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U. S. Nuclear Regulatory Commission  
Att: Document Control Desk  
Washington, DC 20555

Gentlemen:

Subject: Three Mile Island Nuclear Generating Station, Unit 1 (TMI-1)  
Operating License No. DPR-50  
Docket No. 50-289  
10 CFR 50 Appendix R - Exemption Request

GPU Nuclear has completed evaluation of the TMI-1 installed Thermo-Lag 3-hour rated fire barriers. As a result of this evaluation, GPU Nuclear is designating the installed 3-hour rated fire barriers as 1-hour rated fire barriers and requesting exemption from the requirements of 10 CFR 50 Appendix R, Section III.G.2.c for an automatic suppression system in the identified fire areas where circuits of redundant safe shutdown equipment in the same fire area are enclosed in a 1-hour fire barrier. The enclosed evaluation also provides the basis for establishing 1-hour ratings for the subject fire barriers, which in some cases involves fire barrier upgrade modifications.

Enclosure A provides the detailed request for exemption from the requirements of 10 CFR 50 Appendix R, Section III.G.2.c for identified fire areas in accordance with the provisions of 10 CFR 50.12. The enclosed exemption request addresses fire areas containing high-voltage plant electrical equipment where automatic water suppression systems are not desirable. Halon gas suppression systems are no longer a viable option due to environmental concerns. These fire areas and adjoining areas are frequently occupied by plant personnel, therefore, carbon dioxide suppression systems are not desirable due to personnel hazard. Therefore, installation of an automatic suppression system in the effected fire areas is not a viable alternative. Modification of the identified fire barriers to achieve a 3-hour rating would cost approximately \$600K-700K which represents a substantial cost hardship with minimal safety enhancement. This evaluation and the associated exemption request fully addresses nine (9) of the nineteen (19) TMI-1 fire areas containing Thermo-Lag fire barrier material. These nine (9) areas are those fire areas where Thermo-Lag installed on electrical raceways was originally rated at 3-hours.

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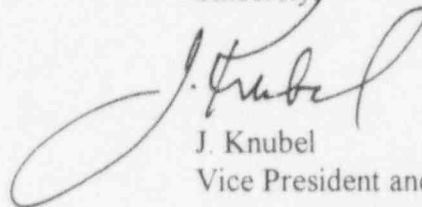
As part of the TMI-1 Thermo-Lag resolution effort, GPU Nuclear will augment the existing detection systems for the fire areas/zones identified in Enclosure A such that each of the nine (9) areas is protected by an area wide automatic detection system. These modifications along with an established 1-hour rated barrier will result in a significant improvement in safety by providing earlier detection and subsequent fire brigade response to the affected fire area.

Enclosure B provides the detailed description of the TMI-1 3-hour fire barrier evaluations including methodology and results which support the enclosed exemption request. The actual fire ratings of the Thermo-Lag configurations or elements, as identified in Enclosure B, have been determined utilizing the Nuclear Energy Institute (NEI) "Application Guide for Evaluation of Thermo-Lag 330 Fire Barrier Systems," (NEI Report No. 0784-00001-TR-02, Revision 1). Additional steel banding is being added to certain fire barriers to conform to NEI test configurations where noted in Enclosure B.

GPU Nuclear requests approval of the enclosed exemption request by October 31, 1996 to support finalization of the scope of engineering and design required for identified barrier upgrades and automatic detection system modifications. Also, feedback on this exemption will help complete evaluations of the presently installed TMI-1 Thermo-Lag 1-hour rated fire barriers which will be completed by December 31, 1996. Where technically justified, exemption requests for installed 1-hour barriers may be submitted to NRC at that time. It is our intent to achieve resolution of the Thermo-Lag issue by December 31, 1999, as previously identified in GPU Nuclear's letter dated July 7, 1995 (C311-95-2265).

GPU Nuclear is available to discuss at the earliest opportunity any NRC questions or provide any additional information related to the enclosed evaluations. If any additional information is required please contact Mr. David J. Distel, Senior Regulatory Affairs Engineer at (201) 316-7955.

Sincerely,



J. Knubel

Vice President and Director, TMI

JK/DJD/plp

Enclosure A: TMI-1 10 CFR 50.12 Thermo-Lag Fire Barrier Exemption Request  
Enclosure B: GPU Nuclear Topical Report No. 094, Revision 1, "TMI-1 Evaluation of Thermo-Lag Fire Barriers"

c: Administrator, Region I  
NRC TMI Senior Resident Inspector  
NRC Senior Project Manager, TMI

**Enclosure A**

**TMI-1 10 CFR 50.12 Thermo-Lag Fire Barrier  
Exemption Request**

(III.G.2.c) "Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area".

## B. OVERVIEW

Because of issues surrounding the validity of fire testing Thermo-Lag fire barriers for cable raceways, it has become necessary to re-establish the fire endurance rating of the aforementioned as installed 3-hour barriers. The methodology for establishing the fire endurance rating and the results are detailed in the attached Topical Report Number 94 (Enclosure B). Those barriers which do not presently have a fire endurance rating of at least 60 minutes will be upgraded to a fire endurance rating of 60 minutes. Those barriers which do not have a 3 hour fire endurance rating but have a fire endurance rating of at least 60 minutes, including the aforementioned barriers which will be upgraded to 60 minutes, are the subject of this exemption request.

An exemption is requested from the requirement in Appendix R Section III.G.2.c for an automatic suppression system in each of the following Fire Areas/Zones as detailed in Enclosure A:

CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, CB-FA-3b and FH-FZ-5

Note that GPU Nuclear intends to augment the existing HVAC duct mounted detection systems for these fire area/zones such that each area is protected by an area wide automatic detection system. The system to be installed is designed to detect invisible molecules generated during the precombustion stages of an incipient fire and provides active and continuous sampling of the air. The system operates independently of air movement and is much more sensitive than conventional ionization detection. This upgraded detection system along with established 1-hour barriers provides a significant improvement in safety by providing earlier detection and subsequent fire brigade response. Additionally, it is noted that since all the above fire areas are located within the Control Building it is expected that fire brigade response would be rapid.

TMI-1 has administrative controls in place over transient combustibles and work in the plant in accordance with 10 CFR 50 Appendix R, Section III.K Sections 1-8 as required by the NRC in the SER dated June 4, 1984. For example, these controls require the total insitu plus allowable transient fire



load in a Fire Area/Zone (or cumulative load) to be half of that which would challenge the lowest rated barrier in the zone. These limits are documented in procedures that are both referenced in and implement the TMI Fire Protection Program under a License Condition 2.c(4). Since these 3-hour barriers are being rerated to 1-hour barriers it will be necessary to lower the allowable transient limits to these fire areas in order to maintain compliance with Appendix R, Section III.K commitments as discussed above. Temporary compensatory measures will be required when transient loads may exceed the allowable limits (i.e. fire watches, continuous manning, use of alternative materials). Transient combustible load evaluations consider the type of combustible material, the room's configuration and the location of the transient material in the room. Additional administrative controls are implemented for flammable or combustible liquids in accordance with existing fire protection program procedures. These provisions will continue to ensure that transient loads do not affect safe shutdown capability and maintain compliance with Appendix R.

#### C. SUMMARY

The underlying purpose of the rule is to accomplish safe shutdown in the event of a fire and maintain the plant in a safe condition. The TMI-1 FHAR requires fire barrier protection for the circuits currently protected as described in Enclosure A in order to insure safe shutdown. These fire barriers have been evaluated to demonstrate that they have a fire endurance rating of at least 60 minutes when tested in accordance with the ASTM E-119 test. In addition, fire barriers not currently rated at 60 minutes will be upgraded to a 60 minute rating when tested in accordance with the ASTM E-119 test. A fast response area detection system will be installed in areas where the exemption is requested as listed below. The fire hazards analysis results discussed below conclude that postulated fire severity in each of the nine fire areas/zones is less than that experienced in an ASTM E-119 test. This, combined with adequate fire protection features (fire barriers, manual suppression and a fast response area wide detection system) in each fire area/zone, fire brigade response and control of transient combustibles assure that the protected circuits will remain functional in the event of any fire and therefore the plant will retain safe shutdown capability. Thus, the underlying purpose of the rule is satisfied. Therefore, the exemption from the requirement in 10 CFR 50 Appendix R, section III.G.2.c for an automatic suppression system in Fire Areas/Zones CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, CB-FA-3b and FH-FZ-5 respectively meets the special circumstances delineated in 10 CFR 50.12 (a)(2)(iii). The application of the regulation in this particular

circumstance is not necessary to achieve the underlying purpose of the rule since the above analysis demonstrates that these fire areas/zones where installed Thermo-Lag raceway fire barriers have a fire endurance rating of at least one hour with manual suppression and fast response area wide detection provides an equivalent level of safety and therefore, meets the underlying purpose of the rule. In addition, the special circumstances of 10 CFR 50.12 (a)(2)(iii) apply in that modifying the aforementioned barriers to achieve a 3-hour fire endurance rating or installation of an automatic suppression system, required by the regulation, would not result in a significant increase in the level of protection provided and would result in undue hardship and cost significantly in excess of those incurred by others similarly situated. These costs consist of additional engineering, procurement of material, fabrication and installation costs for replacing or upgrading cable raceway fire barrier envelopes and raceway supports which are the subject of this exemption request and/or installing automatic suppression systems for nine (9) fire areas/zones.

The following is the justification for the exemption requested in this letter.

1. FIRE AREA CB-FA-2b (Ref. Dwg. No. CB-FA-2b)

FIRE AREA DESCRIPTION (Information taken from the TMI-1 FIRE HAZARDS ANALYSIS REPORT)

a. FIRE AREA FEATURES

Fire Area CB-FA-2b is located on elevation 322' of the Control Building. Area dimensions are approximately 48 feet x 20 feet x 15 feet high. Area boundaries consist of reinforced concrete and metal panel walls, and reinforced concrete floor and ceiling. All area boundaries are 3-hour rated fire barriers. The north boundary is adjacent to the Turbine Building. The south boundary is adjacent to Fire Areas CB-FA-2d and CB-FA-2e. The east boundary is adjacent to Fire Area CB-FA-2a. The west boundary is adjacent to CB-FA-2c. The floor is adjacent to Fire Area CB-FA-1 and the ceiling is adjacent to Fire Area CB-FA-3b.

b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustible in this Fire Area is the electrical equipment (switchgear) and cable insulation which is spread throughout the area. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. This Fire Area also contains minor amounts of plastics and normally present Class A combustibles as documented in the FHAR. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Area. The overall fire loading is considered low, 51,300 BTU/FT<sup>2</sup>. This corresponds to a fire severity on the ASTM E-119 time-temperature curve of between 38 and 39 minutes. Note that cable inside trays protected with Thermo-Lag is conservatively considered part of the combustible loading.

c. FIRE PROTECTION FEATURES

Fire protection for this fire area consists of HVAC duct smoke detection which actuates an alarm in the control room and isolates supply and return air flow to the Area upon alarm. An area wide early warning detection system which actuates an alarm in the control room will be added to augment the HVAC duct smoke detection system. Hose protection is provided outside this area in Fire Zone FH-FZ-5. This hose protection is

capable of bringing an effective hose stream to bear on any location within this Fire Area. In addition, portable CO2 and dry chemical extinguishers are located in the stair tower.

The aforementioned fire protection features are maintained by the surveillance program required by the TMI-1 license condition.

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self contained breathing apparatus. Note there is no radiological hazard in this area that could impede fire fighting operations or fire brigade response.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the following functions:

- Make-up and Supporting Functions
- RCS Pressure
- Steam Generator Pressure and Level
- Source Range Monitoring
- Electrical Power System

These functions require fire barrier protection in order to insure a safe shutdown path if a fire eliminates all other unprotected circuits and equipment in this fire area. This assumption served as the basis for protecting the above functions in this fire area.

The following information describes the layout and function of the protected safe shutdown circuits in this fire area. Drawing CB-FA-2b depicts safe shutdown circuit routings for the various functions. This drawing also depicts circuit routings for redundant or alternative unprotected safe shutdown circuits. These are not exact routings but rather show the general paths of the various circuits. As noted below, most of the protected circuits are routed in a steel tray protected by an envelope with fire endurance rating of at least 60 minutes (the actual rating is 85 minutes). The remainder of the protected circuits are routed in rigid steel conduit and are protected by envelopes which have a fire endurance rating of at least 60 minutes.

#### ENVELOPE 1CCE-FB02

Cables for the following functions are protected by this envelope which runs west to east and passes approximately 5 feet over an open cable tray and the 480V 1S Switchgear:

- Make-up and Supporting Functions
- RCS Pressure
- Source Range Monitoring
- Electrical Power System

#### ENVELOPE 1CCE-FB03

Cables for the following functions are protected by this envelope which runs west to east along the south wall of this fire area. This envelope is located over a heavily loaded cable tray. Steel HVAC ductwork is located between the open cable tray and the envelope.

- Steam Generator Pressure and Level

#### ENVELOPE 1CCE-FB09

Cables for the following function are protected by this envelope which runs west to east and passes approximately 5 feet over an open cable tray and the 480V 1S Switchgear.

- Electrical Power System

#### ENVELOPE 1CCE-FB10

Cables for the following function are protected by this envelope which runs west to east. The envelope is not located directly over any insitu combustibles although it is just south of the 480V 1S Switchgear.

- Electrical Power System

## e. THERMO-LAG DESCRIPTION

The following Thermo-Lag fire barriers are the subject of this exemption request. The TMI-1 FHAR currently requires these fire barriers to have a three hour fire endurance rating:

ENVELOPE NO.	TYPE	ACTUAL RTG.	NEI TEST
1CCE-FB02	Penetration	Upgrade to 60 min.	N/A
1CCE-FB02	12" x 37" Penetration	Upgrade to 60 min.	N/A
1CCE-FB09	17.5" x 15" x 6" Penetration	Upgrade to 60 min.	N/A
1CCE-FB10	Penetration	Upgrade to 60 min.	N/A
1CCE-FB02	24" x 6" Cable Tray	85	2-10
1CCE-FB02	24" x 6" Cable Tray	85	2-10
1CCE-FB02	24" x 6" Radial bend tray	85	2-10
1CCE-FB03	Condulet	69	2-3
1CCE-FB03	1.25" Conduit	69	2-3
1CCE-FB03	1.25" Radial bend conduit	69	2-3
1CCE-FB03	9.5" x 5" x 6" Condulet	69	2-3
1CCE-FB09	1" Conduit	69	2-3
1CCE-FB09	1" Radial bend conduit	69	2-3
1CCE-FB09	11.5" x 5.5" x 12" Condulet	69	2-3
1CCE-FB10	Condulet	69	2-3
1CCE-FB10	1" Conduit	69	2-3
1CCE-FB10	1" Radial bend conduit	69	2-3
1CCE-FB10	8" x 5.5" x 4.5" Condulet	69	2-3

## f. EVALUATION

## • FIRE HAZARDS ANALYSIS

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system. The combustible materials present in the area consist of electrical switchgear and cable insulation which represent a fire load of 51,300 BTU/FT<sup>2</sup>. A fire, would most likely begin in a section of the electrical switchgear. A fire would not prevent entry into the compartment for fire fighting because it would develop slowly. Ignition of exposed cable insulation (IEEE 383 qualified) from a fire originating in the electrical switchgear would also be limited as described below.



Thermo-Lag conduit fire barrier envelope 1CCE-FB09 passes over a heavily loaded open cable tray and the switchgear. The potential exposure to the fire barrier envelope is greatest at this location. It is reasonable to assume a fire originating in the switchgear discussed above ignites the cable in the tray above which subsequently exposes the Thermo-Lag fire barrier envelope. In addition, cable tray fire barrier envelope 1CCE-FB02 passes over a heavily loaded open cable tray and the switchgear. The potential exposure to this fire barrier is greatest at this location. It is reasonable to assume a fire originating in the switchgear ignites the cable in the tray and exposes this Thermo-Lag fire barrier envelope. Fire barrier envelope 1CCE-FB03 passes over a heavily loaded open cable tray. However, there is no insitu ignition source below this tray and steel ductwork is located between the envelope and the tray making direct exposure to this envelope from a fire less likely than the above scenarios. Fire barrier envelope 1CCE-FB10 is not located over any insitu combustibles. Potential fires are likely to be less severe than in the above scenarios. Fires originating in a fan motor or a heater controller present less of a potential exposure to the Thermo-Lag fire barrier envelopes in this fire area than the switchgear fire because these hazards do not represent a significant fuel load compared to the switchgear.

The localized fire exposure for the assumed fire scenarios as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough to dissipate the energy from a localized fire in the switchgear and trays directly below the Thermo-Lag fire barrier envelopes. The envelopes will be challenged by this fire. The delay associated with a switchgear fire which eventually spreads to overhead cables results in a slow propagating cable fire. The exposure to the fire barrier envelope(s) is judged less severe than an ASTM E-119 exposure. Room ventilation is isolated automatically by the HVAC duct detection system via dampers in supply and return ductwork for the room. Fire pre-planning proceduralizes manual HVAC isolation if it does not occur automatically as designed.

The results of ASTM E-119 testing have been used to assign Actual Ratings of at least 60 minutes to the Thermo-Lag fire barrier envelopes in this fire area as shown on the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system alarm to bring manual suppression to bear on a fire in this room. This is



significantly less than the minimum of the fire barrier envelope within this zone of 60 minutes.

This fire area lacks significant quantities of cable insulation and transient combustibles. Further, the potential localized exposure to these fire barrier envelopes is not considered more severe than the exposure of an ASTM E-119 test. The fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of detection of a fire. Therefore, a minimum rating of 60 minutes, with existing and planned detection, is adequate to protect the safe shutdown circuits inside the fire barrier envelopes in this fire area with no automatic suppression system.

#### SUMMARY-FIRE AREA CB-FA-2b

This fire area is enclosed by 3 hour rated fire barriers. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system and a manual hose station which is located outside the area. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area.

The fire loading is low. The majority of cable insulation in this area is qualified to the IEEE 383 Flame Test. Therefore, fires would be slow to develop and spread beyond the ignition source. Fires would be quickly detected.

The minimum barrier rating of 60 minutes is considered adequate to protect safe shutdown circuits from damage in the event of a fire in this area without relying on the presence of automatic suppression. Further, the potential exposure to any barrier is not considered more severe than the exposure of the ASTM E-119 test. Since the severity of the exposure does not exceed that of the ASTM E-119 test, a 60 minute barrier rating is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the minimum barrier rating of 60 minutes.

#### CONCLUSION-FIRE AREA CB-FA-2b

GPU Nuclear concludes that an alternate fire protection configuration in Fire Area CB-FA-2b consisting of cable raceway fire barrier envelopes with

a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system which will augment the existing HVAC duct detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Area CB-FA-2b will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, the request for exemption from the requirement for an automatic suppression system in Fire Area CB-FA-2b should be granted.

## 2. FIRE AREA CB-FA-2c (Ref. Dwg. No. CB-FA-2c)

### FIRE AREA DESCRIPTION (Information taken from the TMI-1 FIRE HAZARDS ANALYSIS REPORT)

#### a. FIRE AREA FEATURES

Fire Area CB-FA-2c is located on elevation 322' of the Control Building. Area dimensions are approximately 48 feet x 22 feet x 15 feet high. Area boundaries consist of reinforced concrete and metal panel walls, and reinforced concrete floor and ceiling. All area boundaries are 3-hour rated fire barriers. The north boundary is adjacent to the Control Building Stairwell. The south boundary is adjacent to Fire Area CB-FA-2e. The east boundary is adjacent Fire Area CB-FA-2b. The west boundary is adjacent to Fire Zone FH-FZ-5. The floor is adjacent to Fire Area CB-FA-1 and the ceiling is adjacent to Fire Area CB-FA-3c.

#### b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustible in this area is cable insulation which is spread throughout the area. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. This Fire Area also contains minor amounts of plastics and normally present Class A combustibles as documented in the FHAR. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Area. The overall fire loading is considered low, 35,033 BTU/FT<sup>2</sup>. This corresponds to a fire severity on the ASTM E-119 curve of between 26 and 27 minutes. Note that TMI-1 has administrative controls over transient combustibles and work in the plant.

#### c. FIRE PROTECTION FEATURES

Fire protection for this fire area consists of HVAC duct smoke detectors which actuates an alarm in the control room and isolates supply and return air flow to the area upon alarm. An area wide early warning detection system which actuates an alarm in the control room will be added to augment the HVAC duct smoke detection system. Hose protection is provided outside this area in Fire Zone FH-FZ-5. This hose protection is capable of bringing an effective hose stream to bear on any location within this Fire Area. In addition, portable CO<sub>2</sub> and dry chemical extinguishers are located in the stair tower.

The aforementioned fire protection features are maintained by the surveillance program required by the TMI-1 license condition.

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self contained breathing apparatus. Note there is no radiological hazard in this area that could impede fire fighting operations or fire brigade response.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the following functions:

- Steam Generator Pressure and Level
- Electrical Power System

These functions require fire barrier protection in order to insure a safe shutdown path if a fire eliminates all other unprotected circuits and equipment in this fire area. This assumption served as the basis for protecting the above functions in this fire area.

The following information describes the layout and function of the protected safe shutdown circuits in this fire area. Drawing CB-FA-2c depicts safe shutdown circuit routings for the various functions. This drawing also depicts circuit routings for redundant or alternative unprotected safe shutdown circuits. These are not exact routings but rather show the general paths of the various circuits. Protected circuits are routed in rigid steel conduit and are protected by envelopes which have a fire endurance rating of at least 60 minutes.

**ENVELOPE 1CCE-FB03**

Cables for the following functions are protected by this envelope which is located in the southeast corner. The envelope is not located over any insitu combustibles.

- Steam Generator Pressure and Level

**ENVELOPE 1CCE-FB09**

Cables for the following function are protected by this envelope which is located along the east wall. The envelope is located over a heater controller (electrical panel).

- Electrical Power System

**ENVELOPE 1CCE-FB10**

Cables for the following function are protected by this envelope which runs west to east and passes over the Tech Support Center. The Tech Support Center is a separate room within this area. Its walls are constructed of foam insulation sandwiched between metal panels.

- Electrical Power System

e. **THERMO-LAG DESCRIPTION**

The following Thermo-Lag fire barriers are the subject of this exemption request. The TMI-1 FHAR currently requires these fire barriers to have a three hour fire endurance rating:

<b>ENVELOPE NO.</b>	<b>TYPE</b>	<b>ACTUAL RTG.</b>	<b>NEI TEST</b>
1CCE-FB09	Penetration	Upgrade to 60 min.	N/A
1CCE-FB09	8" x 12" Penetration	Upgrade to 60 min.	N/A
1CCE-FB03	Penetration	60	3-2
1CCE-FB03	1.25" Condulet	69	2-3
1CCE-FB03	1.25" Conduit	69	2-3
1CCE-FB09	Penetration	60	3-2
1CCE-FB09	1" Conduit	69	2-3
1CCE-FB09	1" Radial bend conduit	69	2-3
1CCE-FB09	1" Condulet	69	2-3
1CCE-FB09	17.5" x 15" x 6" Box	69	2-3
1CCE-FB10	1" Conduit	69	2-3
1CCE-FB10	1" Penetration	60	3-1
1CCE-FB10	1" Radial bend conduit	69	2-3

f. EVALUATION

FIRE HAZARDS ANALYSIS

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system. The combustible materials present in the area consist of cable insulation which represent a fire load of 35,033 BTU/FT<sup>2</sup>. A fire, would most likely begin in an electrical cabinet or due to a transient. A fire would not prevent entry into the compartment for fire fighting because it would develop slowly. Ignition of exposed cable insulation (IEEE 383 qualified) from a fire would also be limited as described below.

There are no cable trays or other insitu combustibles located directly underneath Thermo-Lag fire barrier envelopes 1CCE-FB03 and 1CCE-FB10 in this fire area; thus there are no combustibles below the fire barrier envelopes which could provide sustained fire exposure to them. It is reasonable to assume a fire originating with the electrical panels which indirectly exposes these barriers. Fire barrier envelope 1CCE-FB09 is located over a heater controller. There are no other combustibles between the heater controller and the envelope. Fires originating in a heater controller approximately 2-3 feet below an envelope present a potential localized exposure to the Thermo-Lag fire barrier envelope. This hazard does not represent a significant fuel load if it ignites.

The localized fire exposure for the assumed fire scenarios as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough to dissipate the energy from a localized fire in an electrical panel or due to a transient. The exposure to the fire barrier envelope(s) is judged less severe than an ASTM E-119 exposure. Room ventilation is isolated automatically by the HVAC duct detection system via dampers in supply and return ductwork for the room. Fire preplanning proceduralizes manual HVAC isolation if it does not occur automatically as designed.

The results of ASTM E-119 testing have been used to assign Actual Ratings of at least 60 minutes to the Thermo-Lag fire barrier envelopes in this fire area as shown on the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system



alarm to bring manual suppression to bear on a fire in this room. This is significantly less than the minimum of the fire barrier envelope within this zone of 60 minutes.

This fire area lacks significant quantities of cable insulation and transient combustibles. Further, the potential localized exposure to these fire barrier envelopes is not considered more severe than the exposure of an ASTM E-119 test. The fire brigade can be expected to reach the zone and commence suppression activities within 15 minutes of detection of a fire. Therefore, a minimum rating of 60 minutes, with existing and planned detection, is adequate to protect the safe shutdown circuits inside the fire barrier envelopes in this fire area with no automatic suppression system.

#### SUMMARY-FIRE AREA CB-FA-2c

This fire area is enclosed by 3 hour rated fire barriers. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system, and a manual hose station which is located outside the area. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area.

The fire loading is low. The majority of cable insulation in this area is qualified to the IEEE 383 Flame Test. Therefore, fires would be slow to develop and spread beyond the ignition source. Fires would be quickly detected.

Except for a heater controller, there are no insitu combustibles located directly underneath the Thermo-Lag fire barriers in this area. The minimum barrier rating of 60 minutes is considered adequate to protect safe shutdown circuits from damage in the event of a fire in this area without relying on the presence of automatic suppression. Further, the potential exposure to any barrier is not considered more severe than the exposure of the ASTM E-119 test. Since the severity of the exposure does not exceed that of the ASTM E-119 test, a 60 minute barrier rating is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the minimum barrier rating of 60 minutes.



**CONCLUSION-FIRE AREA CB-FA-2c**

GPU Nuclear concludes that an alternate fire protection configuration in Fire Area CB-FA-2c consisting of cable raceway fire barrier envelopes with a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system which will augment the existing HVAC duct smoke detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Area CB-FA-2c will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, the request for exemption from the requirement for an automatic suppression system in Fire Area CB-FA-2c should be granted.

3. FIRE AREA CB-FA-2d (Ref. Dwg. No. CB-FA-2d)

FIRE AREA DESCRIPTION (Information taken from the TMI-1 FIRE HAZARDS ANALYSIS REPORT)

a. FIRE AREA FEATURES

Fire Area CB-FA-2d is located on elevation 322' of the Control Building. Area dimensions are approximately 23 feet x 30 feet x 15 feet high. Area boundaries consist of reinforced concrete and metal panel walls, and reinforced concrete floor and ceiling. All area boundaries are 3-hour rated fire barriers. The north boundary is adjacent to Fire Areas CB-FA-2a and CB-FA-2b. The south boundary is adjacent to Fire Area CB-FA-2f. The east boundary is adjacent to the Turbine Building. The west boundary is adjacent to Fire Area CB-FA-2e. The floor is adjacent to Fire Area CB-FA-1 and the ceiling is adjacent to Fire Area CB-FA-3d.

b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustible in this area is cable insulation which is spread throughout the area. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Area. The overall fire loading is considered low, 42,559 BTU/FT<sup>2</sup>. This corresponds to a fire severity on the ASTM E-119 curve of between 31 and 32 minutes. Note that TMI-1 has administrative controls over transient combustibles and work in the plant.

c. FIRE PROTECTION FEATURES

Fire protection for this fire area consists of HVAC duct smoke detection which actuates an alarm in the control room and isolates supply and return air flow to the area upon alarm. An area wide early warning detection system which actuates an alarm in the control room will be added to augment the HVAC duct smoke detection system. Hose protection is provided outside this area in Fire Zone FH-FZ-5. This hose protection is capable of bringing an effective hose stream to bear on any location within this fire area. In addition, a portable dry chemical extinguisher is located inside this fire area and portable CO<sub>2</sub> and dry chemical extinguishers are located in adjacent areas.

The aforementioned fire protection features are maintained by the surveillance program required by the TMI-1 license condition.

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self contained breathing apparatus. Note there is no radiological hazard in this area that could impede fire fighting operations or fire brigade response.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the following functions:

- Reactor Coolant Pump Thermal Barrier Cooling
- Electrical Power System

These functions require fire barrier protection in order to insure a safe shutdown path if a fire eliminates all other unprotected circuits and equipment in this fire area. This assumption served as the basis for protecting the above functions in this fire area.

The following information describes the layout and function of the protected safe shutdown circuits in this fire area. Drawing CB-FA-2d depicts safe shutdown circuit routings for the various functions. This drawing also depicts circuit routings for redundant or alternative unprotected safe shutdown circuits. These are not exact routings but rather show the general paths of the various circuits. Protected circuits are routed in rigid steel conduit and are protected by envelopes which have a fire endurance rating of at least 60 minutes.

**ENVELOPE 1CCE-FB04**

Cables for the following function are protected by this envelope which runs north to south inside a fireproofed I beam on the ceiling. A heavily loaded open cable tray is located below and slightly to the west of this envelope.

- Reactor Coolant Pump Thermal Barrier Cooling

# **ENVELOPES 1CCE-FB05 AND 1CCE-FB06**

Cables for the following function are protected by these envelopes which are located in the southwest corner of the area. These envelopes pass approximately 2 feet over a heavily loaded cable tray. 120V/250V dc distribution panels are located below the tray and fire barrier envelopes.

- **Electrical Power System**

The function of these circuits is to protect a circuit for a transfer switch from a power source outside this area. There is no redundant or alternative circuit located in this room.

## **e. THERMO-LAG DESCRIPTION**

The following Thermo-Lag fire barriers are the subject of this exemption request. The TMI-1 FHAR currently requires these fire barriers to have a three hour fire endurance rating:

<b>ENVELOPE NO.</b>	<b>TYPE</b>	<b>ACTUAL RTG.</b>	<b>NEI TEST</b>
1CCE-FB04	0.75" Penetration	Upgrade to 60 min.	N/A
1CCE-FB04	0.75" Conduit	69	2-3
1CCE-FB04	0.75" Radial bend conduit	69	2-3
1CCE-FB04	0.75" Condulet	69	2-3
1CCE-FB05	1.5" Conduit	69	2-3
1CCE-FB05	1.5" Penetration	60	3-2
1CCE-FB05	1.5" Radial bend conduit	69	2-3
1CCE-FB05	10.75" x 7.5" x 5.8" Condulet	69	2-3
1CCE-FB05	14" x 6" x 6.5" Condulet	69	2-3
1CCE-FB05	9.5" x 5.5" x 5" Condulet	69	2-3
1CCE-FB06	1.5" Conduit	69	2-3
1CCE-FB06	1.5" Penetration	60	3-2
1CCE-FB06	1.5" Radial bend conduit	69	2-3
1CCE-FB06	1.5" Condulet	69	2-3
1CCE-FB06	14" x 6" x 6" Condulet	69	2-3

## f. EVALUATION

## FIRE HAZARDS ANALYSIS

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system. The combustible materials present in the area consist of inverter panels, battery chargers, breaker panels and cable insulation which represent a fire load of 42,559 BTU/FT<sup>2</sup>. A fire, would most likely begin in an electrical panel. A fire would not prevent entry into the compartment for fire fighting because it would develop slowly. Thermo-Lag fire barrier envelope (1CCE-FB04) passes over a heavily loaded cable tray. The inverter panels do not present a direct exposure to any of the Thermo-Lag fire barrier envelopes. It is reasonable to assume a fire originating at the inverters; however, ignition of the cable underneath the Thermo-Lag fire barrier envelope is unlikely as the inverters are not underneath this tray. The cable in the tray is IEEE 383 qualified and a fire is not likely to spread if it is ignited from below as a result of a fire originating from an inverter. It is more reasonable to assume a fire with the inverters that indirectly exposes the barrier in question. Thermo-Lag fire barrier envelopes 1CCE-FB05 and 1CCE-FB06 pass approximately 2 feet over a heavily loaded cable tray. The electrical panels below this tray present an exposure to the tray which, if ignited could impact these envelopes.

The localized fire exposure for the assumed fire scenarios as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough to dissipate the energy from a localized fire in the inverters which are not directly below the Thermo-Lag fire barrier envelopes. The envelopes over the tray located over the electrical panels could be challenged by this fire originating in these panels. The delay associated with a fire which eventually spreads to overhead cables from an inverter or an electrical panel results in a slow propagating cable fire. The exposure to the fire barrier envelope(s) is judged no more severe than an ASTM E-119 exposure. Room ventilation is isolated automatically by the HVAC duct detection system via dampers in supply and return ductwork for the room. Fire preplanning proceduralizes manual HVAC isolation if it does not occur automatically as designed.

The results of ASTM E-119 testing have been used to assign Actual Ratings of at least 60 minutes to the Thermo-Lag fire barrier envelopes in this fire area as shown on the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire

barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system alarm to bring manual suppression to bear on a fire in this room. This is significantly less than the minimum of the fire barrier envelope within this zone of 60 minutes.

This fire area lacks significant quantities of cable insulation and transient combustibles. Further, the potential localized exposure to these fire barrier envelopes is not considered more severe than the exposure of an ASTM E-119 test. The fire brigade can be expected to reach the zone and commence suppression activities within 15 minutes of detection of a fire. Therefore, a minimum rating of 60 minutes, with existing and planned detection, is adequate to protect the safe shutdown circuits inside the fire barrier envelopes in this fire area with no automatic suppression system.

#### SUMMARY-FIRE AREA CB-FA-2d

This fire area is enclosed by 3 hour rated fire barriers. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system and a manual hose station which is located outside the area. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area.

The fire loading is low. The majority of cable insulation in this area is qualified to the IEEE 383 Flame Test. Therefore, fires would be slow to develop and spread beyond the ignition source. Fires would be detected quickly. The minimum barrier rating of 60 minutes is considered adequate to protect safe shutdown circuits from damage in the event of a fire in this area without relying on the presence of automatic suppression. Further, the potential exposure to any barrier is not considered more severe than the exposure of the ASTM E-119 test. Since the severity of the exposure does not exceed that of the ASTM E-119 test, a 60 minute barrier rating is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the minimum barrier rating of 60 minutes.



#### CONCLUSION-FIRE AREA CB-FA-2d

GPU Nuclear concludes that an alternate fire protection configuration in Fire Area CB-FA-2d consisting of cable raceway fire barrier envelopes with a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system which will augment the existing HVAC duct smoke detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Area CB-FA-2d will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, the request for exemption from the requirement for an automatic suppression system in Fire Area CB-FA-2d should be granted.



4. FIRE AREA CB-FA-2e (Ref. Dwg. No. CB-FA-2e)

FIRE AREA DESCRIPTION (Information taken from TMI-1 FIRE HAZARDS ANALYSIS REPORT)

a. FIRE AREA FEATURES

Fire Area CB-FA-2e is located on elevation 322' of the Control Building. Area dimensions are approximately 23 feet x 30 feet x 15 feet high. Area boundaries consist of reinforced concrete and metal panel walls, and reinforced concrete floor and ceiling. All area boundaries are 3-hour rated fire barriers. The north boundary is adjacent to Fire Areas CB-FA-2b and CB-FA-2c. The south boundary is adjacent to Fire Area CB-FA-2g. The east boundary is adjacent to Fire Area CB-FA-2d. The west boundary is adjacent to Fire Zone FH-FZ-5. The floor is adjacent to Fire Area CB-FA-1 and the ceiling is adjacent to Fire Area CB-FA-3d.

b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustible in this area is cable insulation which is spread throughout the area. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Area. The overall fire loading is considered low, 45,660 BTU/FT<sup>2</sup>. This corresponds to a fire severity on the ASTM E-119 curve of between 34 and 35 minutes. Note that TMI-1 has administrative controls over transient combustibles and work in the plant.

c. FIRE PROTECTION FEATURES

Fire protection for this Fire Area consists of HVAC duct smoke detection which actuates an alarm in the control room and isolates supply and return air flow to the area upon alarm. An area wide early warning detection system which actuates an alarm in the control room will be added to augment the HVAC duct smoke detection system. Hose protection is provided outside this area in Fire Zone FH-FZ-5. This hose protection is capable of bringing an effective hose stream to bear on any location within this Fire Area. In addition, a portable dry chemical extinguisher is located inside this fire area. Adjacent areas are provided with portable dry chemical extinguishers and CO<sub>2</sub> extinguishers.

The aforementioned fire protection features are maintained by the surveillance program required by the TMI-1 license condition.

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self contained breathing apparatus. Note there is no radiological hazard in this area that could impede fire fighting operations or fire brigade response.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the following function:

- NNI/ICS Cabinet

This function requires fire barrier protection in order to insure power to train "A" instrumentation outside this fire area. This function is protected because power for Train A circuits is required for safe shutdown. There are no redundant circuits in this fire area as the protection is for power to equipment relied upon in other fire areas based upon a fire here.

The following information describes the layout and function of the protected safe shutdown circuit in this fire area. Drawing CB-FA-2e depicts safe shutdown circuit routings for the function. This is not an exact routing but rather shows the general paths of the circuit. This circuit is routed in rigid steel conduit and is protected by an envelope which has a fire endurance rating of at least 60 minutes.

**ENVELOPE 1CCE-FB07**

Cables for the NNI/ICS Cabinet are protected by this envelope which runs south to north along the west wall and then west to east over the inverter panels.

The envelope passes from 2 to 5 feet over two side by side heavily loaded cable trays. One of these trays passes approximately 4 feet above the inverter panels.

## e. THERMO-LAG DESCRIPTION

The following Thermo-Lag fire barriers are the subject of this exemption request.

The TMI-1 FHAR currently requires these fire barriers to have a three hour fire endurance rating:

<i>ENVELOPE NO.</i>	<i>TYPE</i>	<i>ACTUAL RTG.</i>	<i>NEI TEST</i>
1CCE-FB07	Penetration	Upgrade to 60 min.	N/A
1CCE-FB07	2" Conduit	69	2-3
1CCE-FB07	2" Radial bend conduit	69	2-3
1CCE-FB07	2" Condulet	69	2-3

## f. EVALUATION

## FIRE HAZARDS ANALYSIS

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system. The combustible materials present in the area consist of electrical panels and cable insulation which represent a fire load of 45,660 BTU/FT<sup>2</sup>. A fire, would most likely begin in an electrical panel. The Thermo-Lag fire barrier envelope passes over a heavily loaded cable tray and the electrical panels. A fire would not prevent entry into the compartment for fire fighting because it would develop slowly. Ignition of exposed cable insulation (IEEE 383 qualified) from a fire originating in an electrical panel would also be limited as described below.

Thermo-Lag conduit fire barrier envelope 1CCE-FB07 passes over two side by side heavily loaded cable trays and the Inverters (electrical panels). The potential exposure to the fire barrier envelope is greatest at this location. It is reasonable to assume a fire originating in the inverter discussed above ignites the cable in the tray above which subsequently exposes the Thermo-Lag fire barrier envelope.

The localized fire exposure for the assumed fire scenario as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough

to dissipate the energy from a localized fire in the inverter and tray directly below the Thermo-Lag fire barrier envelope. The envelope will be challenged by this fire. The delay associated with a fire which eventually spreads to overhead cables results in a slow propagating cable fire. The exposure to the fire barrier envelope is judged no more severe than an ASTM E-119 exposure. Room ventilation is isolated automatically by the HVAC duct detection system via dampers in supply and return ductwork for the room. Fire preplanning proceduralizes manual HVAC isolation if it does not occur automatically as designed.

The results of ASTM E-119 testing have been used to assign Actual Ratings of at least 60 minutes to the Thermo-Lag fire barrier envelopes in this fire area as shown on the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system alarm to bring manual suppression to bear on a fire in this room. This is significantly less than the minimum of the fire barrier envelope within this zone of 60 minutes.

This fire area lacks significant quantities of cable insulation and transient combustibles. Further, the potential localized exposure to these fire barrier envelopes is not considered more severe than the exposure of an ASTM E-119 test. The fire brigade can be expected to reach the zone and commence suppression activities within 15 minutes of detection of a fire. Therefore, a minimum rating of 60 minutes, with existing and planned detection, is adequate to protect the safe shutdown circuits inside the fire barrier envelopes in this fire area with no automatic suppression.

#### SUMMARY-FIRE AREA CB-FA-2e

This fire area is enclosed by 3 hour rated fire barriers. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system and a manual hose station which is located outside the area. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area.

The fire loading is low. The majority of cable insulation in this area is qualified to the IEEE 383 Flame Test. Therefore, fires would be slow to develop and spread beyond the ignition source. Fires would be detected

quickly. The minimum barrier rating of 60 minutes is considered adequate to protect safe shutdown circuits from damage in the event of a fire in this area without relying on the presence of automatic suppression. Further, the potential exposure to any barrier is not considered more severe than the exposure of the ASTM E-119 test. Since the severity of the exposure does not exceed that of the ASTM E-119 test, a 60 minute barrier rating is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the minimum barrier rating of 60 minutes.

#### CONCLUSION-FIRE AREA CB-FA-2e

GPU Nuclear concludes that an alternate fire protection configuration in Fire Area CB-FA-2e consisting of cable raceway fire barrier envelopes with a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system which will augment the existing HVAC duct smoke detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Area CB-FA-2e will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, the request for exemption from the requirement for an automatic suppression system in Fire Area CB-FA-2e should be granted.

5. FIRE AREA CB-FA-2f (Ref. Dwg. No. CB-FA-2f)

FIRE AREA DESCRIPTION (Information taken from TMI-1 FIRE HAZARDS ANALYSIS REPORT)

a. FIRE AREA FEATURES

Fire Area CB-FA-2f is located on elevation 322' of the Control Building. Area dimensions are approximately 24 feet x 30 feet x 15 feet high. Area boundaries consist of reinforced concrete and metal panel walls, and reinforced concrete floor and ceiling. All area boundaries are 3-hour rated fire barriers. The north boundary is adjacent to Fire Area CB-FA-2d. The south boundary is not adjacent to any other plant areas. The east boundary is adjacent to the Turbine Building. The west boundary is adjacent to Fire Area CB-FA-2g. The floor is adjacent to Fire Area CB-FA-1 and the ceiling is adjacent to Fire Area CB-FA-3d.

b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustibles in this area are cable insulation and battery cases which are spread throughout the area. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Area. The overall fire loading is considered low, 32,784 BTU/FT<sup>2</sup>. This corresponds to a fire severity on the ASTM E-119 curve of between 24 and 25 minutes. Note that TMI-1 has administrative controls over transient combustibles and work in the plant.

c. FIRE PROTECTION FEATURES

Fire protection for this Fire Area consists of HVAC duct smoke detection which actuates an alarm in the control room and isolates supply and return air flow to the area upon alarm. Hydrogen monitors which alarm in the control room are located in the area's return air ducts. An area wide early warning detection system which actuates an alarm in the control room will be added to augment the HVAC duct smoke detection system. Hose protection is provided outside this area in Fire Zone FH-FZ-5. This hose protection is capable of bringing an effective hose stream to bear on any location within this fire area. Adjacent areas are provided with portable dry chemical extinguishers and CO<sub>2</sub> extinguishers. The aforementioned fire



protection features are maintained by the surveillance program required by the TMI-1 license condition.

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self contained breathing apparatus. Note there is no radiological hazard in this area that could impede fire fighting operations or fire brigade response.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barrier in this fire area are associated with the following functions:

- Make-up and Supporting Functions
- Reactor Coolant Pump Thermal Barrier Cooling
- Electrical Power System

These functions require fire barrier protection in order to insure a safe shutdown path if a fire eliminates all other unprotected circuits and equipment in this fire area. This assumption served as the basis for protecting the above functions in this fire area. With the exception of a redundant circuit for one Supporting Function to the Make-Up System (Main oil pump for Make-up pump) and a redundant circuit for Reactor Coolant Pump Thermal Barrier Cooling (Intermediate Cooling Pump), the remaining circuits protected do not have redundant circuits routed in this fire area. These remaining circuits are protected because "Train A and C batteries" are located in this fire area. A fire is assumed to disable these batteries and power to Train A and Train C components. Therefore, Train B circuits required for safe shutdown are protected to insure safe shutdown in the event Train A and C power is lost due to a fire in this area.

The following information describes the layout and function of the protected safe shutdown circuits in this fire area. Drawing CB-FA-2f depicts safe shutdown circuit routings for the various functions. This drawing also depicts circuit routings for redundant or alternative unprotected safe shutdown circuits. These are not exact routings but rather show the general paths of the various circuits. As noted below, the protected circuits are routed in a steel tray protected by an envelope which has a fire endurance rating of at least 60 minutes.



**ENVELOPE 1CCE-FB08**

Cables for the following functions are protected by this envelope which is located on the west wall. The envelope is located about 5 feet above a heavily loaded open cable tray. This tray is about 5 feet over the edge of the battery cases.

- Make-up and Supporting Functions
- Reactor Coolant Pump Thermal Barrier Cooling
- Electrical Power System

**e. THERMO-LAG DESCRIPTION**

The following Thermo-Lag fire barriers are the subject of this exemption request.

The TMI-1 FHAR currently requires these fire barriers to have a three hour fire endurance rating:

<i>ENVELOPE NO.</i>	<i>TYPE</i>	<i>ACTUAL RTG.</i>	<i>NEI TEST</i>
1CCE-FB08	30" x 36" x 12" Box	Upgrade to 60 min.	N/A
1CCE-FB08	24" x 6" Cable tray	85	2-10
1CCE-FB08	6" x 6" Radial bend tray	86	2-10

**f. EVALUATION****FIRE HAZARDS ANALYSIS**

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system. The combustible materials present in the area consist of battery cases and cable insulation which represent a fire load of 32,784 BTU/FT<sup>2</sup>. The Thermo-Lag fire barrier envelope (1CCE-FB08) passes over a heavily loaded horizontal cable tray. The potential exposure to the fire barrier envelope is greatest at this location. It is reasonable to assume a fire originating at the batteries although the electrolyte filled battery cases are unlikely to contribute fuel to a fire. However, ignition of the cable underneath the Thermo-Lag fire barrier envelope is unlikely as the edge of

the battery casings are about 5 feet under this tray. The cable in the tray is IEEE 383 qualified and a fire is not likely to ignite cable in the tray. The fire would propagate slowly even if it is ignited from below as a result of a fire originating from the batteries. It is more reasonable to assume a fire with the battery to cable interface that indirectly exposes the barrier in question.

The localized fire exposure for the assumed fire scenario as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough to dissipate the energy from a localized fire originating with a battery. The Thermo-Lag fire barrier envelope will not be challenged by this fire as direct flame impingement is not likely from a fire originating with the batteries as described above. The fire would be localized. Room ventilation is isolated automatically by the HVAC duct detection system via dampers in supply and return ductwork for the room. Fire preplanning proceduralizes manual HVAC isolation if it does not occur automatically as designed.

The results of ASTM E-119 testing have been used to assign Actual Ratings of at least 60 minutes to the Thermo-Lag fire barrier envelopes in this fire area as shown on the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system alarm to bring manual suppression to bear on a fire in this room. This is significantly less than the minimum of the fire barrier envelope within this zone of 60 minutes.

This fire area lacks significant quantities of cable insulation and transient combustibles. Further, the potential localized exposure to these fire barrier envelopes is not considered more severe than the exposure of an ASTM E-119 test. The fire brigade can be expected to reach the zone and commence suppression activities within 15 minutes of detection of a fire. Therefore, a minimum rating of 60 minutes with existing and planned detection is adequate to protect the safe shutdown circuits inside the fire barrier envelopes in this fire area with no automatic suppression system.

#### SUMMARY-FIRE AREA CB-FA-2f

This fire area is enclosed by 3 hour rated fire barriers. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system,

hydrogen monitoring system and a manual hose station which is located outside the area. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area.

The fire loading is low and the fire barrier in question is not exposed directly to a fire initiating from a battery which is the most likely source of a fire in this area. The majority of cable insulation in this area is qualified to the IEEE 383 Flame Test. Therefore, fires would be slow to develop and spread beyond the ignition source. Fires would be quickly detected. The minimum barrier rating of 60 minutes is considered adequate to protect safe shutdown circuits from damage in the event of a fire in this area without relying on the presence of automatic suppression. Further, the potential exposure to any barrier is not considered more severe than the exposure of the ASTM E-119 test. Since the severity of the exposure does not exceed that of the ASTM E-119 test, a 60 minute barrier rating is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the minimum barrier rating of 60 minutes.

#### CONCLUSION-FIRE AREA CB-FA-2f

GPU Nuclear concludes that an alternate fire protection configuration in Fire Area CB-FA-2f consisting of cable raceway fire barrier envelopes with a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system which will augment the existing HVAC duct smoke detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Area CB-FA-2f will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, the request for exemption from the requirement for an automatic suppression system in Fire Area CB-FA-2f should be granted.

6. FIRE AREA CB-FA-2g (Ref. Dwg. No. CB-FA-2g)

FIRE AREA DESCRIPTION (Information taken from TMI-1 FIRE HAZARDS ANALYSIS REPORT)

a. FIRE AREA FEATURES

Fire Area CB-FA-2g is located on elevation 322' of the Control Building. Area dimensions are approximately 24 feet x 30 feet x 15 feet high. Area boundaries consist of reinforced concrete and metal panel walls, and reinforced concrete floor and ceiling. All area boundaries are 3-hour rated fire barriers. The north boundary is adjacent to Fire Area CB-FA-2e. The south boundary is not adjacent to any other plant areas. The east boundary is adjacent to Fire Area CB-FA-2f. The west boundary is adjacent to Fire Zone FH-FZ-5. The floor is adjacent to Fire Area CB-FA-1 and the ceiling is adjacent to Fire Area CB-FA-3d.

b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustibles in this area are cable insulation and battery cases which are spread throughout the area. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Area. The overall fire loading is considered low, 28,407 BTU/FT<sup>2</sup>. This corresponds to a fire severity on the ASTM E-119 curve of between 21 and 22 minutes. Note that TMI-1 has administrative controls over transient combustibles and work in the plant.

c. FIRE PROTECTION FEATURES

Fire protection for this Fire Area consists of HVAC duct smoke detection which actuates an alarm in the control room and isolates supply and return air flow to the area upon alarm. Hydrogen monitors which alarm in the control room are located in the area's return air ducts. An area wide early warning detection system which actuates an alarm in the control room will be added to augment the HVAC duct smoke detection system. Hose protection is provided outside this area in Fire Zone FH-FZ-5. This hose protection is capable of bringing an effective hose stream to bear on any location within this Fire Area. Adjacent areas are provided with portable dry chemical extinguishers and CO<sub>2</sub> extinguishers.

The aforementioned fire protection features are maintained by the surveillance program required by the TMI-1 license condition.

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self contained breathing apparatus. Note there is no radiological hazard in this area that could impede fire fighting operations or fire brigade response.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the following function:

- **NNI/ICS Cabinet**

This function requires fire barrier protection in order to insure power to instrumentation outside this fire area. This function is protected because "Train B and D batteries" are located in this fire area. A fire is assumed to disable these batteries and power to Train B and Train D components. Therefore, power for Train A circuits required for safe shutdown are protected to insure safe shutdown in the event Train B and D power is lost due to a fire in this area.

The following information describes the layout and function of the protected safe shutdown circuit in this fire area. Drawing CB-FA-2g depicts safe shutdown circuit routings for the function. This is not an exact routing but rather shows the general path of the circuit. This circuit is routed in rigid steel conduit and is protected by an envelope which has a fire endurance rating of at least 60 minutes.

**ENVELOPE 1CCE-FB07**

Cables for the NNI/ICS Cabinet are protected by this envelope which runs south to north along the west wall. The envelope is not located over any insitu combustibles.



## e. THERMO-LAG DESCRIPTION

The following Thermo-Lag fire barriers are the subject of this exemption request.

The TMI-1 FHAR currently requires these fire barriers to have a three hour fire endurance rating:

ENVELOPE NO.	TYPE	ACTUAL RTG.	NEI TEST
1CCE-FB07	Penetration	Upgrade to 60 min.	N/A
1CCE-FB07	19" x 5" x 5" Condulet	69	2-3
1CCE-FB07	2" Conduit	69	2-3
1CCE-FB07	2" Penetration	60	3-1
1CCE-FB07	2" Radial bend conduit	69	2-3
1CCE-FB07	22" x 7" x 6" Condulet	69	2-3

## f. EVALUATION

## FIRE HAZARDS ANALYSIS

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system. The combustible materials present in the area consist of battery cases and cable insulation which represent a fire load of 28,407 BTU/FT<sup>2</sup>. There are no cable trays or other insitu combustibles underneath Thermo-Lag fire barrier envelope which could provide sustained fire exposure to the barrier envelope. It is more reasonable to assume a fire with the battery to cable interface that indirectly exposes the barrier in question. The electrolyte filled battery cases are unlikely to contribute fuel to a fire.

The localized fire exposure for the assumed fire scenario as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough to dissipate the energy from a localized fire originating with a battery. The Thermo-Lag fire barrier envelope will not be challenged by this fire as direct flame impingement is not likely from a fire originating with the batteries as described above. The fire would be localized. Room ventilation is isolated automatically by the HVAC duct detection system via dampers in supply and return ductwork for the room. Fire preplanning

proceduralizes manual HVAC isolation if it does not occur automatically as designed.

The results of ASTM E-119 testing have been used to assign Actual Ratings of at least 60 minutes to the Thermo-Lag fire barrier envelopes in this fire area as shown on the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system alarm to bring manual suppression to bear on a fire in this room. This is significantly less than the minimum of the fire barrier envelope within this zone of 60 minutes.

This fire area lacks significant quantities of cable insulation and transient combustibles. Further, the potential localized exposure to these fire barrier envelopes is not considered more severe than the exposure of an ASTM E-119 test. The fire brigade can be expected to reach the zone and commence suppression activities within 15 minutes of detection of a fire. Therefore, a minimum rating of 63 minutes with existing and planned detection is adequate to protect the safe shutdown circuits inside the fire barrier envelopes in this fire area with no automatic suppression system.

#### SUMMARY-FIRE AREA CB-FA-2g

This fire area is enclosed by 3 hour rated fire barriers. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system, hydrogen monitoring system and a manual hose station which is located outside the area. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area.

The fire loading is low and the fire barrier in question is not exposed directly to a fire initiating from a battery which is the most likely source of a fire in this area. The majority of cable insulation in this area is qualified to the IEEE 383 Flame Test. Therefore, fires would be slow to develop and spread beyond the ignition source. Fires would be detected quickly. The minimum barrier rating of 60 minutes is considered adequate to protect safe shutdown circuits from damage in the event of a fire in this area without relying on the presence of automatic suppression. Further, the potential exposure to any barrier is not considered more severe than the

exposure of the ASTM E-119 test. Since the severity of the exposure does not exceed that of the ASTM E-119 test, a 60 minute barrier rating is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the minimum barrier rating of 60 minutes.

#### CONCLUSION-FIRE AREA CB-FA-2g

GPU Nuclear concludes that an alternate fire protection configuration in Fire Area CB-FA-2g consisting of cable raceway fire barrier envelopes with a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system which will augment the existing HVAC duct smoke detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Area CB-FA-2g will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, . . . request for exemption from the requirement for an automatic suppression system in Fire Area CB-FA-2g should be granted.

7. FIRE AREA CB-FA-3a (Ref. Dwg. No. CB-FA-3a)

FIRE AREA DESCRIPTION (Information taken from TMI-1 FIRE HAZARDS ANALYSIS REPORT)

a. FIRE AREA FEATURES

Fire Area CB-FA-3a is located on elevation 338'-6" of the Control Building. Area dimensions are approximately 49 feet x 17 feet x 16 feet high. Area boundaries consist of reinforced concrete and metal panel walls, and reinforced concrete floor and ceiling. All area boundaries are 3-hour rated fire barriers. The north boundary is adjacent to the Turbine Building. The south boundary is adjacent to Fire Area CB-FA-3d. The east boundary is adjacent to the Turbine Building. The west boundary is adjacent to Fire Area CB-FA-3b. The floor is adjacent to Fire Area CB-FA-2a and the ceiling is adjacent to Fire Area CB-FA-4a.

b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustibles in this area are electrical equipment (switchgear) and cable insulation which is spread throughout the area. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Area. The overall fire loading is considered low, 50,815 BTU/FT<sup>2</sup>. This corresponds to a fire severity on the ASTM E-119 curve of between 38 and 39 minutes. Note that TMI-1 has administrative controls over transient combustibles and work in the plant.

c. FIRE PROTECTION FEATURES

Fire protection for this Fire Area consists of HVAC duct smoke detection which actuates an alarm in the control room and isolates supply and return air flow to the area upon alarm. An area wide early warning detection system which actuates an alarm in the control room will be added to augment the HVAC duct smoke detection system. Hose protection is provided outside this area in Fire Zone FH-FZ-5. This hose protection is capable of bringing an effective hose stream to bear on any location within this Fire Area. Adjacent areas are provided with portable dry chemical extinguishers, halon and CO<sub>2</sub> extinguishers.

The aforementioned fire protection features are maintained by the surveillance program required by the TMI-1 license condition.

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self contained breathing apparatus. Note there is no radiological hazard in this area that could impede fire fighting operations or fire brigade response.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the following functions:

- Supporting Functions for Make-up
- Reactor Coolant Pump Thermal Barrier Cooling
- Electrical Power System

These functions require fire barrier protection in order to insure a safe shutdown path if a fire eliminates all other unprotected circuits and equipment in this fire area. This assumption served as the basis for protecting the above functions in this fire area.

The following information describes the layout and function of the protected safe shutdown circuits in this fire area. Drawing CB-FA-3a depicts safe shutdown circuit routings for the various functions. This drawing also depicts circuit routings for redundant or alternative unprotected safe shutdown circuits. These are not exact routings but rather show the general paths of the various circuits. Protected circuits are routed in rigid steel conduit and are protected by envelopes which have a fire endurance rating of at least 60 minutes.

**ENVELOPE 1CCG-FB01**

Cables for the following functions are protected by this envelope which is located in the northwest corner of the area. Note that the redundant circuit for the Supporting function for Make-up (Nuclear Service River Water Valve) is also protected by this envelope. A heater controller is located approximately 2-3 feet below this envelope.

- Supporting functions for Make-up
- Electrical Power System

**ENVELOPE ICCG-FB05**

Cable for the following function is protected by this envelope which runs west to east then north to south. The envelope passes about 5 feet over a heavily loaded open cable tray. The envelope is about 6 feet over the 1D 4160V Switchgear and is located inside a fire proofed I-beam where routed over the switchgear.

Where routed over the switchgear, a steel HVAC duct is located in between the envelope and the open cable tray. At every other location over the aforementioned tray, the tray is approximately 8 feet below the envelope. There is no duct between the tray and envelope here.

- Reactor Coolant Pump Thermal Barrier Cooling

e. **THERMO-LAG DESCRIPTION**

The following Thermo-Lag fire barriers are the subject of this exemption request.

The TMI-1 FHAR currently requires these fire barriers to have a three hour fire endurance rating:

<b>ENVELOPE NO.</b>	<b>TYPE</b>	<b>ACTUAL RTG.</b>	<b>NEI TEST</b>
1CCE-FB01	Penetration	Upgrade to 60 min.	N/A
1CCE-FB01	12" x 15" x 13.5" Box	60	2-2
1CCE-FB01	2" Conduit	69	2-3
1CCE-FB01	2" Radial bend conduit	69	2-3
1CCE-FB05	13.5" x 6" x 6" Condulet	69	2-3
1CCE-FB05	16" x 6" x 7.5" Condulet	69	2-3
1CCE-FB05	2" Conduit	69	2-3
1CCE-FB05	2" Penetration	60	3-1
1CCE-FB05	2" Radial bend conduit	69	2-3



## f. EVALUATION

## FIRE HAZARDS ANALYSIS

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system. The combustible materials present in the area consist of electrical switchgear and cable insulation which represent a fire load of 50,815 BTU/FT<sup>2</sup>. A fire, would most likely begin in a section of the electrical switchgear. A fire would not prevent entry into the compartment for fire fighting because it would develop slowly. Ignition of exposed cable insulation (IEEE 383 qualified) from a fire originating in the electrical switchgear would also be limited as described below.

Thermo-Lag conduit fire barrier envelope ICCG-FB05 passes over a heavily loaded cable tray and the switchgear. A steel HVAC duct is located between the tray and envelope here. The potential exposure to the fire barrier envelope is reduced at this location because of the steel duct. It is reasonable to assume a fire originating in the switchgear ignites the cable in the tray located above the switchgear which subsequently exposes the Thermo-Lag fire barrier envelope. The potential exposure to this fire barrier is greatest at this location. It is reasonable to assume a fire originating in the switchgear exposes this Thermo-Lag fire barrier envelope. Where this envelope passes over an open cable tray (about 8 ft), the potential for exposure is less because there are no combustibles below the tray and because the tray is about 8 ft. below the envelope. Fires originating in a heater controller approximately 2-3 feet below Thermo-Lag fire barrier envelope ICCG-FB01 present less of a potential exposure to this fire barrier envelope in this fire area than the switchgear fire because these hazards do not represent a significant fuel load compared to the switchgear.

The localized fire exposure for the assumed fire scenarios as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough to dissipate the energy from a localized fire in the switchgear and trays directly below the Thermo-Lag fire barrier envelope. The envelope will be challenged by this fire. The delay associated with a switchgear fire which eventually spreads to overhead cables results in a slow propagating cable fire. The exposure to the fire barrier envelope(s) is judged less severe than an ASTM E-119 exposure. Room ventilation is isolated automatically by the HVAC duct detection system via dampers in supply and return

ductwork for the room. Fire preplanning proceduralizes manual HVAC isolation if it does not occur automatically as designed.

The results of ASTM E-119 testing have been used to assign Actual Ratings of at least 60 minutes to the Thermo-Lag fire barrier envelopes in this fire area as shown on the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system alarm to bring manual suppression to bear on a fire in this room. This is significantly less than the minimum of the fire barrier envelope within this zone of 60 minutes.

This fire area lacks significant quantities of cable insulation and transient combustibles. Further, the potential localized exposure to these fire barrier envelopes is not considered more severe than the exposure of an ASTM E-119 test. The fire brigade can be expected to reach the zone and commence suppression activities within 15 minutes of detection of a fire. Therefore, a minimum rating of 60 minutes with existing and planned detection is adequate to protect the safe shutdown circuits inside the fire barrier envelopes in this fire area with no automatic suppression system.

#### SUMMARY-FIRE ZONE CB-FA-3a

This fire area is enclosed by 3 hour rated fire barriers. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system and a manual hose station which is located outside the area. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area.

The fire loading is low. The majority of cable insulation in this area is qualified to the IEEE 383 Flame Test. Therefore, fires will be slow to develop and spread beyond the ignition source. Fires would be quickly detected. The minimum barrier rating of 60 minutes is considered adequate to protect safe shutdown circuits from damage in the event of a fire in this area without relying on the presence of automatic suppression. Further, the potential exposure to any barrier is not considered more severe than the exposure of the ASTM E-119 test. Since the severity of the exposure does not exceed that of the ASTM E-119 test, a 60 minute barrier rating is considered adequate since the fire brigade can be expected to reach the

area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the barrier rating of 60 minutes.

#### CONCLUSION-FIRE AREA CB-FA-3a

GPU Nuclear concludes that an alternate fire protection configuration in Fire Area CB-FA-3a consisting of cable raceway fire barrier envelopes with a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system which will augment the existing HVAC duct smoke detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Area CB-FA-3a will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, the request for exemption from the requirement for an automatic suppression system in Fire Area CB-FA-3a should be granted.

8. FIRE AREA CB-FA-3b (Ref. Dwg. No. CB-FA-3b)

FIRE AREA DESCRIPTION (Information taken from TMI-1 FIRE HAZARDS ANALYSIS REPORT)

a. FIRE AREA FEATURES

Fire Area CB-FA-3b is located on elevation 338'-6" of the Control Building. Area dimensions are approximately 49 feet x 17 feet x 16 feet high. Area boundaries consist of reinforced concrete and metal panel walls, and reinforced concrete floor and ceiling. All area boundaries are 3-hour rated fire barriers. The north boundary is adjacent to the Turbine Building. The south boundary is adjacent to Fire Area CB-FA-3d. The east boundary is adjacent to Fire Area CB-FA-3a. The west boundary is adjacent to Fire Zone FH-FZ-5. The floor is adjacent to Fire Area CB-FA-2b and the ceiling is adjacent to Fire Area CB-FA-4a.

b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustibles in this area are electrical equipment (switchgear) and cable insulation which is spread throughout the area. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Area. The overall fire loading is considered low, 52,959 BTU/FT<sup>2</sup>. This corresponds to a fire severity on the ASTM E-119 curve of between 39 and 40 minutes. Note that TMI-1 has administrative controls over transient combustibles and work in the plant.

c. FIRE PROTECTION FEATURES

Fire protection for this Fire Area consists of HVAC duct smoke detection which actuates an alarm in the control room and isolates supply and return air flow to the area upon alarm. An area wide early warning detection system which actuates an alarm in the control room will be added to augment the HVAC duct smoke detection system. Hose protection is provided outside this area in Fire Zone FH-FZ-5. This hose protection is capable of bringing an effective hose stream to bear on any location within this Fire Area. Adjacent areas are provided with portable dry chemical extinguishers and CO<sub>2</sub> extinguishers.

The aforementioned fire protection features are maintained by the surveillance program required by the TMI-1 license condition.

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self contained breathing apparatus. Note there is no radiological hazard in this area that could impede fire fighting operations or fire brigade response.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the following functions:

- Make-up
- RCS Pressure
- Electrical Power System

These functions require fire barrier protection in order to insure a safe shutdown path if a fire eliminates all other unprotected circuits and equipment in this fire area. This assumption served as the basis for protecting the above functions in this fire area.

The following information describes the layout and function of the protected safe shutdown circuits in this fire area. Drawing CB-FA-3b depicts safe shutdown circuit routings for the various functions. This drawing also depicts circuit routings for redundant or alternative unprotected safe shutdown circuits. These are not exact routings but rather show the general paths of the various circuits. As noted below the protected circuits are routed in rigid steel conduit and are protected by envelopes which have a fire endurance rating of at least 60 minutes.

**ENVELOPE 1CCG-FB02**

Cables for the Electrical Power System are protected by this envelope which runs west to east and passes approximately 5 feet over a heavily loaded open cable tray. The envelope is about 6 feet over the 4160V 1E Switchgear.

**ENVELOPE 1CCG-FB03**

Cables for the Electrical Power System are protected by this envelope which runs west to east. This envelope does not pass directly over the 4160V 1E Switchgear. It passes over an electrical panel. A solid bottom tray is located between the electrical panel and the envelope. This envelope passes under a heavily loaded open cable tray along the southwest wall.

**ENVELOPE 1CCG-FB04**

Cables for RCS pressure control are protected by this envelope in order to prevent spurious operation of the PORV (RC-RV-2). There is no redundant circuit in this area. This envelope does not pass directly over the 4160V 1E Switchgear.

It passes over an electrical panel. A solid bottom tray is located between the electrical panel and the envelope. This envelope passes under a heavily loaded open cable tray along the southwest wall.

**ENVELOPE 1CCG-FB05**

Cables for Make-up are protected by this envelope for minimum make-up pump flow and seal injection. There is no redundant circuit in this area. This envelope is located along the east wall. It does not pass over the 4160V Switchgear. There are no insitu combustibles located under this envelope.

e. **THERMO-LAG DESCRIPTION**

The following Thermo-Lag fire barriers are the subject of this exemption request.



The TMI-1 FHAR currently requires these fire barriers to have a three hour fire endurance rating:

<i>ENVELOPE NO.</i>	<i>TYPE</i>	<i>ACTUAL RTG.</i>	<i>NEI TEST</i>
ICCG-FB02	23" x 17" x 5" Penetration	Upgrade to 60 min.	N/A
ICCG-FB03	13" x 16" x 5" Penetration	Upgrade to 60 min.	N/A
ICCG-FB03	16" x 11.5" x 3" Penetration	Upgrade to 60 min.	N/A
ICCG-FB05	15" x 7" x 7" Box	Upgrade to 60 min.	N/A
ICCG-FB05	35" x 10.5" x 16" Box	Upgrade to 60 min.	N/A
ICCG-FB02	3" Conduit	91	2-3
ICCG-FB02	3" Radial bend conduit	91	2-3
ICCG-FB03	1" Conduit	69	2-3
ICCG-FB03	1" Radial bend conduit	69	2-3
ICCG-FB03	14.5" x 4" x 4" Condulet	69	2-3
ICCG-FB03	7.5" x 6" x 5.5" Condulet	69	2-3
ICCG-FB04	0.75" Conduit	69	2-3
ICCG-FB05	Penetration	60	3-1
ICCG-FB05	2" Conduit	69	2-3
ICCG-FB05	2" Radial bend conduit	69	2-3
ICCG-FB05	2" Condulet	69	2-3

#### f. EVALUATION

##### FIRE HAZARDS ANALYSIS

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system. The combustible materials present in the area consist of electrical switchgear and cable insulation which represent a fire load of 52,959 BTU/FT<sup>2</sup>. A fire, would most likely begin in a section of the electrical switchgear. A fire would not prevent entry into the compartment for fire fighting because it would develop slowly. Ignition of exposed cable insulation (IEEE 383 qualified) from a fire originating in the electrical switchgear would also be limited as described below. Thermo-Lag conduit fire barrier envelope ICCG-FB02 passes about 5 feet over a heavily loaded cable tray and the switchgear. The potential exposure to the fire barrier envelope is greatest at this location. It is reasonable to assume a fire originating in the switchgear discussed above ignites the cable in the tray

above which subsequently exposes the Thermo-Lag fire barrier envelope. In addition, cable tray fire barrier envelopes 1CCG-FB03 and 1CCG-FB04 pass over an electrical cabinet; however exposure to these envelopes from the panel is shielded by a solid bottom tray. These envelopes also pass under a heavily loaded tray. There is no potential for sustained exposure at this location due to the absence of fixed combustibles. The potential exposure to these fire barriers is greatest at over the electrical cabinet. It is reasonable to assume a fire originating in the cabinet which indirectly exposes these Thermo-Lag fire barrier envelopes. Finally, fire barrier envelope 1CCG-FB05 is not located over insitu combustibles.

The localized fire exposure for the assumed fire scenarios as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough to dissipate the energy from a localized fire in the switchgear and trays directly below the Thermo-Lag fire barrier envelope. The envelope will not be challenged by this fire.

The delay associated with a switchgear fire which eventually spreads to overhead cables results in a slow propagating cable fire. The exposure to the fire barrier envelope(s) is judged no more severe than an ASTM E-119 exposure. Room ventilation is isolated automatically by the HVAC duct detection system via dampers in supply and return ductwork for the room. The potential exposure to Thermo-Lag is considered more severe here than over the electrical cabinet as the fire barrier envelope is directly over the switchgear and open cable tray as opposed to being shielded by a metal bottom tray. Therefore, the results of ASTM E-119 testing have been used to assign Actual Ratings of at least 60 minutes to the Thermo-Lag fire barrier envelopes in this fire area as shown on the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system alarm to bring manual suppression to bear on a fire in this room. This is significantly less than the minimum cable qualification rating of the fire barrier envelope within this area which is 60 minutes.

This fire area lacks significant quantities of cable insulation and transient combustibles. Further, the potential localized exposure to these fire barrier envelopes is not considered more severe than the exposure of an ASTM E-119 test. The fire brigade can be expected to reach the zone and commence suppression activities within 15 minutes of detection of a fire. Therefore, a minimum rating of 60 minutes with existing and planned

detection is adequate to protect the safe shutdown circuits inside the fire barrier envelopes in this fire area with no automatic suppression system.

#### SUMMARY-FIRE AREA CB-FA-3b

This fire area is enclosed by 3 hour rated fire barriers. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system and a manual hose station which is located outside the area. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area.

The fire loading is low. The majority of cable insulation in this area is qualified to the IEEE 383 Flame Test. Therefore, fires will be slow to develop and spread beyond the ignition source. Fires will be quickly detected. The minimum barrier rating of 60 minutes is considered adequate to protect safe shutdown circuits from damage in the event of a fire in this area without relying on the presence of automatic suppression. Further, the potential exposure to any barrier is not considered more severe than the exposure of the ASTM E-119 test. Since the severity of the exposure does not exceed that of the ASTM E-119 test, a 60 minute barrier rating is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the minimum barrier rating of 60 minutes.

#### CONCLUSION-FIRE AREA CB-FA-3b

GPU Nuclear concludes that an alternate fire protection configuration in Fire Area CB-FA-3b consisting of cable raceway fire barrier envelopes with a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system which will augment the existing HVAC duct smoke detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Area CB-FA-3b will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects

of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, the request for exemption from the requirement for an automatic suppression system in Fire Area CB-FA-3b should be granted.

9. FIRE ZONE FH-FZ-5 (Ref. Dwg. Nos. FH-FZ-5)

FIRE ZONE DESCRIPTION (Information taken from TMI-1 Fire Hazards Analysis Report)

a. FIRE ZONE FEATURES

Fire Zone FH-FZ-5 is located in the Control Building. Area dimensions are approximately 120 feet x 21 feet x 80 feet high. The zone covers four elevations 322'-0", 338'-6", 355'-0" and 380'-0". Each elevation floor except elevation 322'-0" consists of steel grating. The I&C shop is located on elevation 355'-0" in the southwest corner of this zone. Zone boundaries consist of reinforced concrete walls, floor and ceiling. The north and south boundaries are three-hour fire rated barriers. The west boundary is adjacent to Fire Zones FH-FZ-2 and FH-FZ-4, there are no open penetrations. The east boundary is a three hour rated fire barrier except on elevation 380' where adjacent to Fire Zones CB-FZ-5a and CB-FZ-5b. A major portion of the east boundary where adjacent to CB-FZ-5a and CB-FZ-5b consists of reinforced concrete. The remainder is open. In addition, the east boundary where adjacent to Fire Area CB-FA-3d has six ventilated (passive) bus ducts (each 6"x 8-1/2") which are externally sealed at the barrier to a three hour rating, internally provided with a fireproof seal, and are controlled as such. The floor is adjacent to FH-FZ-2. The ceiling is not adjacent to any other plant areas.

b. COMBUSTIBLE MATERIALS AND LOCATIONS

The principal insitu combustibles in the area of the Thermo-Lag envelope are electrical equipment (switchgear) and cable insulation which is spread throughout the zone. Most of the exposed cable insulation meets the requirements of the IEEE 383 Flame Test. The installed Thermo-Lag itself has been added to the combustible inventory in this Fire Zone. The fire loading in this fire zone is high, however the principal contributor to the high fire loading begins on elevation 338'-6" with an office complex area. The ceiling of this level of Fire Zone FH-FZ-5 is reinforced concrete except for an opening via grating to elevation 338'-6" about 30 feet south of the Thermo-Lag envelope.

c. FIRE PROTECTION FEATURES

An area wide early warning detection system which actuates an alarm in the control room will be added to this fire zone on elevation 322'-0". Area detection is provided in the I&C Shop on elevation 355'-0". In addition,

each elevation is provided with two hose stations except elevation 380'-0" which is provided with one fire hose station. Portable CO2 extinguishers are located on elevations 322'-0" and 338'-6", a portable dry chemical and CO2 extinguisher is provided on elevation 355'-0" and a portable water and dry chemical extinguisher is provided inside the stairwell on elevation 380'-0".

Based upon actual experience, 15 minutes is estimated for the full fire brigade complement to bring manual suppression to bear on a fire in this fire area. This assumes the fire brigade is in full turnout gear with self-contained breathing apparatus.

d. **SAFE SHUTDOWN CIRCUITS AND EQUIPMENT**

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the following functions:

- Make-up
- Reactor Coolant Pump Thermal Barrier Cooling

These functions require fire barrier protection in order to insure a safe shutdown path if a fire eliminates all other unprotected circuits and equipment in this fire area. This assumption served as the basis for protecting the above functions in this fire area.

The following information describes the layout and function of the protected safe shutdown circuits in this fire area. Drawing FH-FZ-5 depicts safe shutdown circuit routings for the various functions. This drawing also depicts circuit routings for redundant or alternative unprotected safe shutdown circuits. These are not exact routings but rather show the general paths of the various circuits. Protected circuits are routed in rigid steel conduit and are protected by envelopes which have a fire endurance rating of at least 60 minutes.

**ENVELOPE 1CCE-FB01**

Cables for the following functions are protected by this envelope which runs west to east and passes approximately 10 feet over Switchgear with no intervening cable trays between the Switchgear and envelope.



- Make-up
- Reactor Coolant Pump Thermal Barrier Cooling

e. THERMO-LAG DESCRIPTION

The following Thermo-Lag fire barrier is subject of this exemption request.

The TMI-1 FHAR currently requires this fire barrier to have a three hour fire endurance rating:

ENVELOPE NO.	TYPE	ACTUAL RTG.	NEI TEST
1CCE-FB01	14.5" x 7.5" x 7" Penetration	60	3-2
1CCE-FB01	2.5" Penetration	60	3-1
1CCE-FB01	14.5" x 7.5" x 7" Condulet	69	2-3
1CCE-FB01	2.5" Conduit	69	2-3
1CCE-FB01	2.5" Radial bend conduit	69	2-3
1CCE-FB01	7.75" x 18.5" x 28" Condulet	69	2-3

f. EVALUATION

FIRE HAZARDS ANALYSIS

The technical requirements of Appendix R, Section III.G.2 are not met because this fire area is not provided with an automatic suppression system.

The fire loading in this fire zone corresponds to a fire severity on the ASTM E-119 time-temperature curve which exceeds the minimum barrier rating of 60 minutes for the Thermo-Lag fire barrier envelope in this fire zone. However, the unique features of this fire zone must be considered in evaluating the potential exposure to the envelope.

Concentrations of Class A combustibles which are the principal contributor to the fire loading in this zone are located on elevations 355'-0" and 338'-6" of this fire zone. As stated above, the ceiling of this level of Fire Zone FH-FZ-5 is reinforced concrete except for an opening via grating to elevation 338'-6" about 30 feet south of the Thermo-Lag envelope. While there are intervening combustibles between the fire barrier envelope and the open grating, it is reasonable to assume that the principal exposure to the envelope will come from the switchgear and cable insulation located in the immediate vicinity of the envelope, not the office complex on the floors above.

Thermo-Lag conduit fire barrier envelope 1CCE-FB01 passes about 10 feet over switchgear 1L. The potential exposure to the fire barrier envelope is greatest at this location. It is reasonable to assume a fire originating in the switchgear discussed above exposes the Thermo-Lag fire barrier envelope. Note there are no cable trays directly between the switchgear and the envelope.

The localized fire exposure for the assumed fire scenario as discussed above is judged to be less severe than the conditions experienced in the ASTM E-119 test. The overall volume of the room is substantial enough to dissipate the energy from a fire in the switchgear directly below the Thermo-Lag fire barrier envelope. The envelope will be challenged by this fire. A switchgear fire which results in exposure to the fire barrier envelope is judged no more severe than an ASTM E-119 exposure. The fire is localized. Therefore, the results of ASTM E-119 testing have been used to assign Actual Ratings of 60 minutes in this fire area as shown in the above table. The conditions created by potential fires discussed above and the effects of such fires upon the fire barrier envelopes in question would not exceed the severity of an ASTM E-119 exposure on the same envelope. It is conservatively estimated that it will take 15 minutes upon receipt of an automatic fire detection system alarm to bring manual suppression to bear on a fire in this room. This is significantly less than the minimum barrier rating of the fire barrier envelope within this zone which is 60 minutes.

#### SUMMARY-FIRE ZONE FH-FZ-5

This fire zone consists of multiple elevations. It is not bounded on all sides by rated fire barriers. Fire protection consists of portable extinguishers and manual hose station capability on each elevation. An area wide automatic detection system will be installed to provide early warning capability for potential fires in this area and provide reasonable assurance that a fire will be discovered before it results in significant damage and exposure to the Thermo-Lag fire barrier envelopes in this area. The fire loading is low in the area of the fire zone where the Thermo-Lag envelope is located. While there are intervening combustibles between the fire barrier envelope and the open grating in the ceiling above, it is reasonable to assume that the principal exposure to the envelope will come from the switchgear and cable insulation located in the vicinity of the envelope, not the office complex on the floors above as the opening in the grating is about 30 feet south of the Thermo-Lag envelope. The fire hazards in the area are insufficient to challenge minimum fire barrier rating of 60 minutes, without the presence of automatic suppression, for the Thermo-Lag fire barrier envelope in this fire area. Further, the potential exposure to any barrier is not considered more severe than the exposure of the ASTM E-119 test. Since the severity

of exposure does not exceed that of the ASTM E-119 test, and the fire loading is low, a 60 minute fire barrier without automatic suppression in the fire area is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within 15 minutes of receipt of an automatic fire detection system alarm. This is significantly less than the minimum barrier rating of 60 minutes. It is reasonable to expect that fire fighting activities will suppress the effects of a fire on a Thermo-Lag envelope and extinguish a postulated fire well before 60 minutes. Again, the 60 minute rating is derived from testing of the same barrier to the exposure of an ASTM E-119 test.

#### CONCLUSION-FIRE ZONE FH-FZ-5

GPU Nuclear concludes that an alternate fire protection configuration in Fire Zone FH-FZ-5 consisting of cable raceway fire barrier envelopes with a Thermo-Lag fire endurance rating of at least 60 minutes and an area wide fire detection system will provide reasonable assurance that one safe shutdown train will be free of fire damage. This configuration will achieve an acceptable level of protection equivalent to that of Appendix R, Section III.G.2. Therefore the safe shutdown circuits protected by these envelopes in Fire Zone FH-FZ-5 will maintain the ability to perform their function in the event of a fire. The control of transient combustibles, the automatic detection system and the ability of the plant fire brigade to bring manual suppression to bear on a fire in this area within 15 minutes are considered adequate fire prevention and fire fighting measures to minimize the effects of a fire in this area thus insuring the ability to achieve safe shutdown in the event of a fire in this area.

Based on this conclusion, the request for exemption from the requirement for an automatic suppression system in Fire Zone FH-FZ-5 should be granted.

**Enclosure B**

**TMI-1 EVALUATION OF THERMO-LAG FIRE  
BARRIERS**

**TOPICAL REPORT #094  
REV. 1**

## I. REQUEST

The purpose of this submittal is to request, in accordance with the provisions of Title 10 Code of Federal Regulations Section 50.12 (10 CFR 50.12), "Specific exemptions," an exemption for Three Mile Island Unit 1 (TMI-1) Nuclear Generating Station from provisions of subsection III.G.2.c of Appendix R to 10 CFR Part 50. Appendix R sets forth certain fire protection features pertinent to satisfying Criterion 3 of Appendix A to Part 50. The subsection of Appendix R referenced above addresses specific requirements for the protection of safe shutdown capability against fire.

Subsection III.G.2.c requires that cables, equipment, and associated non-safety circuits of redundant trains of certain shutdown apparatus in the same fire area be enclosed in a 1-hour fire barrier and that, in addition, fire detectors and an automatic suppression system be installed. GPU Nuclear requests an exemption for TMI-1 from the requirements of subsection III.G.2.c for an automatic fire suppression system in areas currently requiring a 3-hour fire barrier utilizing Thermo-Lag as a barrier material for those cable raceways detailed in the Enclosure A as documented in GPU Nuclear Fire Hazards Analysis Report (FHAR) No. 990-1745 Revision 16. Reference Letter 6710-96-2108 dated April 15, 1996, J. Knubel to US NRC Document Control, "Final Safety Analysis Report Update 13 and Fire Hazards Analysis Report Revision 16 for TMI-1".

## II. BASIS

### A. BACKGROUND

Pursuant to 10 CFR 50.48(a), each operating nuclear power plant must have a plan to satisfy Criterion 3, "Fire Protection," of Appendix A to 10 CFR Part 50. Under the terms of 10 CFR 50.48(b), "Appendix R . . . establishes fire protection features required to satisfy Criterion 3 of Appendix A . . . with respect to certain generic issues. In particular, subsections III.G.2.a and III.G.2.c require the following means of ensuring that one redundant train of a system necessary to achieve and maintain hot shutdown conditions is free of fire damage where both trains of that system are located in the same fire area:


(III.G.2.a) "Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier".

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
1CCE-FB02	TRAY 143 CIRCUIT ↓ CG802 CG805 CQ313 CQ323 EA105 EA6822 ED523C LP23 LR23 LX32 MD68 RY4 RY23	MAKEUP AND SUPPORT FUNCTIONS  RCS PRESSURE  SOURCE RANGE MONITORING  ELECTRICAL POWER SYSTEM	TRAY 126 CIRCUIT ↓ LS12 LX41 LX42 LX43 RZ1 RZ2 RZ3 RZ8 RZ13 RZ14 RZ15 RZ17 RZ21 RZ22 RZ23 RZ33 RZ34 RZ35 RZ53 RZ55	MAKEUP AND SUPPORT FUNCTIONS  RCS PRESSURE  SOURCE RANGE MONITORING  ELECTRICAL POWER SYSTEM
			TRAY 134 CIRCUIT ↓ CR322A LS11A LS21A LT21A  TRAY 135 CIRCUIT ↓ LS11A LS12 LS20 LS21 LX41 LX42 LX43 RZ17	
THESE TABLES IDENTIFY ONLY THOSE CIRCUITS REDUNDANT TO A PROTECTED CIRCUIT IN A FIRE AREA/ZONE. WHEN A PROTECTED CIRCUIT HAS NO SPECIFIC REDUNDANT CIRCUIT IN A FIRE AREA, AS DESCRIBED IN THE EXEMPTION REQUEST, THEN THE PROTECTED CIRCUIT IS IDENTIFIED ON THE DRAWING ONLY.			CONT. ON PAGE 2	



ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB02	TRAY 143 CIRCUIT CG802 CG805 CQ313 CQ323 EA105 EA6822 ED523C LP23 LR23 LX32 MD68 RY4 RY23	MAKEUP AND SUPPORT FUNCTIONS  RCS PRESSURE  SOURCE RANGE MONITORING  ELECTRICAL POWER SYSTEM	TRAY 136 CIRCUIT CR322A LS21A LT21A TRAY 137 CIRCUIT CR302B CR305 CR306 CR312C CR314 CR315 CR322A CR322E CR324 CR325 CR336 LS20 LS21 LS21A LT30 ME44 RZ17 LT21A TRAY 138 CIRCUIT CR302B CR305 CR306 CR312C CR314 CR315 CR322E CR324 CR325 CR336	MAKEUP AND SUPPORT FUNCTIONS  RCS PRESSURE  SOURCE RANGE MONITORING  ELECTRICAL POWER SYSTEM
			CONT. ON PAGE 3	

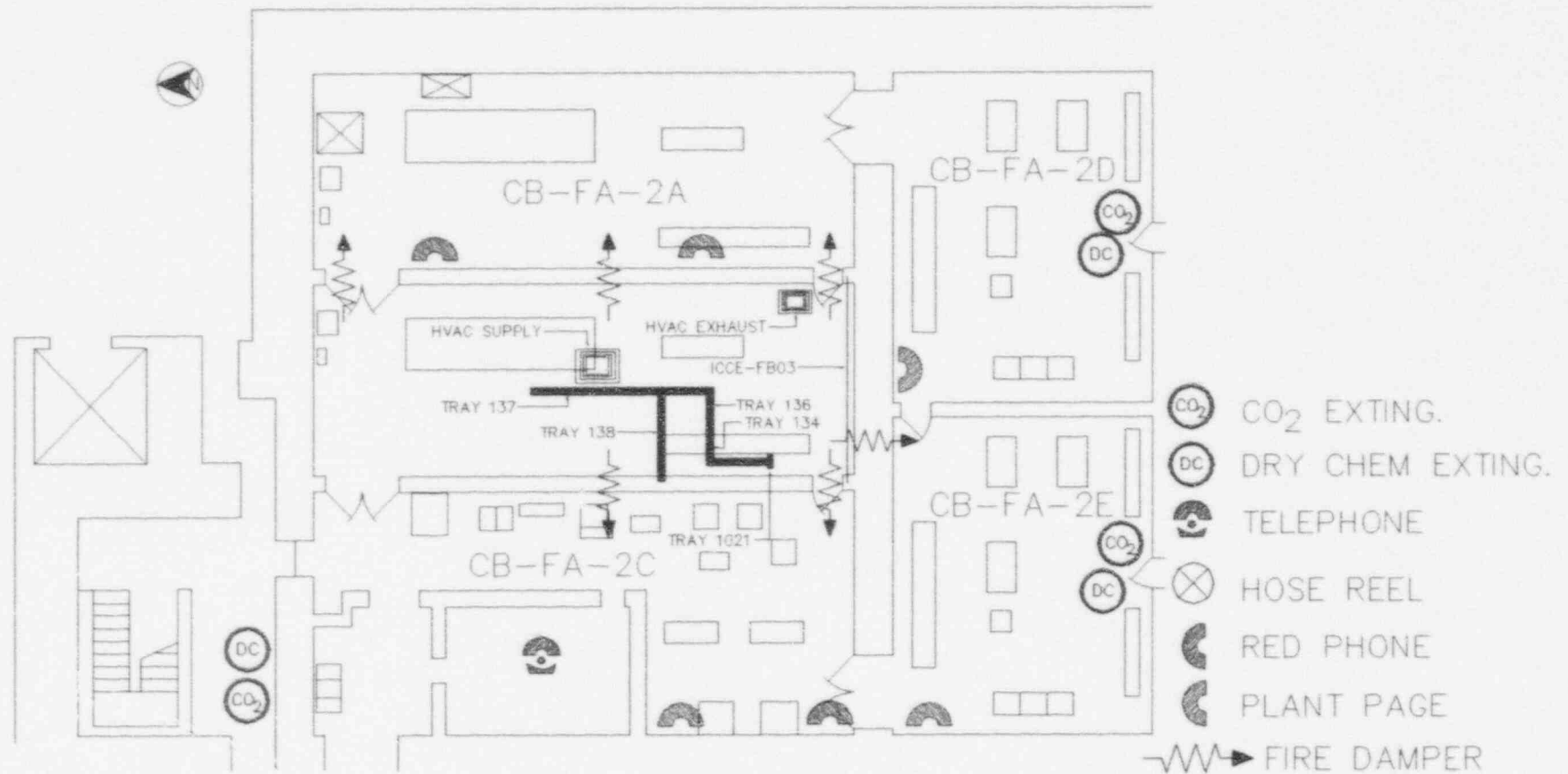
ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB02	TRAY 143 CIRCUIT CG802 CG805 CQ313 CQ323 EA105 EA6822 ED523C LP23 LR23 LX32 MD68 RY4 RY23	MAKEUP AND SUPPORT FUNCTIONS  RCS PRESSURE  SOURCE RANGE MONITORING  ELECTRICAL POWER SYSTEM	TRAY 138 CONT CIRCUIT LT30 ME44 RZ17  TRAY 744 CIRCUIT ME5 TRAY 745 CIRCUIT ME5 TRAY 1017 CIRCUIT CR302B CR305 CR306 CR312C CR314 CR315 CR322A CR322E CR324 CR325 CR336 LS20 LS21 LS21A LT21A LT30 ME44  TRAY 1021 CIRCUIT CR322A LS11A LS21A LT21A CONDUIT CS262A CIRCUIT CS262A  CONT ON PAGE 4	MAKEUP AND SUPPORT FUNCTIONS  RCS PRESSURE  SOURCE RANGE MONITORING  ELECTRICAL POWER SYSTEM

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB02	TRAY 143 CIRCUIT CG802 CG805 CQ313 CQ323 EA105 EA6822 ED523C LP23 LR23 LX32 MD68 RY4 RY23 	MAKEUP AND SUPPORT FUNCTIONS  RCS PRESSURE  SOURCE RANGE MONITORING  ELECTRICAL POWER SYSTEM	CONDUIT EA354 CIRCUIT EA354 CONDUIT ED307A CIRCUIT ED307A CONDUIT LS2 CIRCUIT LS2 CONDUIT LS11A CIRCUIT LS11A ↓ LS12 CONDUIT LS21 CIRCUIT LS21 CONDUIT LX41 CIRCUIT LS20 ↓ LX41 ↓ LX42 ↓ LX43	MAKEUP AND SUPPORT FUNCTIONS  RCS PRESSURE  SOURCE RANGE MONITORING  ELECTRICAL POWER SYSTEM



# CB-FA-2B

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB03	CONDUIT RE465 CIRCUIT RE465 ↓ RE473 RE510 ↓ RE514	STEAM GENERATOR PRESSURE AND LEVEL	TRAY 134 CIRCUIT EA6851A ↓ EA6854A TRAY 136 CIRCUIT EA6851A ↓ EA6854A TRAY 137 CIRCUIT EA6851A ↓ EA6854A TRAY 138 CIRCUIT EA6851A ↓ EA6854A TRAY 1021 CIRCUIT EA6851A ↓ EA6854A	STEAM GENERATOR PRESSURE AND LEVEL



CONTROL BUILDING ELEV. 322'

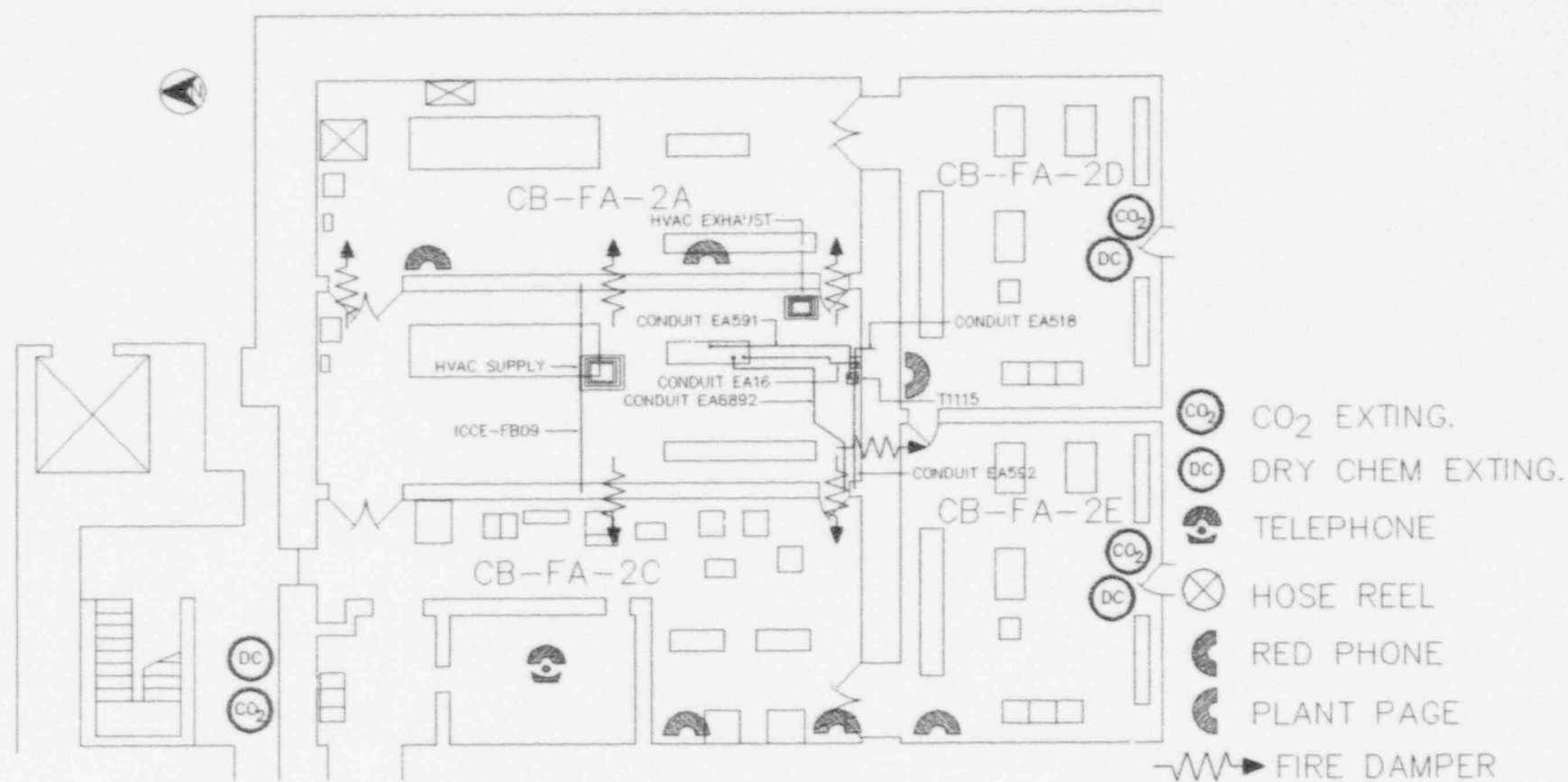
CB-FA-2B  
ICCE-FB03 / MISC

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## CB-FA-2B

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB09	CONDUIT EA6912 CIRCUIT EA6912	ELECTRICAL POWER SYSTEM	CONDUIT EA16 CIRCUIT EA16 CONDUIT EA518 CIRCUIT EA518 CONDUIT EA591 CIRCUIT EA591 CONDUIT EA592 CIRCUIT EA592 CONDUIT EA6892 CIRCUIT EA6892	ELECTRICAL POWER SYSTEM

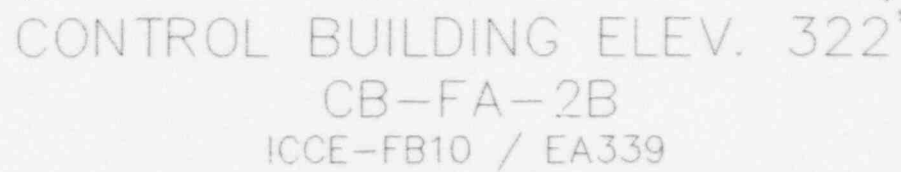


CONTROL BUILDING ELEV. 322'

CB-FA-2B

ICCE-FB09 / EA6912

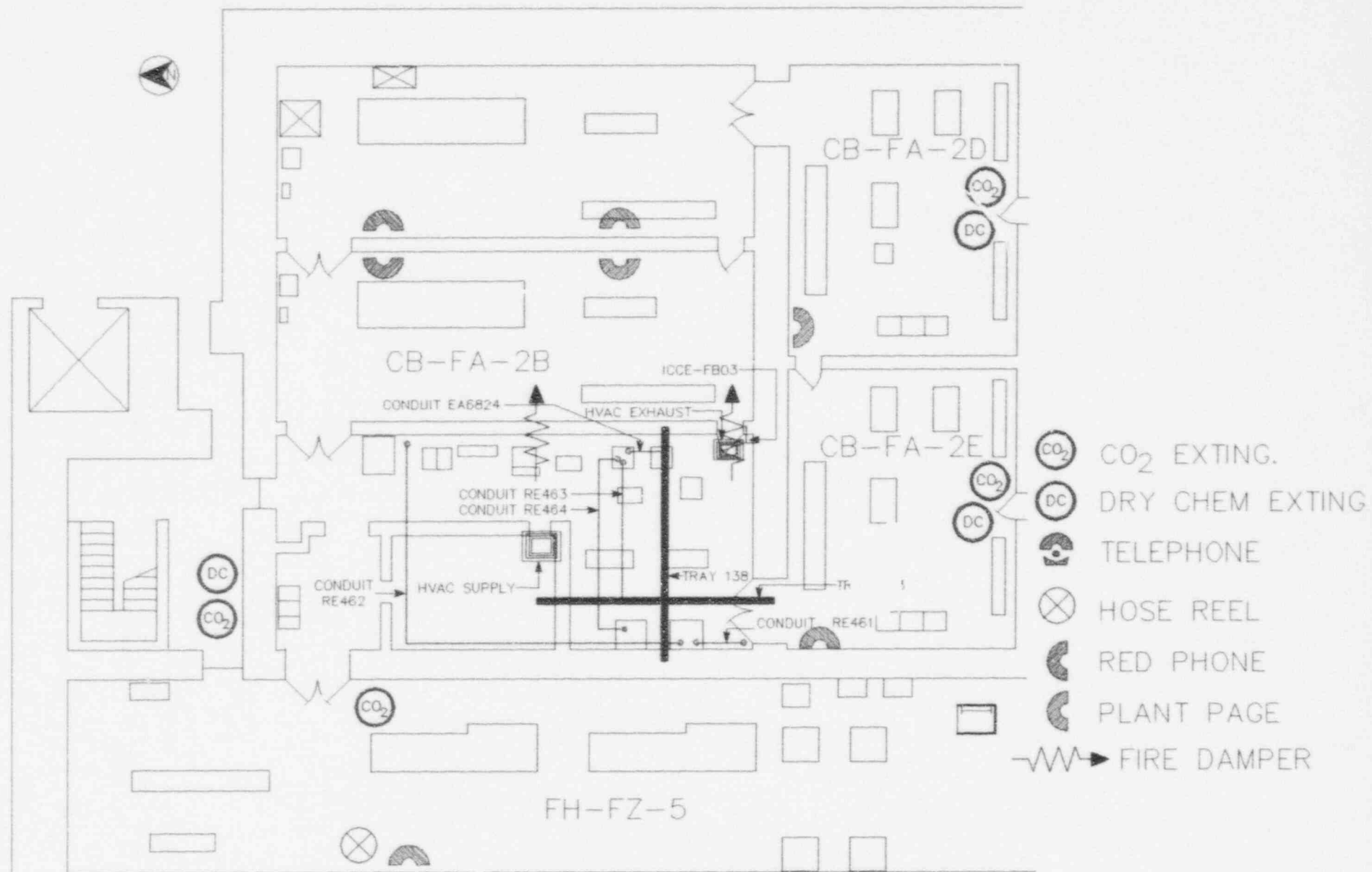
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# CB-FA-2C

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB03	CONDUIT RE465 CIRCUIT RE465 ↓ RE 473 RE 510 ↓ RE 514	STEAM GENERATOR PRESSURE AND LEVEL	CONDUIT EA6824 CIRCUIT EA6851A ↓ EA6854A TRAY 138 CIRCUIT EA6851A ↓ EA6854A CONDUIT RE463 CIRCUIT RE467 ↓ RE 475 RE 479 RE 499 RE 512 RE 513 RE 517 TRAY 833 CIRCUIT RE467 ↓ RE 475 RE 479 RE 499 RE 512 RE 513 RE 517 CONDUIT RE464 CIRCUIT RE468 ↓ RE 476 RE 480 RE 500 CONDUIT RE478 CIRCUIT RE478 CONDUIT RE526 CIRCUIT RE526	STEAM GENERATOR PRESSURE AND LEVEL



CONTROL BUILDING ELEV. 322'

CB-FA-2C

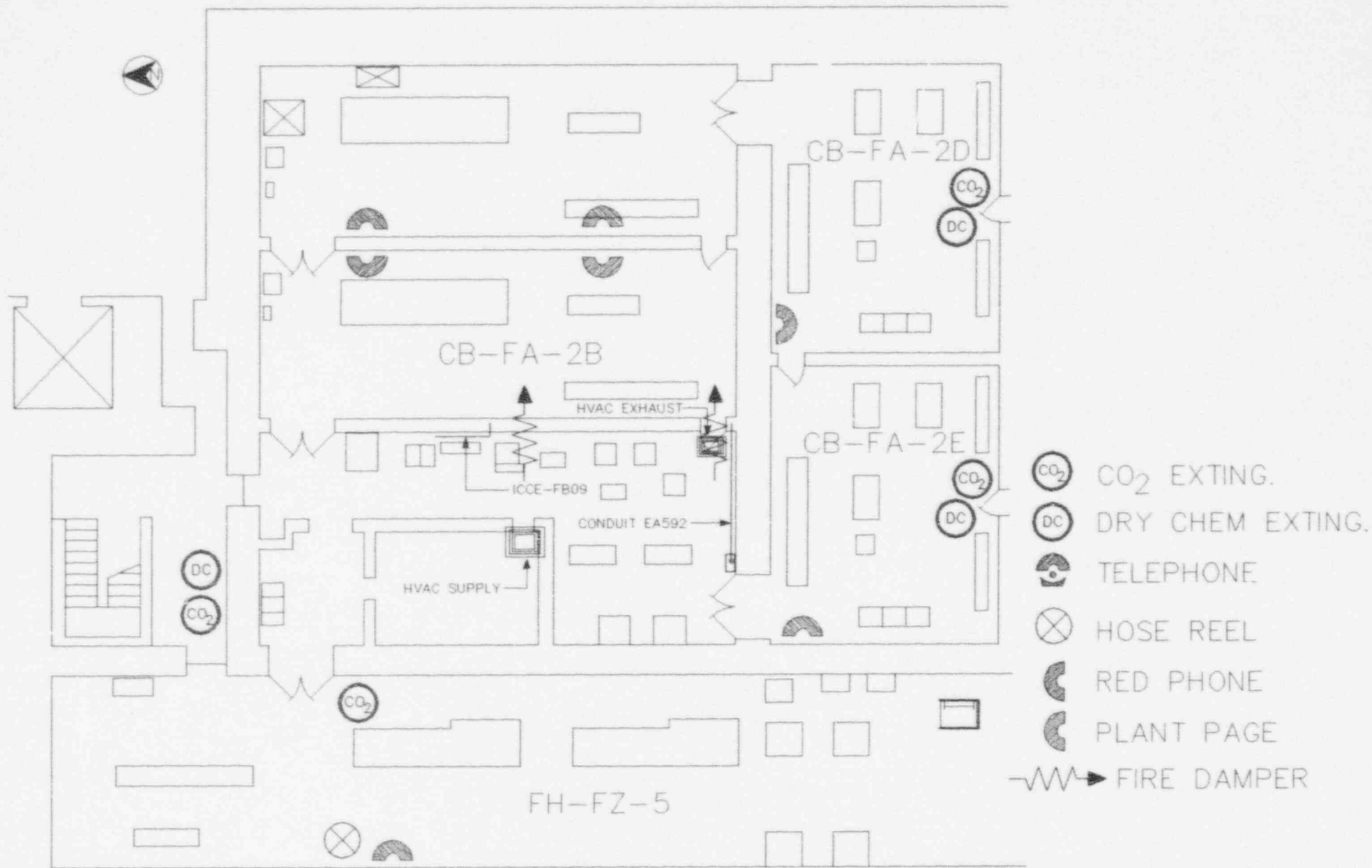
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# CB - FA - 2C

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB09	CONDUIT EA6912 CIRCUIT EA6912	ELECTRICAL POWER SYSTEM	CONDUIT EA592 CIRCUIT EA592	ELECTRICAL POWER SYSTEM





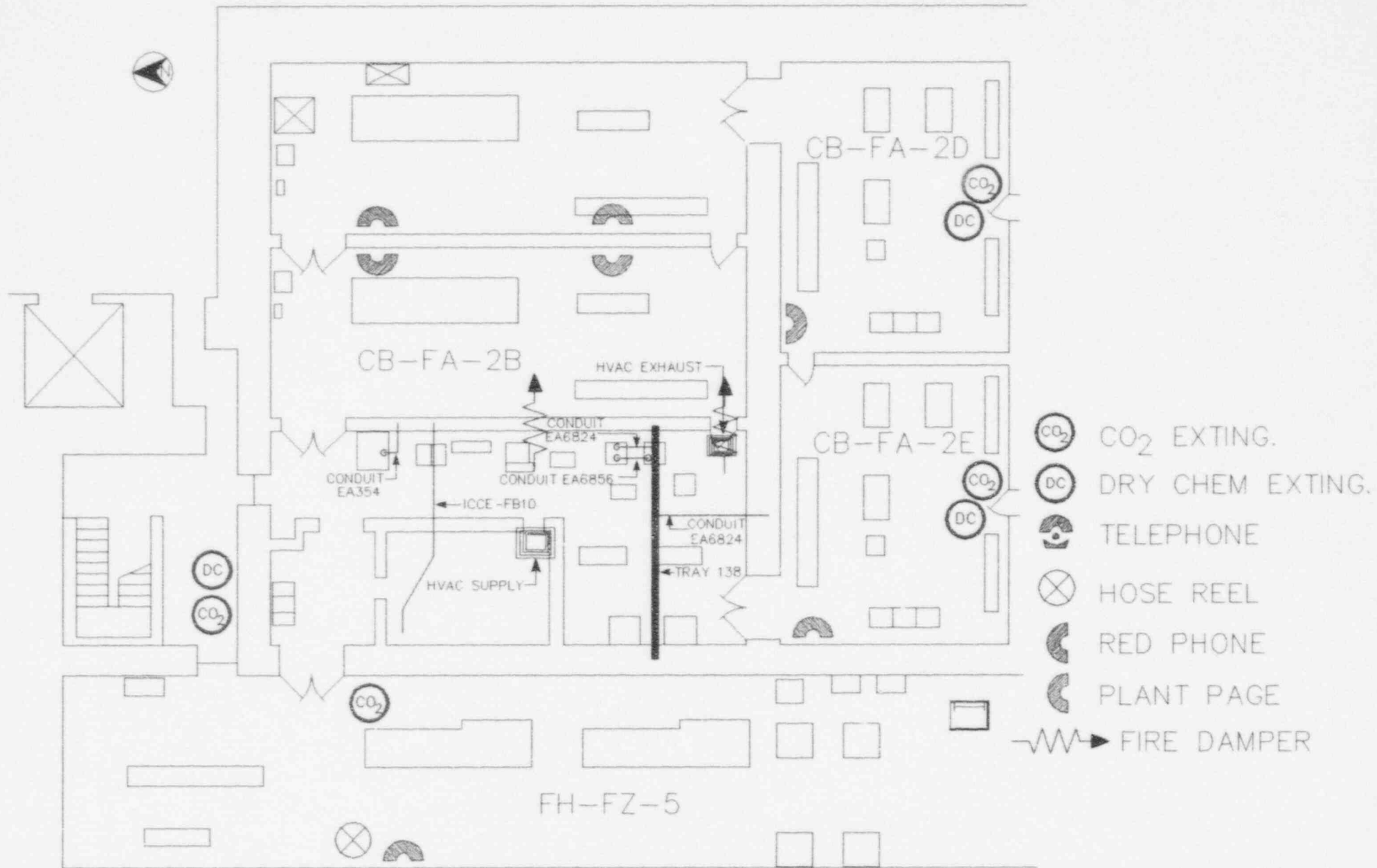
CONTROL BUILDING ELEV. 322'

CB-FA-2C

ICCE-FB09 / EA6912

CB-FA-2C

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB10	CONDUIT EA339 CIRCUIT EA339	ELECTRICAL POWER SYSTEM	CONDUIT EA354 CIRCUIT EA354 CONDUIT EA6856 CIRCUIT EA6856 CONDUIT EA6824 CIRCUIT EA6824 TRAY # 138 CIRCUIT EA6824	ELECTRICAL POWER SYSTEM



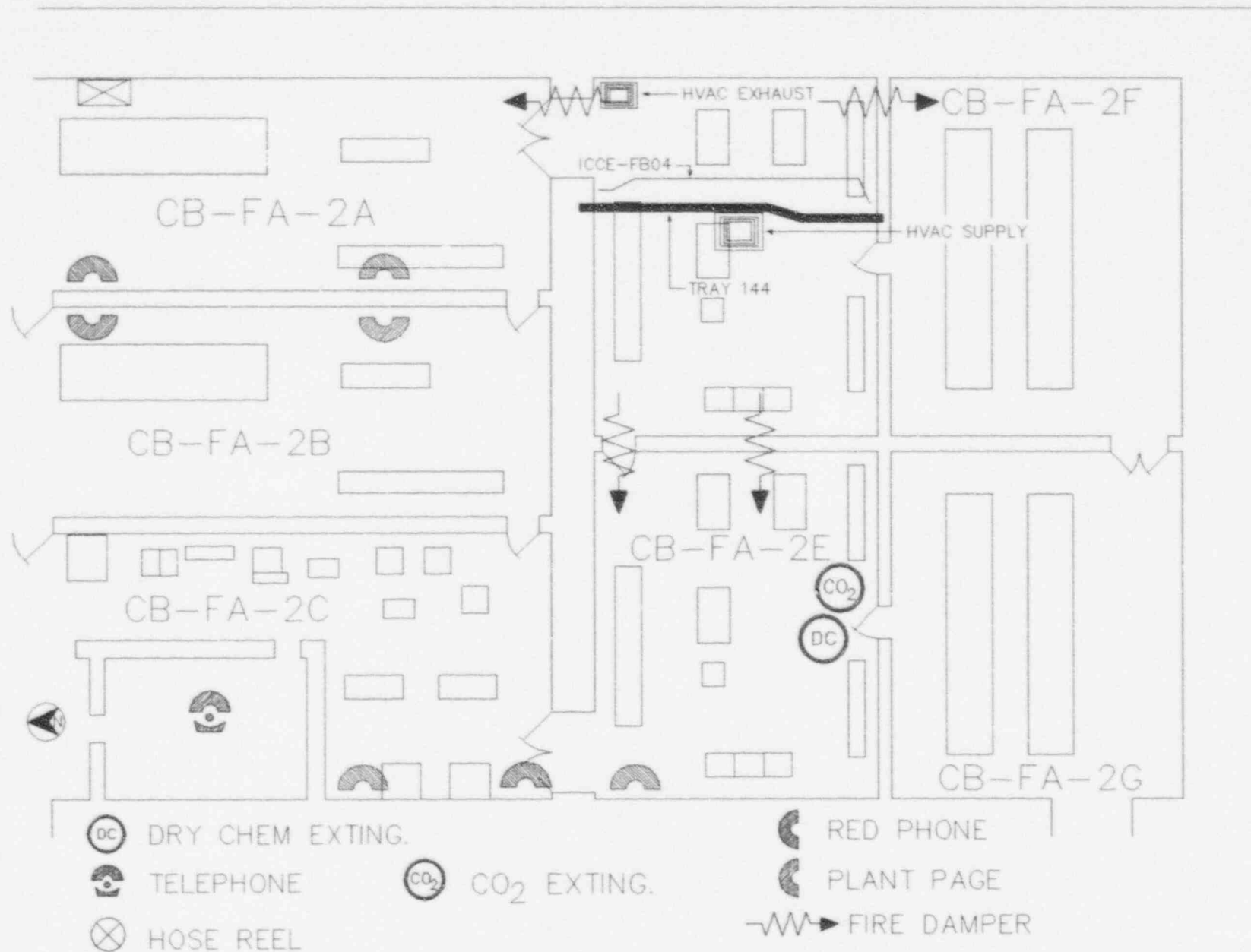
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CB-FA-2C

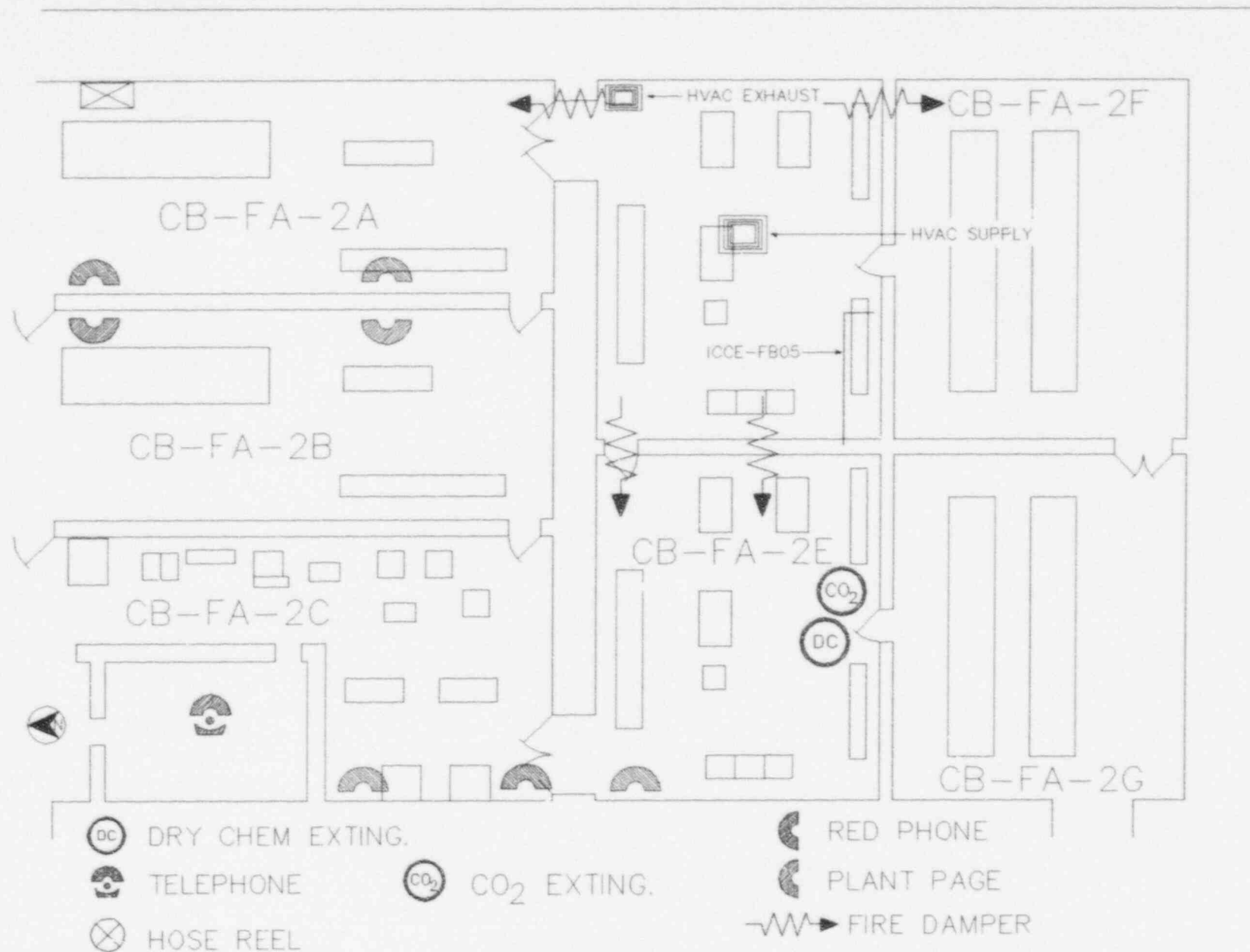
ICCE-FB10 / EA339

# CB-FA-2D

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB04	CONDUIT CH602 CIRCUIT CH602	RCP THERMAL BARRIER COOLING	TRAY 144 CIRCUIT CG681 ↓ CG684	RCP THERMAL BARRIER COOLING  SEAL INJECTION



CONTROL BUILDING ELEV. 322'  
 CB-FA-2D  
 ICCE-FB04 / CH602

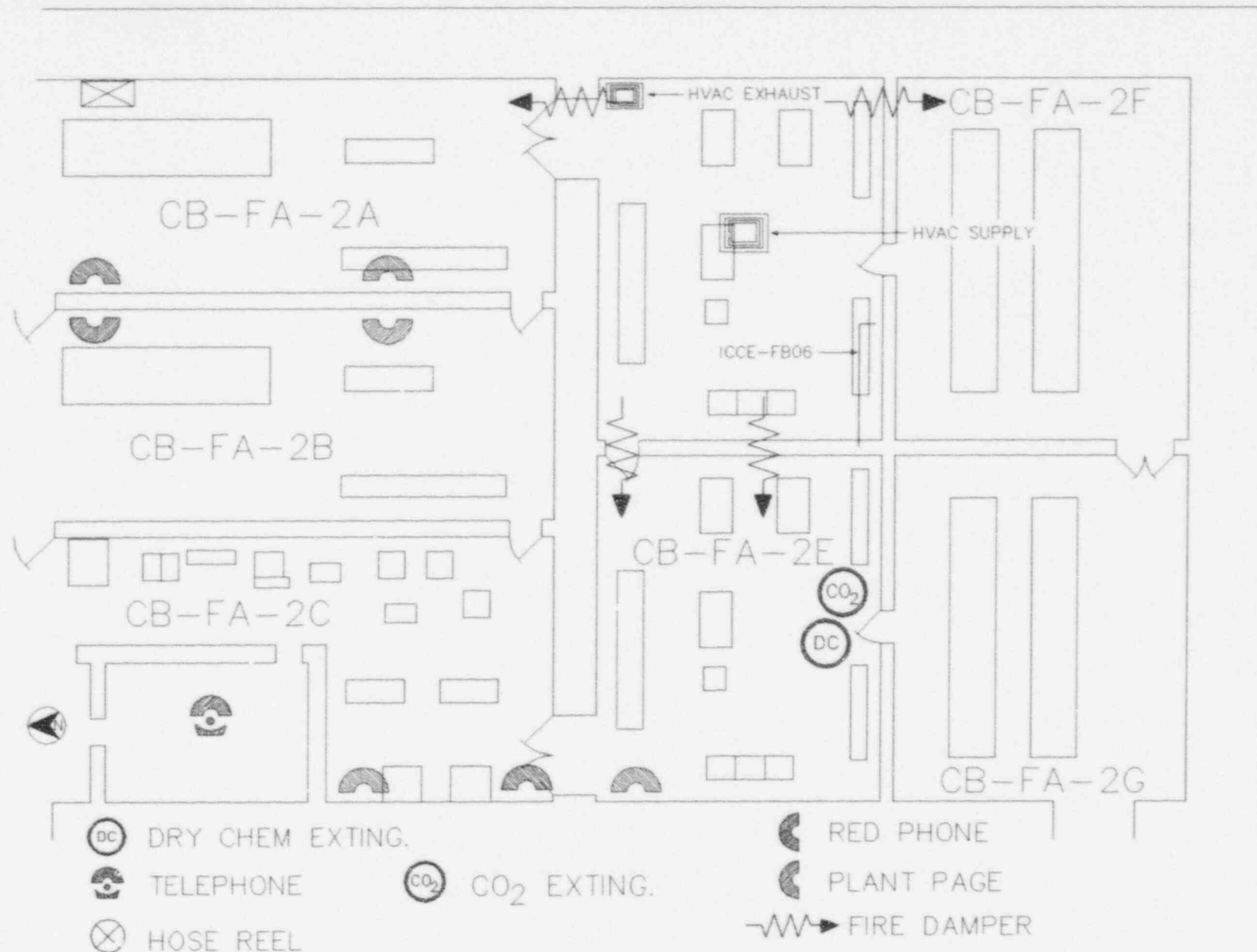


CONTROL BUILDING ELEV. 322'

CB-FA-2D

ICCE-FB05 / RU288

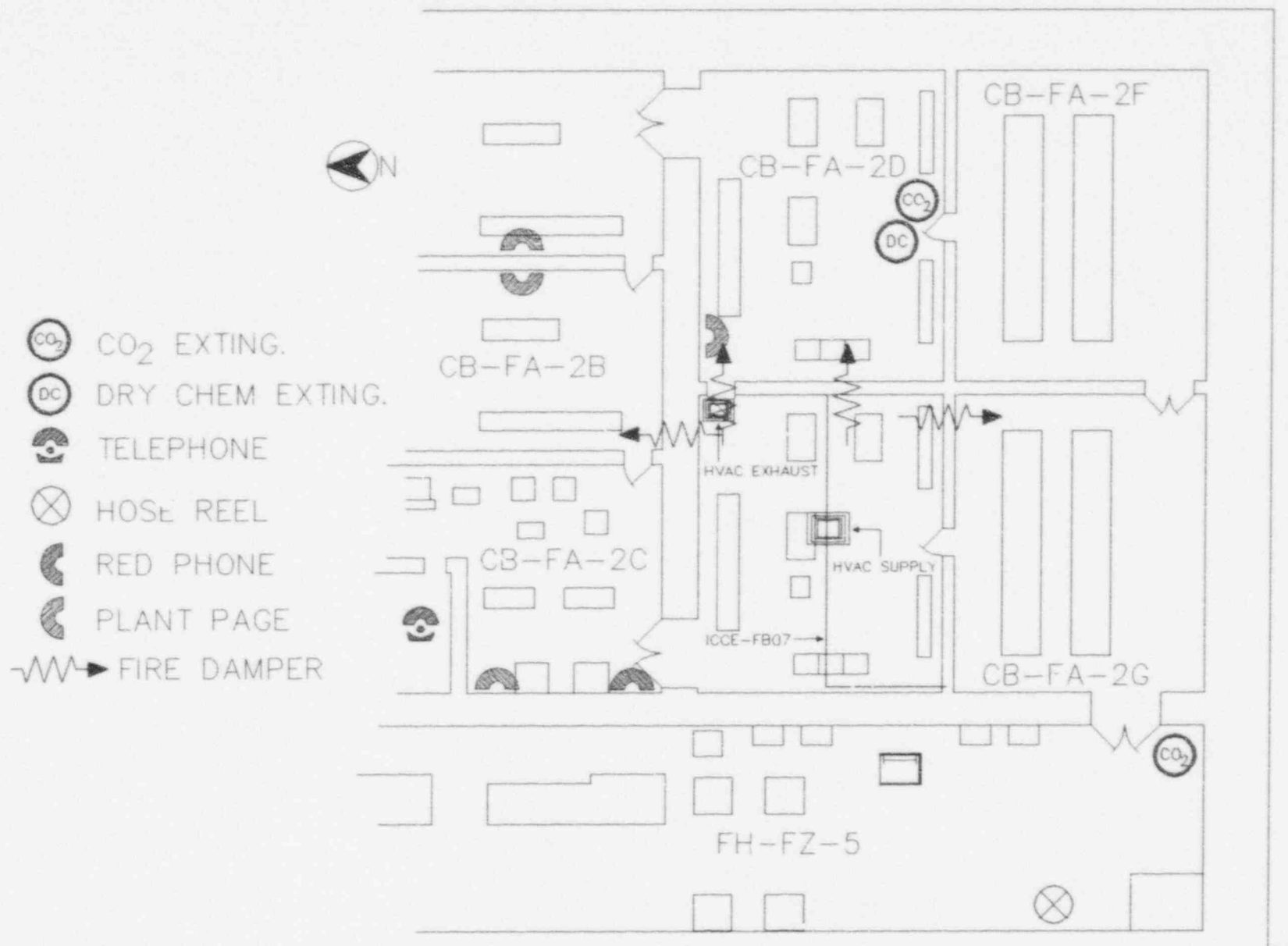




CONTROL BUILDING ELEV. 322'

CB-FA-2D

ICCE-FB06 / RU282



CONTROL BUILDING ELEV. 322'

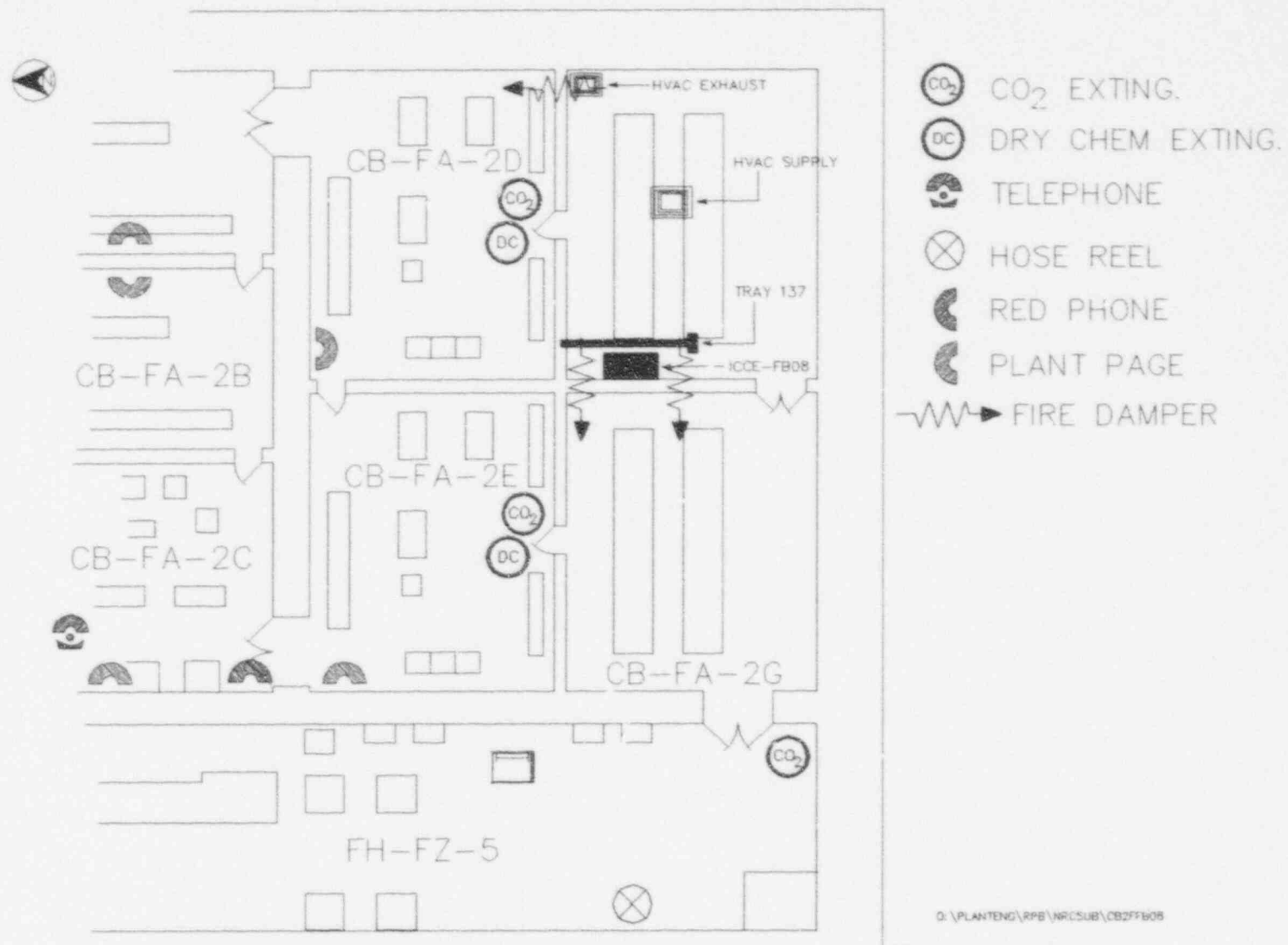
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ICCE-FB07 / EA6041A








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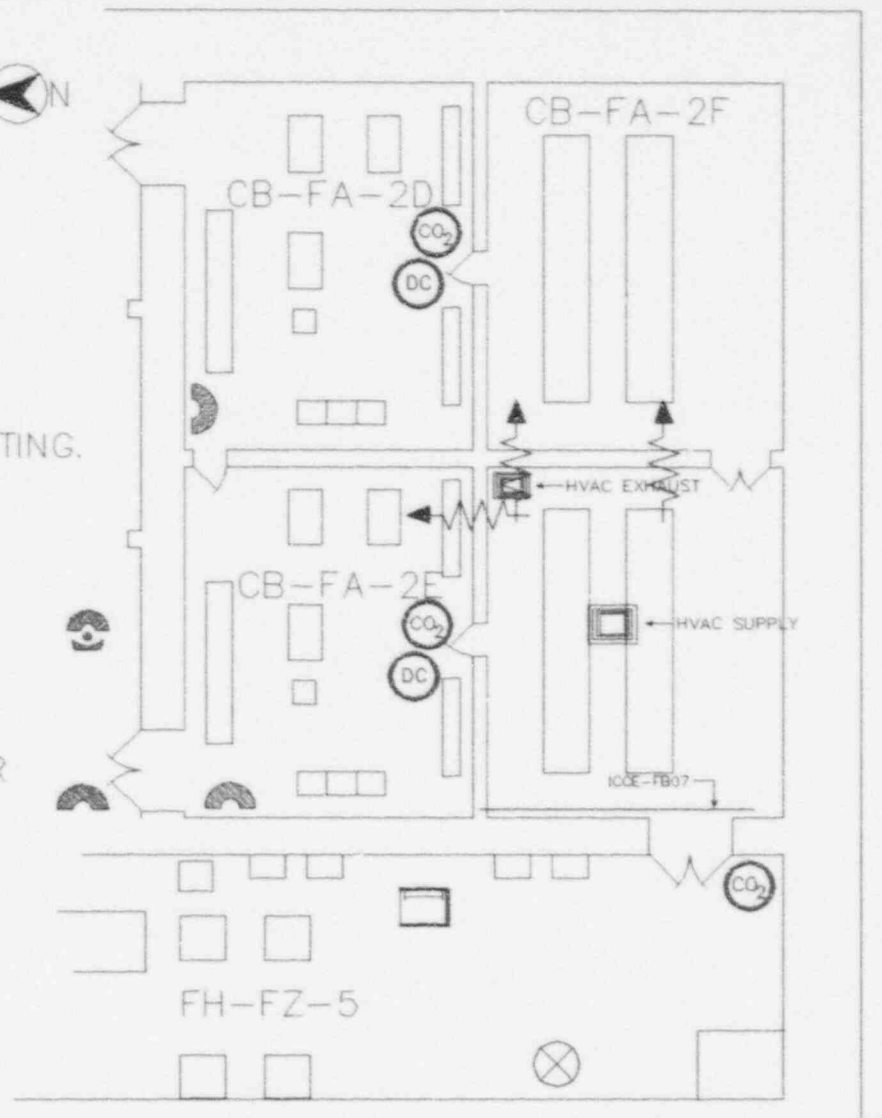
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ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB08	SPLICE BOX S-16 CIRCUIT CH201A ↓          CH201B CONDUIT CH201A CIRCUIT CH201A CONDUIT CH201B CIRCUIT CH201B TRAY 1017 CIRCUIT CH201A TRAY 137 CIRCUIT CH201A ↓          CH201B	MAKEUP AND SUPPORT FUNCTIONS	TRAY 137 CIRCUIT CR215	MAKEUP AND SUPPORT FUNCTIONS



CONTROL BUILDING ELEV. 322'  
 CB-FA-2F  
 ICCE-FB08 / CH201A, CH201B

-  CO<sub>2</sub> EXTING.
-  DRY CHEM EXTING.
-  TELEPHONE
-  HOSE REEL
-  RED PHONE
-  PLANT PAGE
-  FIRE DAMPER



CONTROL BUILDING ELEV. 322'

CB-FA-2G




ICCE-FB07 / EA6041A




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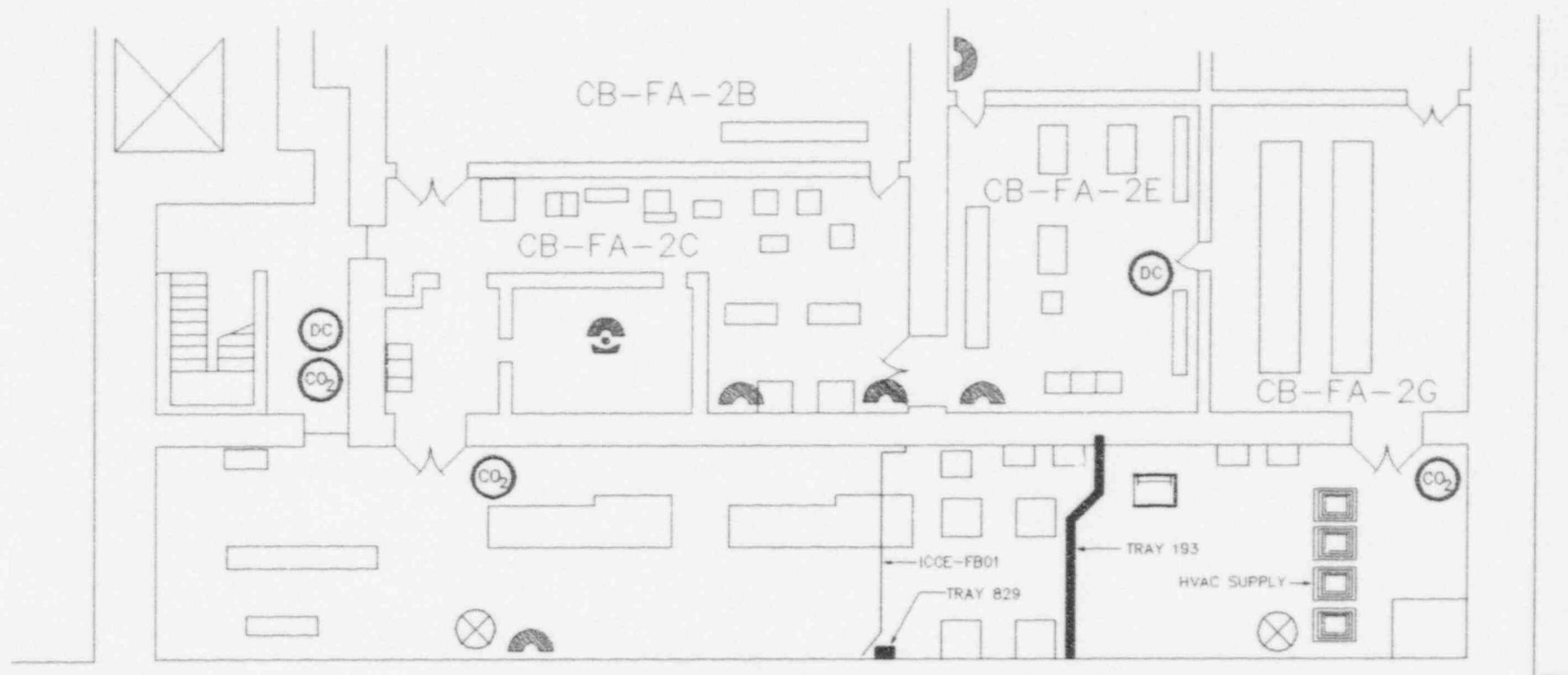
## FH-FZ-5

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCE-FB01	CONDUIT CR232C CIRCUIT CR232C ↓ CR362 CR365B	MAKEUP FUNCTIONS  RCP THERMAL BARRIER COOLING	TRAY 829 CIRCUIT RE345 TRAY 193 CIRCUIT CN616	MAKEUP FUNCTIONS  SEAL INJECTION



-  CO<sub>2</sub> EXTING.  
 DRY CHEM EXTING.  
 TELEPHONE

-  HOSE REEL  
 RED PHONE  
 PLANT PAGE

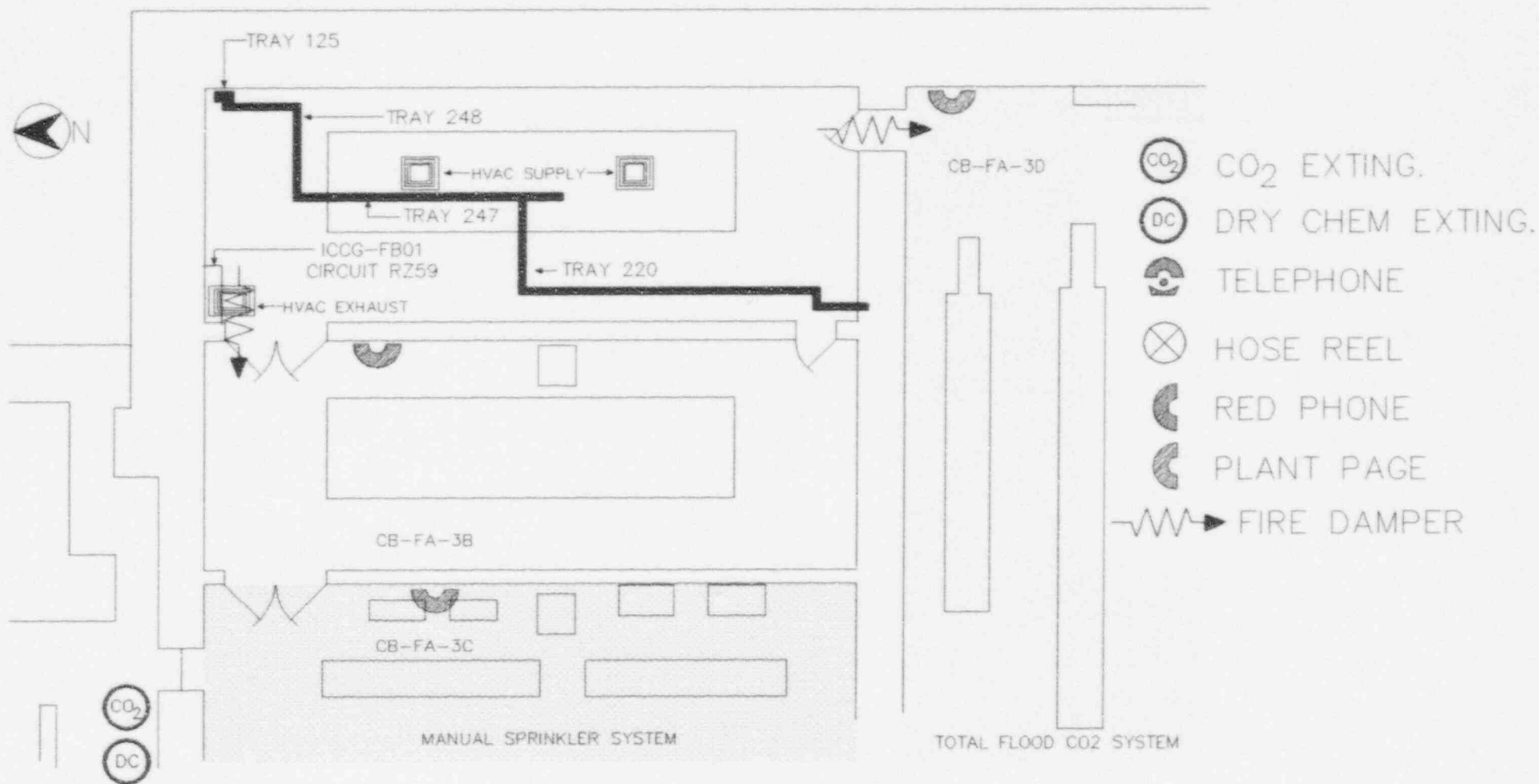


CONTROL BUILDING ELEV. 322'  
FH-FZ-5

ICCE-FB01 / CR232C, CR362, CR365B

# CB-FA-3A

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCG-FB01	CONDUIT R259 CIRCUIT R259	ELECTRICAL POWER SYSTEM	TRAY 125 CIRCUIT G171 TRAY 247 CIRCUIT G171 TRAY 220 CIRCUIT G171 TRAY 248 CIRCUIT G171	ELECTRICAL POWER SYSTEM



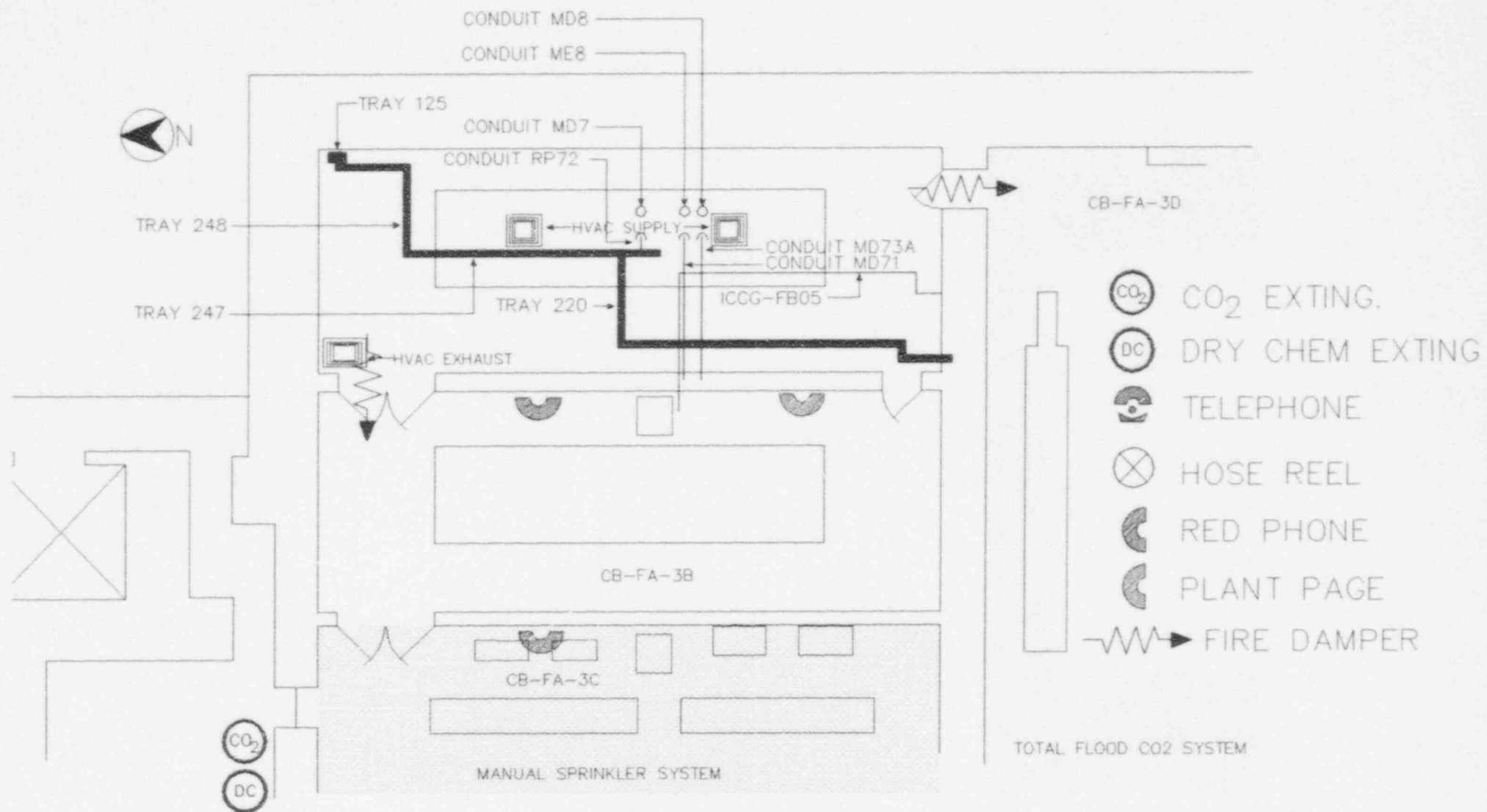
CONTROL BUILDING ELEV. 338'

CB-FA-3A

ICCG-FB01 / RZ59

# CB-FA-3A

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCG-FB05	CONDUIT RV28 CIRCUIT RV28	RCP THERMAL BARRIER COOLING	TRAY 125 CIRCUIT MD68 TRAY 248 CIRCUIT MD68 TRAY 247 CIRCUIT MD65A ↓ MD66 MD68 TRAY 220 CIRCUIT MD65A ↓ MD66 CONDUIT MD8 CIRCUIT MD8 CONDUIT ME8 CIRCUIT ME8 CONDUIT MD7 CIRCUIT MD7 CONDUIT RP72 CIRCUIT MD65A ↓ MD66 MD68 CONDUIT MD73A CIRCUIT MD73A CONDUIT MD71 CIRCUIT MD71 CONDUIT RV28 CIRCUIT RV343	SEAL INJECTION



CONTROL BUILDING ELEV. 338'

CB-FA-3A

ICCG-FB05 / RV28

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ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
1CCG-FB02	CONDUIT RP71 CIRCUIT LX52 ↓ RY5 RY6	ELECTRICAL POWER SYSTEM	TRAY 126 CIRCUIT ↓ LT12B RZ1 RZ2 RZ3 RZ8 RZ13 RZ14 RZ15 RZ16 RZ17 RZ21 RZ22 RZ23 RZ33 RZ34 RZ35 RZ53 RZ55 TRAY 255 CIRCUIT ↓ LT12B LX61 LX62 LX63A ME86 RZ1A RZ1B RZ2A RZ2B RZ4 RZ5 RZ6 RZ3A RZ3B CONT. ON PAGE 2	ELECTRICAL POWER SYSTEM

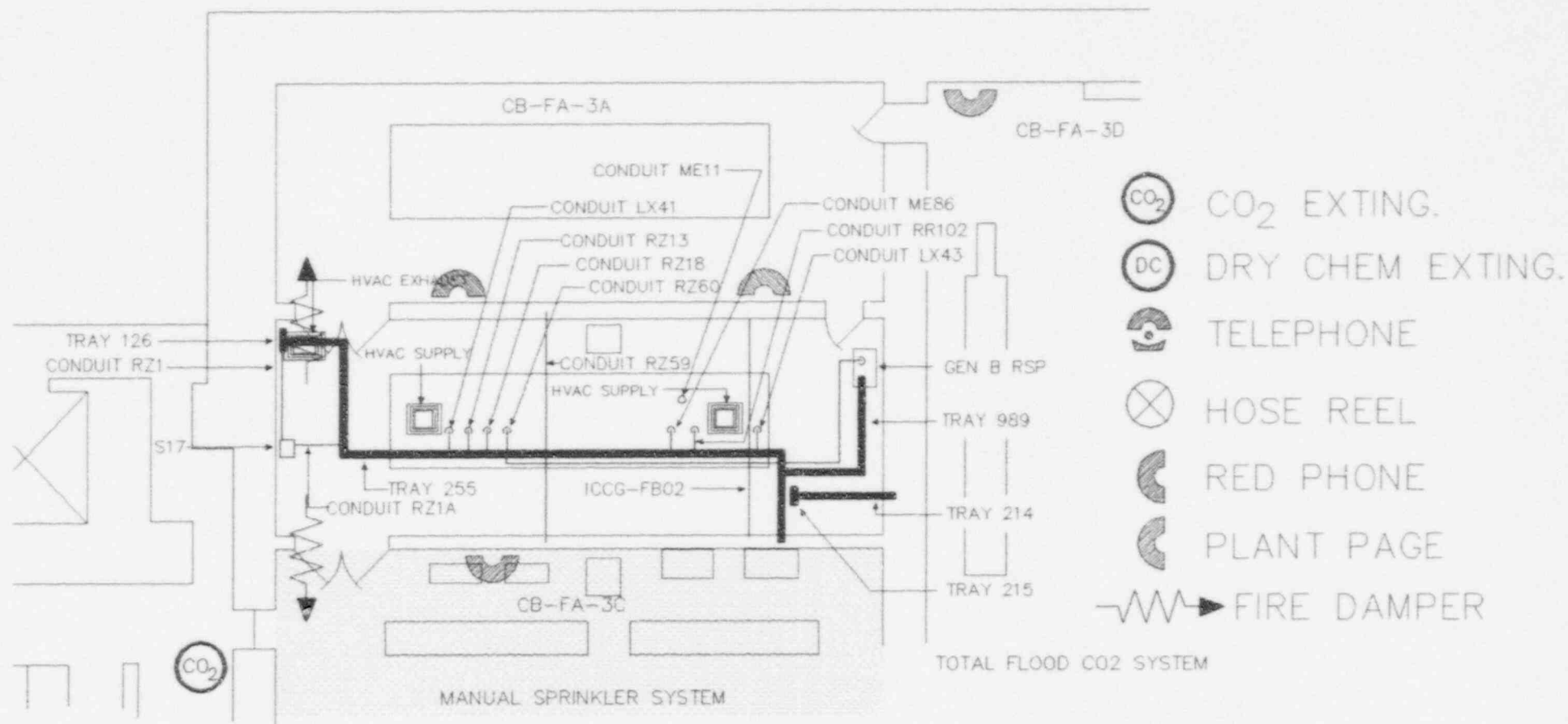
ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
1 CCG-FB02	CONDUIT RP71 CIRCUIT LX52 ↓ RY5 RY6	ELECTRICAL POWER SYSTEM	TRAY 255 CONT. CIRCUIT RZ8A ↓ RZ8C RZ8B RZ13 RZ14 RZ15 RZ16 RZ17 RZ18 RZ19 RZ21A RZ21B RZ22A RZ22B RZ23A RZ23B RZ33A RZ34A RZ34B RZ35A RZ35B RZ36 RZ53B RZ55 RZ56 TRAY 214 CIRCUIT ↓ RZ1B RZ2B RZ3B RZ5 RZ6 RZ8C RZ21B CONT ON PAGE 3	ELECTRICAL POWER SYSTEM



ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCG-FB02	CONDUIT RP71 CIRCUIT LX52 ↓ RY5 RY6	ELECTRICAL POWER SYSTEM	TRAY 214 CONT. CIRCUIT RZ 22B ↓ RZ 34B RZ 35B ME86 TRAY 215 CIRCUIT ME86 ↓ RZ1B RZ2B RZ3B RZ5 RZ6 RZ8C RZ21B RZ 22B RZ 34B RZ 35B TRAY 989 CIRCUIT RZ1A ↓ RZ1B RZ 2A RZ 2 B RZ 3A RZ 3B RZ 4 RZ8A RZ8B RZ8C RZ18 RZ19 RZ 21A RZ 21B RZ 22A RZ 22B CONT ON PAGE 4	ELECTRICAL POWER SYSTEM

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCG-FB02	CONDUIT RP71 CIRCUIT LX52 ↓ RY5 RY6	ELECTRICAL POWER SYSTEM	TRAY 989 CONT. CIRCUIT RZ23A ↓ RZ23B RZ33A RZ34A RZ34B RZ35A RZ35B RZ36 RZ53B RZ56 CONDUIT RZ1 CIRCUIT RZ1 ↓ RZ2 RZ3 RZ8 RZ21 RZ22 RZ23 RZ33 RZ34 RZ35 RZ53 CONDUIT RZ1A CIRCUIT RZ1A ↓ RZ2A RZ3A RZ8A RZ21A RZ22A RZ23A RZ33A RZ34A RZ35A CONT ON PAGE 5	ELECTRICAL POWER SYSTEM

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
1CC6-FB02	CONDUIT RP71 CIRCUIT LX52 ↓ RY5 RY6	ELECTRICAL POWER SYSTEM	CONDUIT RZ1A CONT. CIRCUIT RZ53B CONDUIT LX41 CIRCUIT LX61 ↓ LX62 LX63A CONDUIT RZ13 CIRCUIT RZ13 ↓ RZ14 RZ15 RZ36 RZ55 RZ56 CONDUIT RZ18 CIRCUIT RZ8B ↓ RZ18 RZ19 CONDUIT RZ60 CIRCUIT RZ60 CONDUIT RZ59 CIRCUIT RZ59 CONDUIT ME11 CIRCUIT ME11 CONDUIT ME86 CIRCUIT ME86 CONDUIT RR10Z CIRCUIT LT12B CONDUIT LX43 CIRCUIT LX63A	ELECTRICAL POWER SYSTEM



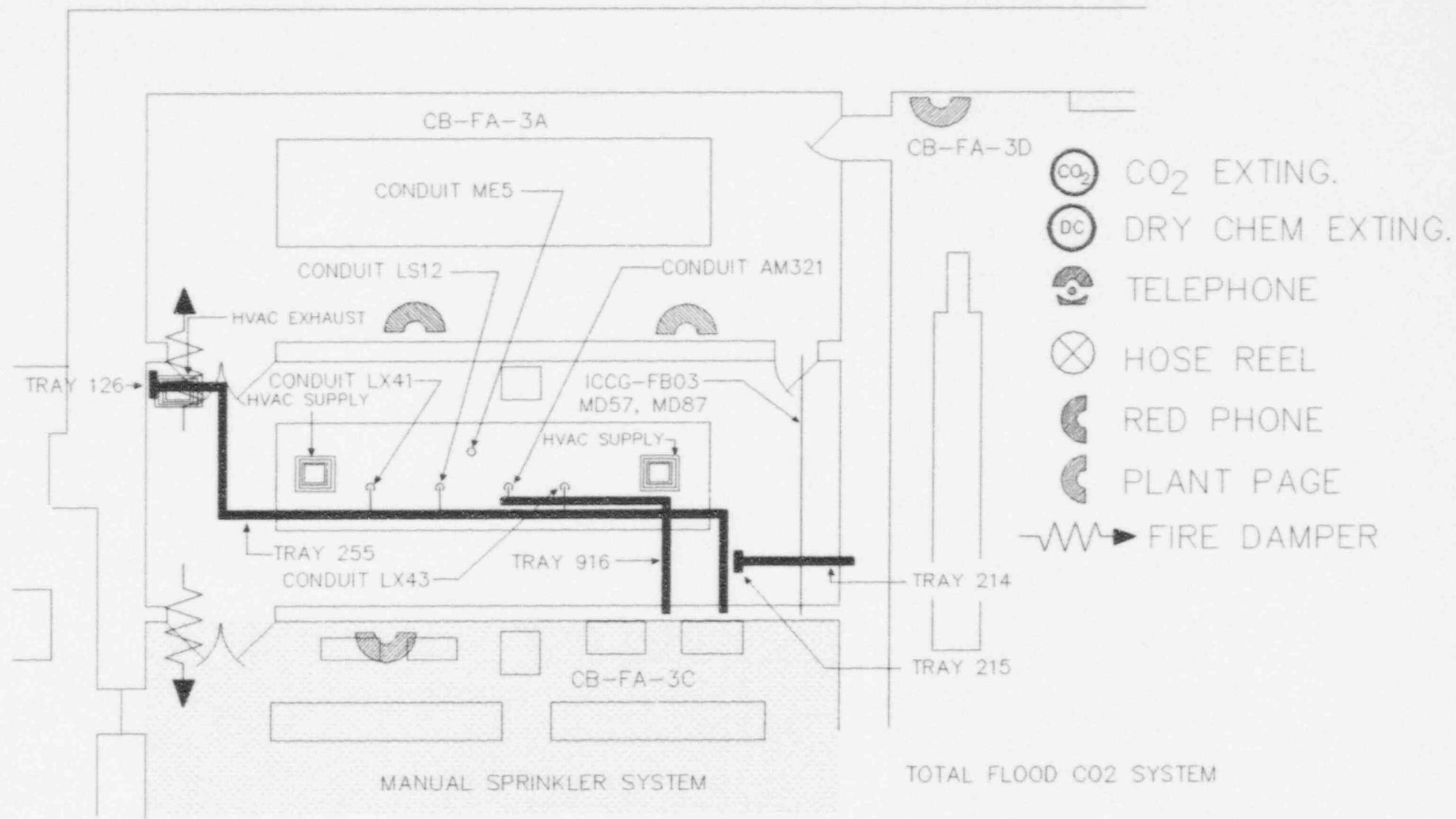
CONTROL BUILDING ELEV. 338'  
CB-FA-3B

ICCG-FB02 / RY5, RY6, LX52

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# CB-FA-3B

ENVELOPE	PROTECTED CIRCUIT	PROTECTED FUNCTION	REDUNDANT CIRCUIT	REDUNDANT FUNCTION
ICCG-FB03	CONDUIT MD57 CIRCUIT MD57	ELECTRICAL POWER SYSTEM	TRAY 126 CIRCUIT LS12 LX41 LX42 LX43 ↓ TRAY 255 CIRCUIT LS12 LX41 LX42 LX43 ME56 ↓ TRAY 214 CIRCUIT ME56 TRAY 215 CIRCUIT ME56 TRAY 916 CIRCUIT ME57 CONDUIT LS12 CIRCUIT LS12 ↓ ME56 CONDUIT LX41 CIRCUIT LX41 CONDUIT LX43 CIRCUIT LX43 CONDUIT ME5 CIRCUIT ME5 CONDUIT AM321 CIRCUIT ME57	ELECTRICAL POWER SYSTEM

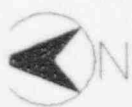
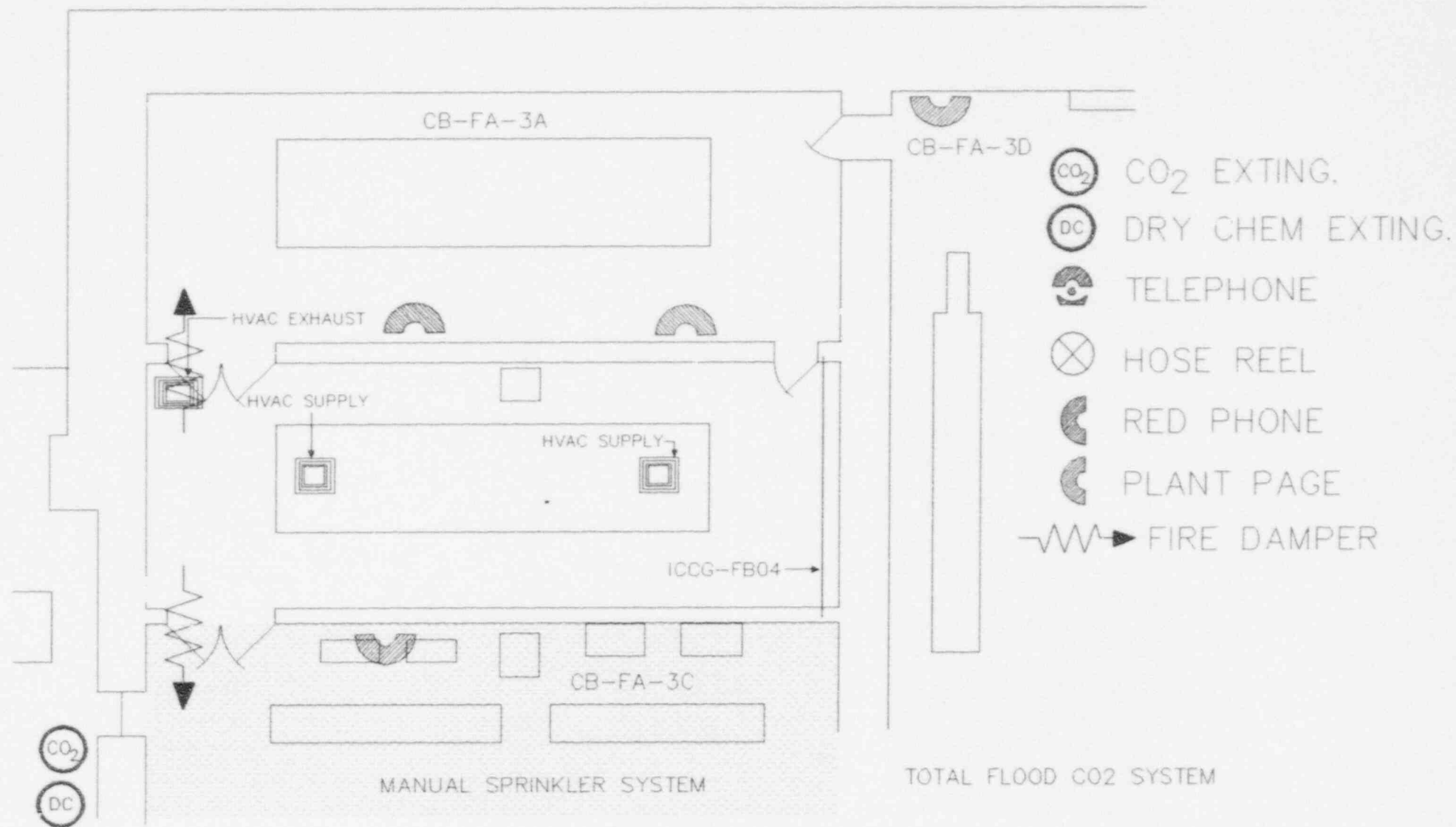


CONTROL BUILDING ELEV. 338'

CB-FA-3B

ICCG-FB03 / MD57, MD87



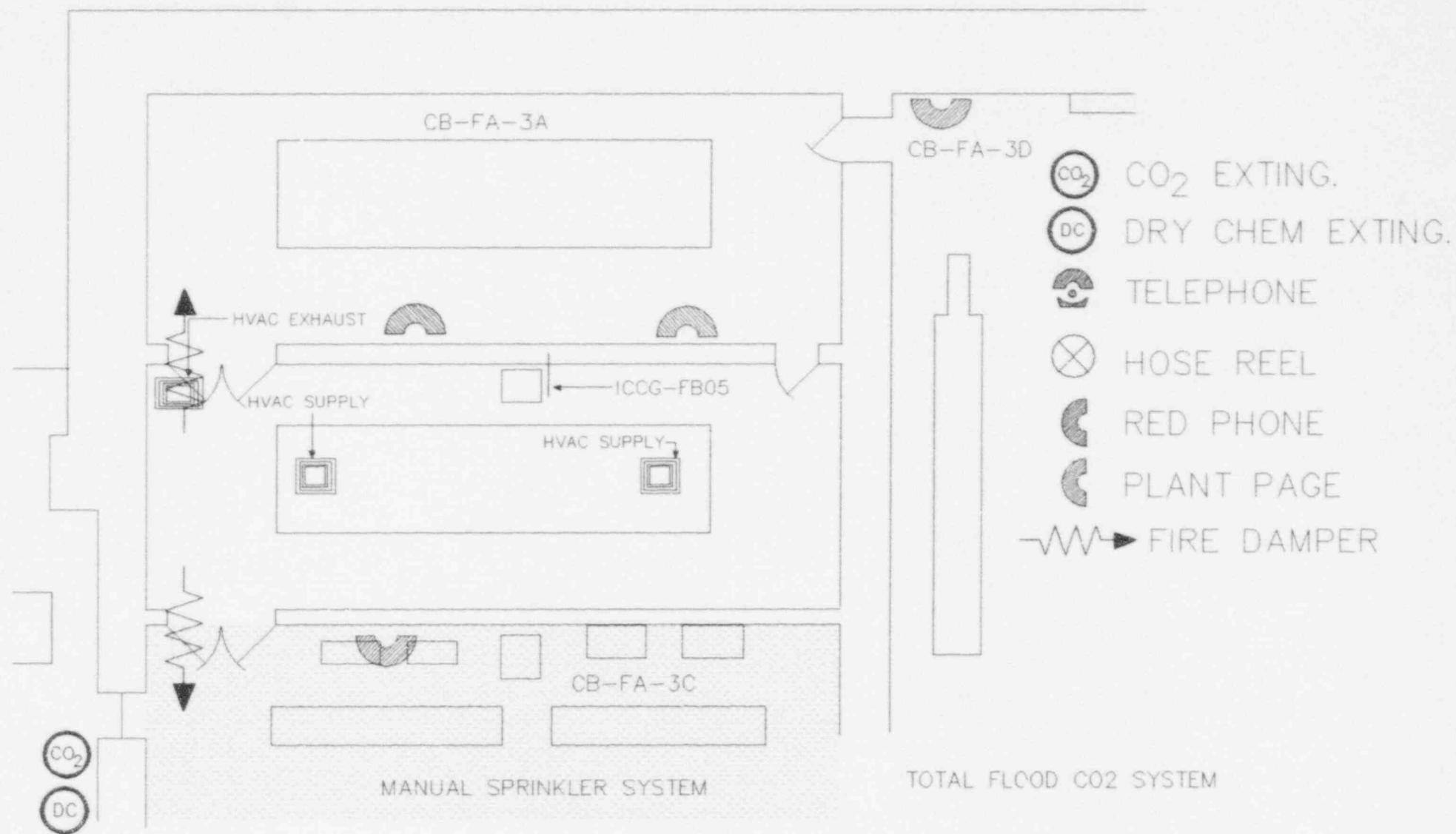


CONTROL BUILDING ELEV. 338'

CB-FA-3B

ICCG-FB04 / RG201





CONTROL BUILDING ELEV. 338'

CB-FA-3B

ICCG-FB05 / RV28

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