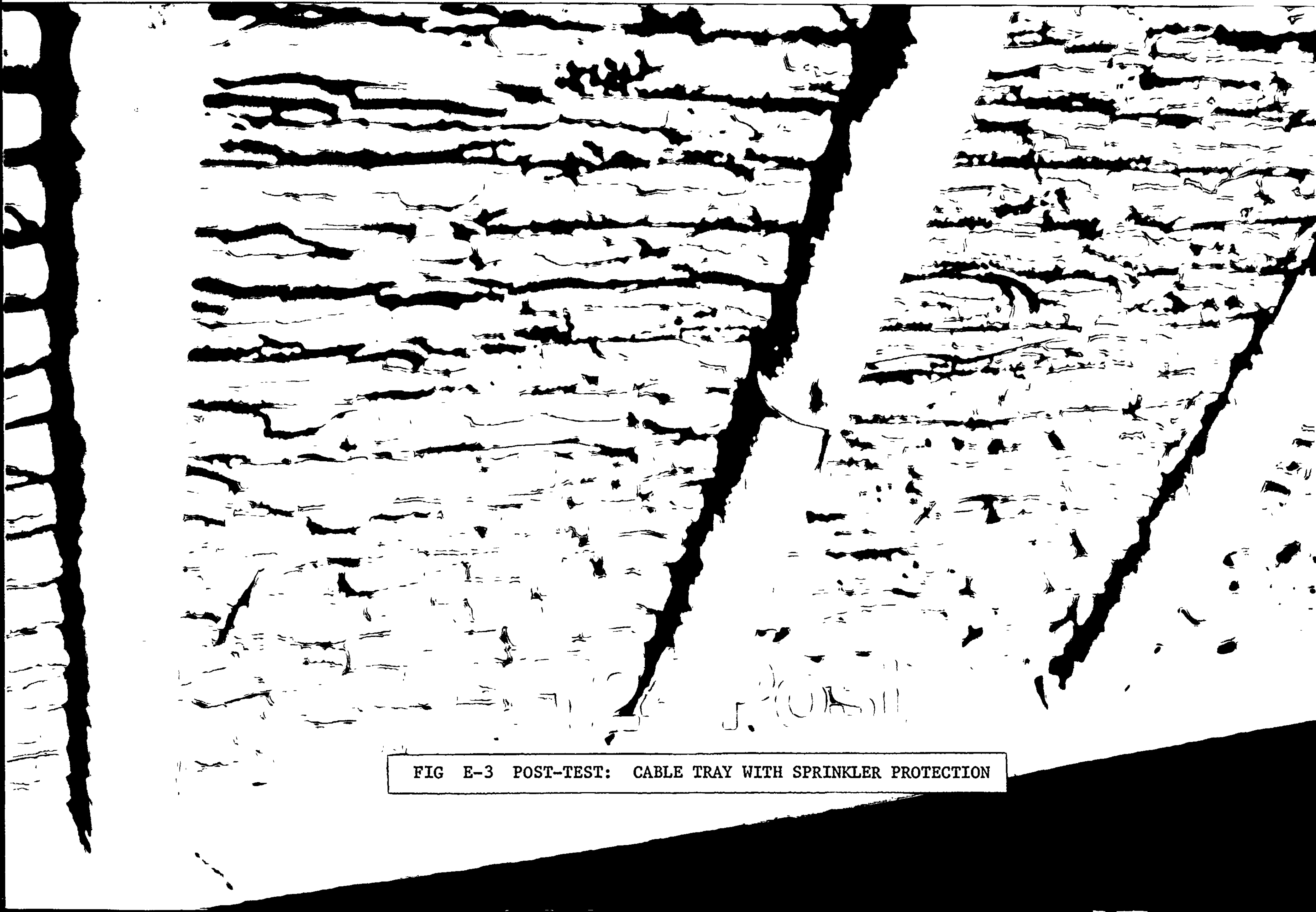

FIG E-3 POST-TEST: CABLE TRAY WITH SPRINKLER PROTECTION

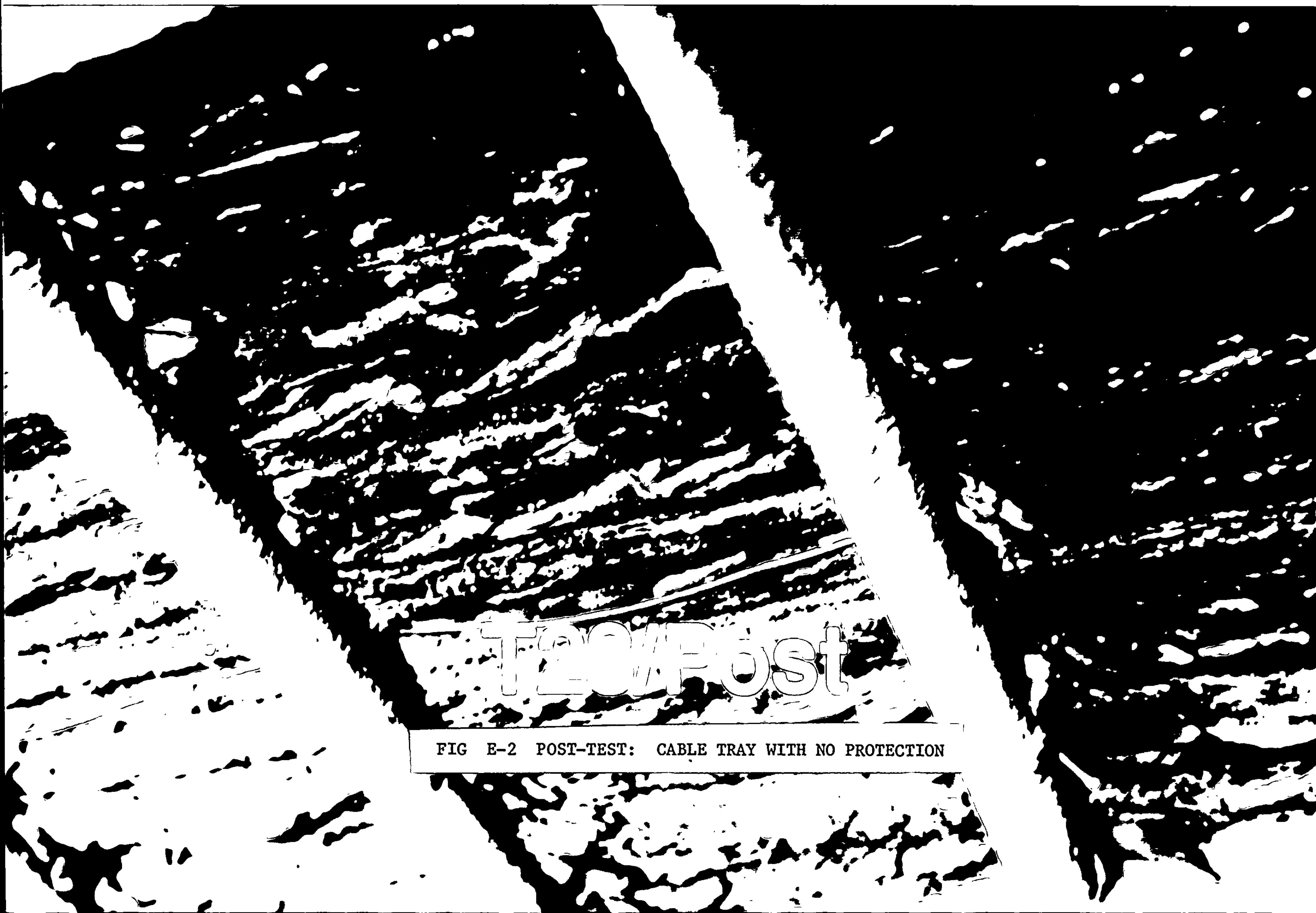

FIG E-2 POST-TEST: CABLE TRAY WITH NO PROTECTION

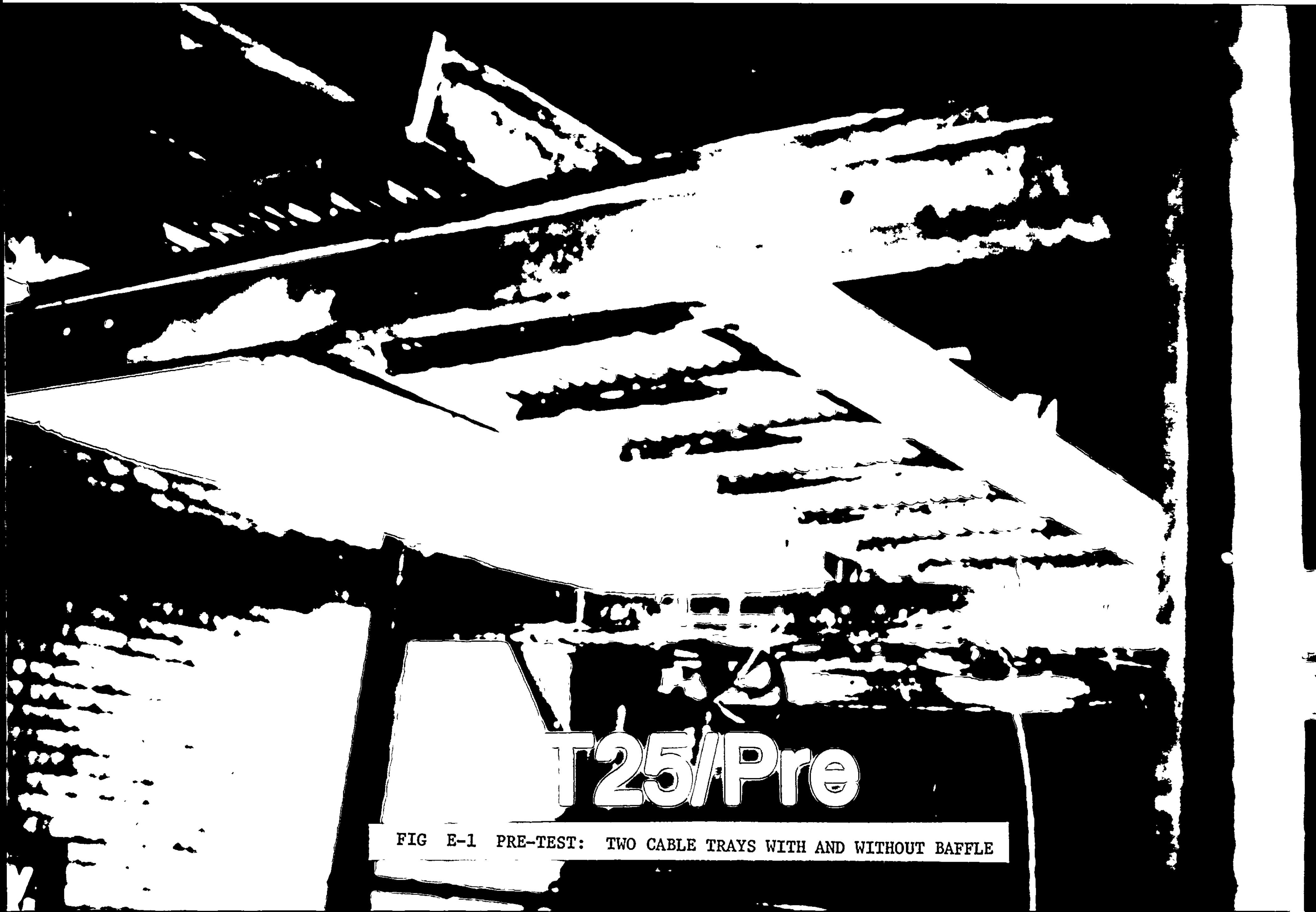


FIG E-1 PRE-TEST: TWO CABLE TRAYS WITH AND WITHOUT BAFFLE