

Mr. James W. Langenba
 Vice President and Director, TMI
 GPU Nuclear Corporation
 P.O. Box 480
 Middletown, PA 17057

July 11, 1997

SUBJECT: THREE MILE ISLAND NUCLEAR GENERATING STATION, UNIT 1, 10 CFR PART 50
 APPENDIX R EXEMPTION REQUEST (TAC NO. M96473)

Dear Mr. Langenbach:

By letters dated August 16 and August 28, 1996, and January 3, 1997, GPU Nuclear, the licensee for Three Mile Island Nuclear Generating Station, Unit 1, submitted a request for an exemption from the requirements of Title 10 of the Code of Federal Regulations, Part 50, Appendix R, Section III.G.2.c, to the extent that it requires the installation of automatic suppression systems in certain fire areas. In lieu of an automatic sprinkler system, the licensee will install area-wide detection in these areas and will ensure that all the fire barrier envelopes have a minimum 1-hour fire endurance rating.

The staff has completed its review of the request for an exemption. Contingent on the prior installation of area-wide detection, the inclusion of those detectors in the fire protection program, and the prior upgrading of fire barriers to ensure that all barriers have a 1-hour fire rating (as the licensee committed to in its submittal of August 16, 1996), the request for exemption is approved for the following fire areas: CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b. The request for exemption for fire zone FH-FZ-5 is denied. We request that you respond within 30 days of receipt of this letter of your action to bring fire zone FH-FZ-5 into full compliance with the regulations.

A copy of the exemption (Enclosure 1) is being forwarded to the Office of the Federal Register for publication. The enclosed Safety Evaluation (Enclosure 2) documents the NRC staff's review of this issue.

This completes our effort on this issue and we are, therefore, closing out TAC No. M96473.

Sincerely,
 Original signed by:
 Bart C. Buckley, Sr. Project Manager
 Project Directorate I-3
 Division of Reactor Projects - I/II
 Office of Nuclear Reactor Regulation

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Docket No. 50-289

Enclosures: 1. Exemption
 2. Safety Evaluation
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Three Mile Island Nuclear Station, Unit No. 1

cc:

Michael Ross
Director, O&M, TMI
GPU Nuclear Corporation
P.O. Box 480
Middletown, PA 17057

John C. Fornicola
Director, Planning and
Regulatory Affairs
GPU Nuclear Corporation
100 Interpace Parkway
Parsippany, NJ 07054

Jack S. Wetmore
Manager, TMI Regulatory Affairs
GPU Nuclear Corporation
P.O. Box 480
Middletown, PA 17057

Ernest L. Blake, Jr., Esquire
Shaw, Pittman, Potts & Trowbridge
2300 N Street, NW.
Washington, DC 20037

Chairman
Board of County Commissioners
of Dauphin County
Dauphin County Courthouse
Harrisburg, PA 17120

Chairman
Board of Supervisors
of Londonderry Township
R.D. #1, Geyers Church Road
Middletown, PA 17057

Michele G. Evans
Senior Resident Inspector (TMI-1)
U.S. Nuclear Regulatory Commission
P.O. Box 311
Middletown, PA 17057

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Robert B. Borsum
B&W Nuclear Technologies
Suite 525
1700 Rockville Pike
Rockville, MD 20852

William Dornsife, Acting Director
Bureau of Radiation Protection
Pennsylvania Department of
Environmental Resources
P.O. Box 2063
Harrisburg, PA 17120

Dr. Judith Johnsrud
National Energy Committee
Sierra Club
433 Orlando Avenue
State College, PA 16803

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of
GPU NUCLEAR CORPORATION
Three Mile Island Nuclear
Generating Station, Unit 1

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Docket No. 50-289

EXEMPTION

I.

GPU Nuclear Corporation (GPU or the licensee) is the holder of Facility Operating License No. DPR-50 for the Three Mile Island Nuclear Generating Station, Unit 1 (TMI-1 or the facility). The facility consists of one pressurized water reactor located at the licensee's site in Dauphin County, Pennsylvania. The license provides, among other things, that it is subject to all rules, regulations and orders of the Nuclear Regulatory Commission (the Commission or NRC) now and hereafter in effect.

II.

Section III.G.2 to Appendix R of 10 CFR Part 50 specifies the fire protection requirements for redundant trains of systems necessary to achieve and maintain safe shutdown conditions when the redundant trains are located within the same fire area. Subsection III.G.2.c requires that automatic fire suppression systems shall be installed in fire areas where redundant circuits required for safe shutdown are separated by fire barriers having a 1-hour rating and have fire detectors installed. By letter dated August 16, 1996, supplemented by letters dated August 28, 1996, and January 3, 1997, the

licensee requested an exemption from the requirements of Section III.G.2.c of Appendix R, to the extent that it requires the installation of automatic fire suppression systems. The exemption was requested for fire areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b, and fire zone FH-FZ-5 at TMI-1. The licensee is seeking this exemption in accordance with the provisions of 10 CFR 50.12.

The licensee's request encompasses eight fire areas and one fire zone where Thermo-Lag fire barrier systems were installed on electrical raceways to protect circuits required for safe shutdown. The Thermo-Lag barriers were originally installed to provide 3-hour separation between redundant circuits located in the same fire area. As part of the licensee's review of installed Thermo-Lag fire barriers at TMI-1, the licensee identified locations that do not support a 3-hour rating.

The licensee requested the exemption after determining that installation of fire suppression systems in the affected areas was not a viable alternative for meeting the regulatory requirements of Section III.G.2.c. The licensee stated that installation of an automatic suppression system is not desirable because of the potential for electrical equipment damage from a water suppression system and because of personnel hazard concerns from a carbon dioxide suppression system. Halon gas suppression systems cannot be used because of environmental considerations. The licensee determined that modification of the existing Thermo-Lag fire barrier envelopes within the affected fire areas to achieve a 3-hour rating, and thereby eliminating the regulatory requirement for fire suppression systems, represented a substantial hardship without a significant increase in the level of protection provided.

In lieu of installing automatic fire suppression systems, the licensee proposed installing area-wide automatic fire detection systems in each of the affected areas and establishing a minimum 1-hour fire rating for the existing Thermo-Lag fire barriers.

III.

The NRC staff has completed its safety evaluation of the licensee's request for exemption from certain requirements of Section III.G.2.c of Appendix R. The staff's review included an evaluation of the fire hazards, the fire protection features and the safe shutdown circuits present in each of the affected fire areas.

The licensee has administrative controls in place for transient combustibles and work in the plant in accordance with Section III.K of Appendix R as documented in an NRC Safety Evaluation dated June 4, 1984. These controls require, in part, that total in-situ plus allowable transient fire loads (or cumulative load) in a given fire area/zone be half of that which would challenge the lowest rated fire barrier in the zone. These limits are documented in licensee procedures that are referenced in and implemented by the licensee's Fire Protection Program.

The licensee completed an evaluation of the Thermo-Lag fire barriers which are the subject in this exemption request in Topical Report #904, "TMI 1 Evaluation of Thermo-Lag Fire Barriers," dated July 10, 1996, and provided in a letter dated August 28, 1996. The licensee found that the subject Thermo-Lag barriers either currently have a fire rating of 1-hour or more (in accordance with an American Society for Testing and Materials (ASTM) E-119 fire exposure test) or the licensee has committed to upgrade the existing barriers to achieve a 1-hour rating.

For a postulated fire in areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b, the loss of redundant trains of several different safe shutdown circuits, including reactor make-up and supporting functions, RCS pressure control, steam generator pressure and level functions, source range monitoring, electrical power system function, non-nuclear instrumentation/integrated control system (NNI/ICS) cabinets, and reactor coolant pump (RCP) thermal barrier cooling functions, could occur. These circuits must be maintained functional and free from fire damage to assure shutdown of the plant.

Fires in these eight fire areas are postulated to be slowly developing cable fires, with possible ignition sources, including electrical switchgear, fan motors, or heater controllers. Exposure of the protected envelopes to fire could be expected in some of the fire areas, should a fire occur. Some of the envelopes are in close proximity to heavily loaded cable trays, which could contribute to a postulated fire. The fire loadings for these fire areas range from low to moderate.

The licensee has committed to augmenting the existing detection systems in the eight fire areas listed above with area-wide early warning fire detection systems. The systems to be installed are designed to detect invisible molecules generated during the precombustion phases of an incipient fire and to provide active and continuous sampling of the air. The systems operate independently of air movement and are much more sensitive than conventional ionization detection.

If a fire were to occur in a given fire area, detection by the proposed area-wide detection system would most likely be rapid. The existing heating, ventilation, and air conditioning (HVAC) smoke detection systems would isolate

room ventilation upon detecting smoke in the area. Indication of fire would be received in the control room, and if necessary, the fire brigade would be dispatched. The fire brigade response time to any of the fire areas upon receipt of an alarm has been conservatively estimated at 15 minutes. Manual firefighting equipment (hand-held fire extinguishers and hose stations) is available in, or adjacent to, all of the fire areas. Manual suppression could be brought to bear on a fire within any of these fire areas within 15 minutes.

For fire areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b, the exposure threat of the Thermo-Lag protected circuits is low due to the proximity of the Thermo-Lag envelopes to intervening combustibles. Therefore, a 1-hour barrier coupled with an area-wide early warning fire detection system and a rapid fire brigade response meets the defense-in-depth principle. There is reasonable assurance that a fire in any of these fire areas will not adversely affect the ability to achieve and maintain safe shutdown.

The staff does not believe the same assurance has been provided for fire zone FH-FZ-5. The Thermo-Lag protected envelope in fire zone FH-FZ-5 passes directly over switchgear and is in close proximity to cable trays which present a combustible hazard. The combustible loading in this zone is higher than the other eight fire areas, and the area-wide detection is not available on all elevations of this fire zone. Given these factors, there is no reasonable assurance that a fire would not damage cables in the protected envelope. There is only one Thermo-Lag envelope in this zone, made up of protected conduit. The staff does not believe an undue hardship exists with respect to upgrading this envelope to a 3-hour fire rating.

On the basis of the NRC staff evaluations discussed above, and contingent on the installation of area-wide fire detection systems, upgrading the existing Thermo-Lag fire barriers to ensure a minimum 1-hour fire rating, and continued implementation of the administrative controls previously discussed, the staff has concluded that an exemption from the technical requirements of Section III.G.2.c of Appendix R, to the extent that it requires the installation of automatic fire suppression systems, should be granted for fire areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b. The staff has concluded that the licensee's exemption request for fire zone FH-FZ-5 should be denied.

IV.

The Commission has determined that, pursuant to 10 CFR 50.12, the exemption requested by the licensee in the letter dated August 16, 1996, supplemented by letters dated August 28, 1996, and January 3, 1997, for fire areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b, is authorized by law, will not present an undue risk to public health and safety, and is consistent with the common defense and security. The Commission has further determined that special circumstances are present in that application of the regulation is not necessary to achieve the underlying purpose of the rule, which is to establish fire protection features such that the ability to perform safe shutdown functions in the event of a fire is maintained.

Therefore, contingent on the installation of an area-wide fire detection system in the affected fire areas and upgrading the existing Thermo-Lag fire barriers within the affected fire areas to ensure a minimum 1-hour fire rating, and continued implementation of the administrative controls discussed

above, the Commission hereby grants GPU Nuclear Corporation an exemption from the technical requirements of Section III.G.2.c of Appendix R, to the extent that it requires the installation of automatic fire suppression systems, for fire areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b, at TMI-1. The request for exemption for fire zone FH-FZ-5, included by the licensee in the same submittal, is denied.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will have no significant impact on the quality of the human environment (62 FR 37082).

This exemption is effective upon issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Original signed by:

Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

Dated at Rockville, Maryland,
this 11th day of July 1997.

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UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

LICENSEE REQUEST FOR EXEMPTION FROM

SECTION III.G.2.c OF APPENDIX R TO 10 CFR PART 50

THREE MILE ISLAND NUCLEAR GENERATING STATION, UNIT 1

DOCKET NO. 50-289

1. INTRODUCTION

Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to Title 10 of the Code of Federal Regulations (10 CFR) Part 50, establishes fire protection features required to satisfy General Design Criterion 3, "Fire protection," of Appendix A to 10 CFR Part 50, with respect to certain generic issues for nuclear power plants licensed to operate prior to January 1, 1979. By letters dated August 16 and August 28, 1996, and supplement dated January 3, 1997, GPU Nuclear, the licensee for Three Mile Island Nuclear Generating Station, Unit 1 (TMI-1), requested an exemption from the technical requirements of Section III.G.2.c of Appendix R to 10 CFR Part 50 which specifies the separation of certain redundant safe shutdown circuits with 1-hour fire-rated barriers and automatic suppression and detection systems.

2. EXEMPTION REQUESTED

The licensee requested an exemption from the technical requirements of Section III.G.2.c of Appendix R to the extent that it requires the installation of automatic suppression systems in fire areas where redundant circuits required for safe shutdown are separated by fire barriers having a 1-hour rating and have fire detectors installed.

3. DISCUSSION

The licensee has completed a review of installed Thermo-Lag fire barriers in TMI-1. The licensee is qualifying the installed Thermo-Lag barriers that are the subject of this exemption request as 1-hour rated fire barriers and is requesting an exemption from the requirements of 10 CFR Part 50, Appendix R, Section III.G.2.c, for an automatic suppression system in certain fire areas where circuits of redundant safe shutdown equipment in the same fire area are enclosed in a 1-hour fire barrier.

The licensee's request encompasses nine fire areas where Thermo-Lag is installed on electrical raceways and was originally installed to provide

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3-hour separation between redundant circuits located in the same fire area in accordance with Section III.G.2.a of Appendix R. In a letter of August 16, 1996, the licensee committed to augment the existing detection systems in these fire areas/zones such that each of the nine fire areas is protected by an area-wide automatic detection system.

The licensee has requested the exemption for the following fire areas/zones, all of which are contained in the control building structure in the plant: 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.

The licensee 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 documented in an NRC Safety Evaluation dated June 4, 1984. These controls require 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 licensee procedures that are referenced in and implement the licensee's Fire Protection Program under license condition 2.c(4). Due to the re-rating of fire barriers in the areas discussed from 3-hour to 1-hour barriers, the allowable transient limits will have to be lowered for these areas to remain in compliance with Appendix R, Section III.K, commitments. The licensee will lower these limits for these fire areas to remain in compliance, and will invoke temporary compensatory measures should the transient fire loads exceed the allowable limits, as described in their letter dated August 16, 1996.

The licensee completed an evaluation of all the Thermo-Lag fire barriers which are subject to this exemption request in Topical Report #094, "TMI 1 Evaluation of Thermo-Lag Fire Barriers," dated July 10, 1996, provided in a letter dated August 28, 1996. The licensee found that they either currently have a fire rating of 1-hour or more (in accordance with an American Society for Testing and Materials (ASTM) E-119 fire exposure test) or the licensee has committed to upgrade the existing barriers to achieve a 1-hour rating. A summary of each of the nine fire areas is presented below.

3.1 Fire Area CB-FA-2b

This area is located on elevation 322' of the control building and measures approximately 48 feet x 20 feet x 15 feet high. The principle combustibles in the area are electrical equipment (switchgear) and exposed cable insulation. Most of the cable insulation in the area meets the Institute of Electrical and Electronics Engineers (IEEE) 383 standard for flammability. The fire hazard in this area is low to moderate.

Fire protection features for this area include a heating, ventilation, and air conditioning (HVAC) duct smoke detection system which actuates an alarm in the control room. This is to be augmented with an area-wide early warning fire detection system. A fire hose station is available in an adjacent fire zone, and is capable of bringing a hose stream to bear on any location within this fire area. In addition, portable CO₂ and dry chemical extinguishers are available in the adjacent stair tower. It is estimated by the licensee that

the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes.

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
- Reactor Coolant System (RCS) Pressure
- Steam Generator Pressure and Level
- Source Range Monitoring
- Electrical Power System

These circuits require fire barrier protection in order to ensure a safe shutdown path is available if a fire damages the redundant unprotected circuits and equipment in this fire area. Cables for the above functions are protected in four different barrier "envelopes" including a number of different Thermo-Lag protected configurations, including conduits, condulets and cable trays as well as penetration interfaces. Several of the envelopes pass over heavily loaded cable trays and switchgear, which could act as a possible ignition source. A fire in the cable trays could expose the protected envelopes.

3.2 Fire Area CB-FA-2c

This area is located on elevation 322' of the control building and measures approximately 48 feet x 22 feet x 15 feet high. The principle combustible in the area is exposed cable insulation. Most of the cable insulation in the area meets the IEEE 383 standard for flammability. The fire loading for this area is considered to be low.

Fire protection features for this area include an HVAC duct smoke detection system which actuates an alarm in the control room. This is to be augmented with an area-wide early warning fire detection system. A fire hose station is available in an adjacent fire zone, and is capable of bringing a hose stream to bear on any location within this fire area. In addition, portable CO₂ and dry chemical extinguishers are available in the adjacent stair tower. It is estimated by the licensee that the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes. 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 circuits require fire barrier protection in order to ensure a safe shutdown path is available if a fire damages the other unprotected circuits and equipment in this fire area. Cables for the above functions are protected in three different barrier envelopes which contain a number of different Thermo-Lag protected configurations, including conduits, condulets, and boxes

as well as penetration interfaces. Two of the envelopes in this fire area are not located near in-situ combustibles or ignition sources. The third is located above a heater controller (electrical panel) with no intervening combustibles.

3.3 Fire Area CB-FA-2d

This area is located on elevation 322' of the control building and measures approximately 23 feet x 30 feet x 15 feet high. The principle combustible in the area is exposed cable insulation. Most of the cable insulation in the area meets the IEEE 383 standard for flammability. The fire loading for this area is low to moderate.

Fire protection features for this area include an HVAC duct smoke detection system which actuates an alarm in the control room. This is to be augmented with an area-wide early warning fire detection system. A fire hose station is available in an adjacent fire zone, and is capable of bringing a hose stream to bear on any location within this fire area. In addition, portable CO₂ and dry chemical extinguishers are available in the adjacent stair tower. It is estimated by the licensee that the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes.

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 circuits require fire barrier protection in order to ensure a safe shutdown path is available if a fire damages the other unprotected circuits and equipment in this fire area. Cables for the above functions are protected in three different barrier envelopes which contain a number of different Thermo-Lag protected configurations, including conduits, condulets, and penetration interfaces. All of the envelopes pass over heavily loaded cable trays, while two of them are also over 120V/250V dc distribution panels, which could serve as an ignition source.

3.4 Fire Area CB-FA-2e

This area is located on elevation 322' of the control building and measures approximately 23 feet x 30 feet x 15 feet high. The principle combustible in the area is exposed cable insulation. Most of the cable insulation in the area meets the IEEE 383 standard for flammability. The fire loading in this area is considered low to moderate.

Fire protection features for this area include an HVAC duct smoke detection system which actuates an alarm in the control room. This is to be augmented with an area-wide early warning fire detection system. A fire hose station is available in an adjacent fire zone, and is capable of bringing a hose stream to bear on any location within this fire area. In addition, portable CO₂ and

dry chemical extinguishers are available in the adjacent stair tower. It is estimated by the licensee that the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes. The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the non-nuclear instrumentation/integrated control system (NNI/ICS) cabinet. This circuit requires fire barrier protection in order to insure power to train "A" instrumentation outside this fire area. Cables for the above functions are protected in an envelope with four Thermo-Lag protected configurations, including two conduits, a conduit, and a penetration interface. This envelope passes over two side-by-side heavily loaded cable trays.

3.5 Fire Area CB-FA-2f

This area is located on elevation 322' of the control building and measures approximately 24 feet x 30 feet x 15 feet high. The principle combustibles in the area are battery cases and exposed cable insulation. Most of the cable insulation in the area meets the IEEE 383 standard for flammability. The fire loading for this area is considered low.

Fire protection features for this area include an HVAC duct smoke detection system which actuates an alarm in the control room. This is to be augmented with an area-wide early warning fire detection system. A fire hose station is available in an adjacent fire zone, and is capable of bringing a hose stream to bear on any location within this fire area. In addition, portable CO₂ and dry chemical extinguishers are available in the adjacent stair tower. It is estimated by the licensee that the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes.

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
- Reactor Coolant Pump Thermal Barrier Cooling
- Electrical Power System

These circuits require fire barrier protection in order to ensure a safe shutdown path is available if a fire damages the other unprotected circuits and equipment in this fire area. Cables for the above functions are protected in a barrier envelope which contains a box and a cable tray protected by Thermo-Lag. This envelope passes about 5 feet above a heavily loaded open cable tray.

3.6 Fire Area CB-FA-2g

This area is located on elevation 322' of the control building and measures approximately 24 feet x 30 feet x 15 feet high. The principle combustibles in the area are battery cases and exposed cable insulation. Most of the cable insulation in the area meets the IEEE 383 standard for flammability. The fire loading in this area is considered low.

Fire protection features for this area include an HVAC duct smoke detection system which actuates an alarm in the control room. This is to be augmented with an area-wide early warning fire detection system. A fire hose station is available in an adjacent fire zone, and is capable of bringing a hose stream to bear on any location within this fire area. In addition, portable CO₂ and dry chemical extinguishers are available in the adjacent stair tower. It is estimated by the licensee that the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes.

The specific safe shutdown circuits and equipment protected by the existing Thermo-Lag fire barriers in this fire area are associated with the NNI/ICS cabinet. This circuit requires fire barrier protection in order to ensure power to instrumentation outside this fire area. Cables for the above functions are protected in an envelope which contains a box and a cable tray protected by Thermo-Lag. The envelope is not located near any in-situ combustibles.

3.7 Fire Area CB-FA-3a

This area is located on elevation 338'-6" of the control building and measures approximately 49 feet x 17 feet x 16 feet high. The principle combustibles in the area are electrical equipment (switchgear) and exposed cable insulation. Most of the cable insulation in the area meets the IEEE 383 standard for flammability. The fire loading for this area is considered moderate.

Fire protection features for this area include an HVAC duct smoke detection system which actuates an alarm in the control room. This is to be augmented with an area-wide early warning fire detection system. A fire hose station is available in an adjacent fire zone, and is capable of bringing a hose stream to bear on any location within this fire area. In addition, portable CO₂ and dry chemical extinguishers are available in the adjacent stair tower. It is estimated by the licensee that the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes.

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 (RCP) Thermal Barrier Cooling
- Electrical Power System

These circuits require fire barrier protection in order to ensure a safe shutdown path is available if a fire damages the other unprotected circuits and equipment in this fire area. Cables for the above functions are protected in two different envelopes of different Thermo-Lag protected configurations, including conduits, condulets, and boxes as well as penetration interfaces. One envelope is located 2 to 3 feet above a heater controller. The other passes 5 feet over a heavily loaded open cable tray and 6 feet over the 1D 4160V Switchgear. It is located inside a fireproofed I-beam where it is routed over the switchgear.

3.8 Fire Area CB-FA-3b

This area is located on elevation 338'-6" of the control building and measures approximately 49 feet x 17 feet x 16 feet high. The principle combustibles in the area are electrical equipment (switchgear) and exposed cable insulation. Most of the cable insulation in the area meets the IEEE 383 standard for flammability. The fire loading for this area is considered moderate.

Fire protection features for this area include an HVAC duct smoke detection system which actuates an alarm in the control room. This is to be augmented with an area-wide early warning fire detection system. A fire hose station is available in an adjacent fire zone, and is capable of bringing a hose stream to bear on any location within this fire area. In addition, portable CO₂ and dry chemical extinguishers are available in the adjacent stair tower. It is estimated by the licensee that the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes.

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 circuits require fire barrier protection in order to ensure a safe shutdown path is available if a fire damages the other unprotected circuits and equipment in this fire area. Cables for the above functions are protected in four different barrier envelopes which contain a number of different Thermo-Lag protected configurations, including conduits, condulets, and boxes as well as penetration interfaces. Three of the envelopes described above pass either over or under a heavily loaded open cable tray. The fourth envelope is not located near any in-situ combustibles.

3.9 Fire Zone FH-FZ-5

This fire area is located in the Control Building, with dimensions 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 322'-0" consists of steel grating.

The principle combustibles in the area are electrical equipment (switchgear) and exposed cable insulation. Most of the cable insulation in the area meets the IEEE 383 standard for flammability. The fire loading in the area is high. The principle contributor to the high fire loading begins on elevation 338'-6" with an office complex area. Concentrations of Class A combustibles, which are the principle contributor to the fire loading in this area, are located on elevations 355'-0" and 338'-6" of this fire zone. The ceiling of the 322'-0" elevation is reinforced concrete except for an opening via grating to elevation 338'-6" about 30 feet from the Thermo-Lag envelope. There are intervening combustibles between the fire barrier envelope and the open

grating, but exposure to the envelope will most likely come from combustibles located in the vicinity of the envelope, not from the office complex on the floors above.

Fire protection features in this area include area-wide detection in the Instrument and Controls (I&C) shop on the 355'-0" level. The licensee has committed to install area-wide detection on the 322'-0" elevation of this fire area. Each elevation is provided with two hose stations with the exception of the 380'-0" elevation where only one station is available. Portable fire extinguishers are available on all levels. It is estimated by the licensee that the full fire brigade complement could bring manual suppression to bear on a fire in this fire area in 15 minutes.

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 circuits require fire barrier protection in order to ensure a safe shutdown path is available if a fire damages the other unprotected circuits and equipment in this fire area. Cables for the above functions are protected in a fire barrier envelope which contains a number of different Thermo-Lag protected configurations, including conduits, condulets, and penetration interfaces. This envelope, which is located on the 322'-0" location, is in close proximity with a cable tray that carries redundant cabling and passes over switchgear.

4. EVALUATION

These fire areas do not currently meet the technical requirements of Section III.G.2.c of Appendix R because an automatic fixed fire suppression system is not provided in any of the fire areas. Section III.G of appendix R could be satisfied by either protecting each envelope with a 3-hour fire-rated barrier, or by installing automatic fixed fire suppression in addition to the fire detectors in each fire area, along with verifying that all barriers had a 1-hour fire rating.

In its submittal, the licensee states that installation of an automatic suppression system is not desirable because of possible electrical equipment damage from a water suppression system and personnel hazard concerns from a carbon dioxide suppression system. Halon gas cannot be used due to environmental concerns. Modification of the existing fire barriers to achieve a 3-hour rating would present a substantial cost hardship.

4.1 Fire Areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b

For a postulated fire in fire areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b, the loss of redundant trains of several different safe shutdown circuits, including reactor make-up and

supporting functions, RCS pressure control, steam generator pressure and level functions, source range monitoring, electrical power system function, NNI/ICS cabinets, and RCP thermal barrier cooling functions, could occur. These circuits must be maintained functional and free from fire damage to assure safe shutdown of the plant.

Fires in the fire areas discussed above are postulated to be slowly developing cable fires, with possible ignition sources including electrical switchgear, fan motors, or heater controllers. Exposure of the protected envelopes to fire could be expected in some of the fire areas, should a fire occur. Some of the envelopes are in close proximity to heavily loaded cable trays, which could contribute to a postulated fire. The fire loadings for the fire areas mentioned above range from low to moderate.

The licensee has committed to install area-wide early warning fire detection in all of the fire areas described above. 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. The licensee also committed to upgrade the Thermo-Lag barriers in the fire areas mentioned above to at least a 1-hour fire rating.

If a fire was to occur in a given fire area, detection from the proposed area-wide detection system would most likely be rapid. The existing HVAC smoke detection system would isolate room ventilation upon detecting smoke in the area. Indication of fire would be received in the control room, and if necessary, the fire brigade would be dispatched soon thereafter. Fire brigade response to any of the fire areas upon receipt of an alarm has been conservatively estimated at 15 minutes. Manual firefighting equipment (hand-held fire extinguishers and hose stations) is available in or adjacent to all of the fire areas. Manual suppression could be brought to bear on a fire within any of the above areas in 15 minutes or less.

For fire areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b, the exposure threat to the Thermo-Lag protected circuits in these areas is low due to the proximity of the Thermo-Lag envelopes to intervening combustibles. Therefore, a 1-hour barrier coupled with an area-wide early warning fire detection system, administrative controls limiting the transient combustibles in the areas mentioned, and a rapid fire brigade response meets the defense-in-depth principle. Therefore, there is reasonable assurance that a fire in any of the fire areas discussed above will not adversely affect the ability to achieve and maintain safe shutdown.

The underlying purpose of Appendix R, Section III.G.2.c, is to establish fire protection features such that the ability to perform safe shutdown functions in the event of a fire will be maintained.

Based on the above, the staff concludes that the underlying purpose of the rule is satisfied. Therefore, this request for exemption from the requirements of Appendix R, Section III.G.2.c, meets the special circumstances delineated in 10 CFR 50.12(a)(2)(ii). The application of the regulation in

this circumstance is not necessary to achieve the underlying purpose of the rule since the above discussion demonstrates that with respect to the fire areas/zones where the installed Thermo-Lag barriers have at least a 1-hour fire endurance rating and there is manual suppression available and fast response area-wide detection, and administrative controls limiting transient combustibles, there is an adequate level of safety in terms of maintaining the ability to perform safe shutdown functions in the event of a fire, and, therefore, the underlying purpose of the rule is met.

4.2 Fire Zone FH-FZ-5

The staff does not believe that reasonable assurance has been provided that fire area FH-FZ-5 is protected to the same degree as the fire areas evaluated in Section 4.1, above. The Thermo-Lag protected envelope in fire zone FH-FZ-5 passes directly over switchgear and is in close proximity to cable trays which present a combustible hazard. The combustible loading in this area is higher than all the others, and area-wide detection is not available on all the elevations of this fire area. Given these factors, there is no reasonable assurance that a fire would not damage cables in the protected envelope. There is only one Thermo-Lag envelope in this area, made up of protected conduit. The staff does not believe that there would be undue hardship involved in upgrading this envelope to a 3-hour fire rating.

5. CONCLUSION

5.1 Fire Areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b

On the basis of the NRC staff evaluation above, and contingent on the installation of area-wide detection and the upgrading of fire barriers to ensure that all barriers have a 1-hour fire rating (as the licensee committed to in its submittal of August 16, 1996), and the implementation of the administrative controls discussed herein, the staff concludes that an exemption from the technical requirements of Section III.G.2.c of Appendix R to the extent that it requires the installation of automatic suppression systems, should be granted for fire areas CB-FA-2b, CB-FA-2c, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-2g, CB-FA-3a, and CB-FA-3b.

5.2 Fire Zone FH-FZ-5

Based on the above evaluation, the staff concluded that the licensee's request for an exemption from the technical requirements of Section III.G.2.c of Appendix R should be denied for fire area FH-FZ-5.

Principle contributors: C.S. Bajwa and E.A. Connell

Date: July 11, 1997