October 14, 1987

Docket No. 50-331

Mr. Lee Liu
Chairman of the Board and
Chief Executive Officer
Iowa Electric Light and Power Company
Post Office Box 351
Cedar Rapids, Iowa 52406

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Dear Mr. Liu:

SUBJECT: EXEMPTION FROM APPENDIX R TO 10 CFR PART 50 CONCERNING SEPARATING REDUNDANT TRAINS BY 3-HOUR FIRE BARRIERS AND PROVIDING AUTOMATIC FIRE SUPPRESSION AND DETECTION SYSTEMS (TAC 55994)

Re: Duane Arnold Energy Center

The Commission has issued the enclosed Exemption from the requirements of Section III.G of Appendix R to 10 CFR Part 50 to the extent that separating redundant trains by 3-hour fire barriers and providing automatic fire suppression and detection systems in certain areas not be required.

The Exemption is being forwarded to the Office of the Federal Register for publication.

Also enclosed for your information is a copy of an Environmental Assessment and Finding of No Significant Impact which has been published in the Federal Register. A copy of our Safety Evaluation is also enclosed.

Sincerely,

Original signed by

Anthony J. Cappucci, Project Manager
Project Directorate III-1
Division of Reactor Projects-III, IV, V
& Special Projects

Enclosures:
1. Exemption
2. Safety Evaluation
3. Technical Evaluation Report
4. Environmental Assessment

cc w/enclosures:
See next page

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Sincerely

Robert Gilbert, Project Manager
BWR Project Directorate #2
Division of BWR Licensing

Enclosures:
1. Exemption
2. Safety Evaluation
3. Technical Evaluation Report
4. Environmental Assessment

cc w/enclosures:
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Mr. Thomas Houvenagle
Regulatory Engineer
Iowa Commerce Commission
Lucas State Office Building
Des Moines, Iowa 50319

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter	)	Docket No. 50-331
	)	
IOWA ELECTRIC LIGHT AND POWER COMPANY	)	
	)	
Duane Arnold Energy Center	)	

EXEMPTION

I.

The Iowa Electric Light and Power Company (the licensee) is the holder of Facility Operating License No. DPR-49 which authorizes operation of Duane Arnold Energy Center (DAEC/the facility). The license provides, among other things, that the facility is subject to all rules, regulations, and Orders of the Nuclear Regulatory Commission (the Commission) now or hereafter in effect.

The facility is a boiling water reactor located at the licensee's site in Linn County, Iowa.

II.

On November 19, 1980, the Commission published a revised Section 50.48 and a new Appendix R to 10 CFR Part 50 regarding fire protection features of nuclear power plants. The revised Section 50.48 and Appendix R became effective on February 17, 1981. Section III of Appendix R contains 15 subsections, lettered A through O, each of which specifies requirements for a particular aspect of the fire protection features at a nuclear power plant. One of the subsections, III.G, is the subject of the licensee's exemption requests.

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Section III.G.2 of Appendix R requires that one train of cables and equipment necessary to achieve and maintain safe shutdown be maintained free of fire damage by one of the following means:

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.

b. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.

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.

Subsection III.G.3 of Appendix R requires that where Subsection III.G.2 cannot be met, alternative or dedicated shutdown capability should be provided. Also, for areas where alternative or dedicated shutdown is provided, fire detection and a fixed fire suppression system shall be installed in the area, room, or zone under consideration.

III.

By letter dated September 28, 1984, the licensee requested exemptions from Subsection III.G.2 of Appendix R. By letters dated October 31, 1984, October 21, 1986 and April 3, 1987, the licensee provided additional information regarding the exemption request. In the April 3, 1987 letter, the licensee provided information relevant to the "special circumstances" finding required by revised 10 CFR 50.12(a) (see 50 FR 50764). They combined the fire zones into separate categories, described the exemption request in each category and then presented the special circumstances for each category as follows:

Fire Zones: Water tight unlabeled doors between Fire Zones 1-D and 2-B (watertight door No. 203) and 1-D and 1-A (watertight door No. 202).

Description of Exemption Request: These doors are required to be both watertight and 3 hour rated. Underwriters Laboratories (UL) approved the doors as 3 hour rated if gasket material is not used. However, without the gaskets the doors are not watertight. Although there is no known gasket material which is 3 hour rated, Iowa Electric replaced the gasket material with gaskets made of Ferratex #8201 material which is used in U. S. Naval scuttles, doors and hatches located in missile blast areas and also on fume-tight doors in fire bulkheads.

Special Circumstances of 10 CFR 50.12: Iowa Electric believes that both special circumstances 10 CFR 50.12(a)(2)(ii) and (vi) apply to the requested exemption. Use of Ferratex #8201 gaskets makes the doors equivalent to 3 hour rated doors and literal compliance with that rating is not necessary to achieve the underlying purpose of the rule (10 CFR 50.12(a)(2)(ii)). Furthermore, the licensee has made a good faith effort to locate a 3 hour rated gasket, but such material has not been developed (10 CFR 50.12(a)(2)(vi)).

Fire Zones: 1-C to 2-A/2-B; 1-D to 2-A/2-B; 2-A/2-B to 3-A/3-B, 3-C and 3-D; 2-D to 3-A/3-B; 3-A/3-B to 4-A/4-B; 7-E to 8-F, 8-G, 8-H and 8-J; 10-A to 11-A; 10-B to 11-A; 10-D to 11-A; 11-A to 12-A; 16-A/16-B to 16-B/16-A; 16-F to 16-A and 16-B; 17-A/17-B to 17-B/17-A; 17-C/17-D to 17-D/17-C.

Description of Exemption Request: Exemptions from the requirement to protect structural steel forming part of or supporting required fire barriers (exemption from Section III.G.2.a to 10 CFR Part 50, Appendix R) were requested for the fire zones identified above.

Special Circumstances of 10 CFR 50.12: Iowa Electric has demonstrated by analysis in the referenced letter that the peak temperature of the structural steel would not exceed the critical temperature of 1100 degrees F when exposed to fires postulated in the DAEC Fire Hazards Analysis. Therefore, protection of the structural steel is not necessary to achieve the underlying purpose of the rule (10 CFR 50.12(a)(2)(ii)).

Fire Zones: Open hatch between 3-B and 4-B (Fire Zone 3-B)

Description of Exemption Request: An exemption was requested from the requirement (exemption from Section III.G.2.a to 10 CFR Part 50, Appendix R) to provide a rated fire barrier at the hatch between Fire Zones 3-B and 4-B to separate redundant safe shutdown equipment.

Special Circumstances of 10 CFR 50.12: A rated fire barrier is not needed to achieve the underlying purpose of the rule because of the existence of deluge and partial zone suppression systems, low combustible loading and combustible distribution (10 CFR 50.12(a)(2)(ii)).

Fire Zones: 1-A, 1-C, 2-D, 3-A, 3-B, 4-A, 7-A, 7-C

Description of Exemption Requests: Exemptions were requested for fire dampers located between Fire Zones 1-A and 1-C, 7-A and 7-C, 3-B and 4-A. Because of congestion and construction tolerances, the dampers cannot be installed totally "in accordance with the conditions of their listing and the manufacturer's installation instructions" as required by NFPA 90A, Article 3-3.7.2.1.

Exemptions were also requested from the requirements of Section III.G.2.a (also Section III.G.2.b for Fire Zone 1-A) of 10 CFR Part 50, Appendix R. The exemption request proposed the use of the flexible wrap manufactured by B & B insulators under the trade name "Hemyc". The use of the flexible "Hemyc" material provides protection equivalent to a complete 3 hour fire barrier.

Special Circumstances of 10 CFR 50.12: The ability of the fire barriers and fire dampers to function will be unimpaired by their installation. Thus, requiring in-situ testing of the dampers to meet the literal reading of NFPA 90A, Article 3-3.7.2.1 is not necessary to achieve the underlying purpose of the rule. The flexible "Hemyc" material has been shown, by extrapolation from 1 hour test data, to be equivalent to a 3 hour fire barrier and its use achieves the underlying purpose of the rule (10 CFR 50.12(a)(2)(ii)). For Fire Zone 1-A, Iowa Electric has demonstrated that

exemption from full zone detection and automatic suppression is justified and requiring such is not necessary to achieve the underlying purpose of the rule (10 CFR 50.12(a)(2)(ii)).

Based on the above information and analysis, the Commission's staff concludes that "special circumstances" exist for the licensee's requested exemptions. See 10 CFR 50.12(a)(2)(ii) and (vi).

The following lists the specific exemption requests submitted by the licensee in their September 28, 1984 letter, supplemented by letters dated October 31, 1984 and October 21, 1986.

1. o Reactor Building, Elevation 716 feet, 9 inches, Torus Area, Fire Zone 1A.

   An exemption was requested from the specific requirements of Section III.G.2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.

   o Reactor Building, Elevation 757 feet, 6 inches, RHR Valve Room, Fire Zone 2D.

   An exemption was requested from the specific requirements of Section III.G.2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.

   o Reactor Building, Elevation 786 feet, Laydown Area and Reactor Water Cleanup (RWCU) Area, Fire Zones 3A/3B.

   An exemption was requested from the specific requirements of Section III.G.2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.

2. o Reactor Building, Elevation 716 feet, 9 inches, Torus Area, Fire Zone 1A.

   An exemption was requested from specific requirements of Section III.G.2.b to the extent that it requires automatic fire suppression and detection be installed throughout the fire area.

3. o Door No. 202 (Between Fire Zone 1D and Fire Zone 1A).

   An exemption was requested from the specific requirement of Section III.G.2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.

   o Door No. 203 (Between Fire Zone 1D and Fire Zone 2B).

   An exemption was requested from the specific requirement of Section III.G.2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.

4. o Equipment Hatch Between Fire Zone 3B and Fire Zone 4B.

   An exemption was requested from the specific requirement of Section III.G.2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.

5. o Fire Dampers FD-010 and FD-012 (Between Fire Zone 1A and Fire Zone 1C).

   An exemption was requested from the specific requirement of Section III.G.2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.

- o Fire Damper FD-021 (Between Fire Zone 7A and Fire Zone 7C). An exemption was requested from the specific requirement of Section III.G.2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.
- o Fire Damper FD-111 (Between Fire Zone 3B and Fire Zone 4A). An exemption was requested from the specific requirement of Section III.G 2.a to the extent that it requires redundant safe shutdown cables and equipment be separated by a 3-hour rated fire barrier.

6. o Protection of Exposed Structural Steel for Rated Barriers. An exemption was requested from the specific requirements of Section III.G.2.a to the extent that it requires structural steel forming part of or supporting fire barriers be protected to provide fire resistance equivalent to that required of the barrier.

In summary, the exemptions were requested for separating redundant trains by 3-hour rated fire barriers and for providing automatic fire suppression and detection systems. The exemptions for 3-hour rated fire barriers separating redundant trains included valve motor operators and flexible conduit not protected for 3 hours, watertight doors, and an open equipment hatch and fire dampers not installed in the configuration as they were fire tested. Fire Zone 1A does not contain automatic fire suppression and detection systems throughout the zone. Structural steel forming a part of or supporting required fire barriers in certain areas is not protected to a fire resistance equivalent to that of the barriers.

The licensee has provided alternative and/or acceptable levels of fire protection for areas containing redundant safe shutdown systems not separated from each other. Fire protection in areas with more than a negligible combustible load and containing safe shutdown equipment or cables consists of fire detectors and/or automatic fire suppression systems, and portable extinguishers and hose stations.

The Commission's staff finds that there is reasonable assurance that a fire in these areas would be of low magnitude, promptly detected, and extinguished. The low combustible loading in each area ensures that redundant safe shutdown equipment located in the adjoining areas will not be damaged before the fire brigade can extinguish the fire.

Based on the review of the licensee's analysis, the Commission's staff concludes that the installation of 3-hour fire rated enclosures around safe shutdown valve motor operators and the installation of an automatic fire suppression and detection system throughout Fire Zone 1A would not significantly increase the level of fire protection in these zones. Furthermore, the identified fire dampers and doors, equipment hatch, and unprotected structural steel provide a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Additional details concerning the exemptions are provided in the Safety Evaluation issued concurrently.

IV.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), (1) these exemptions as described in Section III are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security; and (2) special circumstances 10 CFR 50.12(2)(ii) and (vi) are present as discussed in III above. Therefore, the Commission hereby grants the aforementioned exemptions from the requirements of Section III.G of Appendix R to 10 CFR Part 50 as described in Section III above.

Pursuant to 10 CFR 51.32, the Commission has determined that granting these exemptions will have no significant impact on the environment (52 FR 37855).

A copy of the concurrently issued Safety Evaluation related to this action is available for public inspection at the Commission's Public Documert Room, 1717 H Street, N.W., Washington, D.C. and at the local public document room located at Cedar Rapids Public Library, 500 First Street, SE, Cedar Rapids, Iowa 52401. A copy may be obtained upon written request addressed to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Division of Reactor Projects - III, IV, V and Special Projects.

This Exemption is effective upon issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Dennis M. Crutchfield, Director
Division of Reactor Projects - III, IV, V
& Special Projects

Dated at Bethesda, Maryland
this 14th day of October 1987

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATIVE TO APPENDIX R EXEMPTIONS REQUESTED FOR

IOWA ELECTRIC LIGHT AND POWER COMPANY

DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

1.0 INTRODUCTION

By letter dated September 28, 1984, the Iowa Electric Light and Power Company (the licensee) requested exemptions from Section III.G of Appendix R to 10 CFR Part 50 and provided clarifications to exemption requests previously granted. By letters dated October 31, 1984 and October 21, 1986, the licensee provided additional information concerning the protection of structural steel in support of their exemption requests. These exemption requests are the subject of this evaluation.

NRC staff fire protection engineers visited the site on March 12, 1986 to review the above zones where the exemptions from Appendix R were requested and to gather additional information.

This safety evaluation is based in part on the enclosed Technical Evaluation Report (TER) generated by an NRC contractor, Franklin Research Center (FRC). This TER has been reviewed by the NRC staff, and the staff is in agreement with the conclusions reached in the FRC TER.

Section III.G.1 of Appendix R requires fire protection features to be provided for structures, systems, and components important to safe shutdown, and capable of limiting fire damage so that:

a. One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and

b. Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.

Section III.G.2 of Appendix R, except as provided for in Paragraph III.G.3, requires that one redundant train of cables and equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits or shorts to ground, necessary to achieve and maintain hot shutdown be maintained free of fire damage by one of the following means:

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; or

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b. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or

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.

If the above conditions are not met, or where redundant trains of systems required for hot shutdown may be subject to damage from fire suppression activities or from the rupture or inadvertent operation of fire suppression systems, Section III.G.3 requires that there be alternative or dedicated shutdown capability independent of cables, systems, or components in the fire area of concern. It also requires that fire detection and a fixed suppression system be installed in the fire area of concern.

Because it is not possible to predict the specific conditions under which fires may occur and propagate, design-basis protective features rather than the design-basis fire are specified in the rule. Plant-specific features may require protection different from the measures specified in Section III.G. In such a case, the licensee must demonstrate by means of a detailed fire hazards analysis that existing protection or existing protection in conjunction with proposed modifications will provide a level of safety equivalent to the technical requirements of Section III.G of Appendix R.

In summary, Section III.G is related to fire protection features for ensuring that one train of systems and associated circuits necessary to achieve and maintain safe shutdown are free of fire damage. Either fire protection configurations must meet the specific requirements of Section III.G or an alternative fire protection configuration must be justified by a fire hazards analysis. Generally, the NRC staff will accept an alternative fire protection configuration if:

- The alternative ensures that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control station(s) is free of fire damage.

- The alternative ensures that fire damage to at least one train of equipment necessary to achieve cold shutdown is limited so that it can be repaired within 72 hours (minor repairs using components stored on the site).

- Fire-retardant coatings are not used as fire barriers.

- Modifications required to meet Section III.G would not enhance fire protection safety levels above that provided by either existing or proposed alternatives.

- Modifications required to meet Section III.G would be detrimental to overall facility safety.

2.0 o REACTOR BUILDING, ELEVATION 716 FEET, 9 INCH, TORUS AREA - FIRE ZONE 1A

o REACTOR BUILDING. ELEVATION 757 FEET, 6 INCHES, RHR VALVE ROOM - FIRE ZONE 2D

o REACTOR BUILDING, ELEVATION 786 FEET, 0 INCH, LAYDOWN AREA AND REACTOR WATER CLEANUP (RWCU) AREA - FIRE ZONES 3A/3B

2.1 Exemptions Requested

Exemptions were requested from the specific requirements of Section III.G.2.a to the extent that it requires separation of cables, equipment, and associated non-safety circuits of redundant trains by a fire barrier with a 3-hour rating.

2.2 Discussion

The licensee has identified the above fire zones which do not meet the requirements of Section III.G.2.a due to the lack of fire barrier enclosures for safe shutdown valves and valve motor operators and the installation of flexible conduit fire wrap in an untested configuration.

Exemptions from the specific requirements of Appendix R to provide automatic suppression and detection throughout these fire zones were previously requested and granted. As part of the previous exemption requests, the licensee committed to provide 1-hour rated fire wraps on cables in conjunction with spot automatic suppression systems to protect safe shutdown valves. The staff found that the proposed protection was adequate for these zones.

The licensee has now proposed to change the previously approved designs to incorporate the use of 3-hour rated cable fire wraps, flexible fire wrap, and to eliminate the spot automatic suppression systems.

The proposed design change incorporates the use of 3-hour rated cable wrap for rigid conduit and junction boxes. The material selected is 3-hour rated Thermolag, manufactured by TSI, Inc. In accordance with Section III.G.2.a of Appendix R, automatic suppression is not required when 3-hour fire rated separation is provided between redundant safe shutdown systems. Therefore, the specific requirements of Appendix R are met for the 3-hour wrapped circuits for rigid conduit and junction boxes in the identified zones.

The 3-hour rated fire wrap described above is not provided for cables in flexible conduits, the motor operators, or the valves. Due to the rigid characteristics of the 3-hour rated Thermolag material, the licensee proposed to protect flexible conduit using a flexible fire wrap manufactured by B&B Insulators under the trade name "Hemyc." The flexible conduits (varying from 6 to 18 inches in length) are located near the the motor operators. The "Hemyc" material compensates for slight movement or vibration that may cause cracking or failure of the Thermolag fire barrier system. The "Hemyc" material has been tested and approved for a fire resistance rating of 1 hour based on a given

thickness of the wrap. The "Hemyc" material is installed on the flexible conduits in excess of the 1-hour rating. The thickness installed was analyzed by the manufacturer as equivalent to a 3-hour barrier but no testing was performed.

The fire zones for which the above protection is proposed are described below.

2.2.1 Reactor Building, Elevation 716 feet, 9 inches, Torus Area, Fire Zone 1A

Fire Zone 1A incorporates the entire torus area on elevation 716 feet, 9 inches. The torus area contains safe shutdown equipment from Division I and Division II. Redundant functions are, with one exception, located on opposite ends of the torus area and are separated by at least 50 feet. Refer to Section 3.0 for additional information on the separation of redundant functions within the torus area.

The exception to the separation described above is a pair of Division I RHR valves located near Division II safe shutdown equipment. Valves MO-2005, MO-2006, and MO-2007 are Division I RHR valves that provide suppression pool cooling water. They are located in the northwest part of Fire Zone 1A in an area that is primarily a Division II area. The redundant Division II valves, MO-1932, MO-1933, and MO-1934 are located in the southwest corner of Fire Zone 1A. There is approximately a 30-foot separation free of intervening combustibles between the redundant trains and valves.

Division I valves MO-2005 and MO-2007 are required to maintain hot shutdown conditions. Valve MO-2006 is not required to operate for safe shutdown; however, the electrical portion of the valve circuit that provides an interlock signal is required to prevent maloperation of MO-2005 and MO-2007 and is protected with 3-hour fire wrap. If the safety relief valves are used for plant shutdown, suppression pool cooling would be required to achieve and maintain safe shutdown. The licensee has stated that suppression pool cooling would not be required before it is possible to manually open the RHR flow path to the pool.

Fire Zone 1A has a floor area of approximately 10,815 square feet. The fixed combustible loading for Fire Zone 1A is approximately 836 Btu per square foot, which is equivalent to a fire severity of 0.67 minutes based on the ASTM E-119 time-temperature curve. Nearly one-half of the combustible loading is assumed to be 500 pounds of wood scaffolding that has been removed from the zone.

General area fire detection and automatic fire suppression are not provided for Fire Zone 1A. Portable extinguishers and manual hose stations are provided in adjacent zones.

2.2.2 Reactor Building, Elevation 757 feet, 6 inches, RHR Valve Room, Fire Zone 2D

Fire Zone 2D is the RHR valve room on elevation 757 feet, 6 inches of the reactor building. The room contains safe shutdown equipment from both

divisions. Division I RHR valves MO-2003 and MO-2004 are required to operate to achieve and maintain cold shutdown. The valves' electrical circuits are protected to assure that spurious operation will not interfere with safe shutdown. This protection is provided by the 3-hour rated cable wrap and flexible fire barrier material described previously. The licensee has determined that in the event of a fire, the manual closing mechanism for the required valves would remain operable and that the valves would not be required prior to the time it would be possible to manually open the RHR flow path during a fire based on the combustible loading.

By letter dated June 22, 1982, the licensee indicated that the normally closed inboard MO-1908 and outboard MO-1909 valves, which are in series and provide high-low pressure interface isolation for the RHR letdown line, would be disconnected during normal plant operation by locking open their MCC power breakers. Subsequently, the licensee determined that while the above approach would prevent fire-induced spurious opening of the valves, it would also result in loss of control room position indication for the valves. As a result of discussions with the NRC staff in September and October of 1986, the licensee provided a submittal dated October 21, 1986, wherein they stated that circuit modifications had already been completed to provide separation of redundant power and control cables for both the valves in all fire zones except the control room. In the submittal, the licensee committed to make appropriate circuit modifications which would allow the MCC power breakers for both the valves to be kept closed and at the same time prevent a fire-induced breach of the high-low pressure interface. By letter dated February 20, 1987, the licensee provided a description of the proposed circuit modifications. In the February submittal, the licensee stated that in addition to the existing main pressure switch, they planned to install an auxiliary pressure switch with contacts in the control circuitry for the inboard valve (MO-1908) outside the control room, which would prevent the spurious opening of the valve due to control room fire, so long as the reactor pressure exceeds 135 psig. The licensee further stated that all the interconnecting wiring from the auxiliary pressure switch to the MCC for the valve will be located outside the control room area, and the contacts will be rated such that they can withstand the maximum voltages which may be imposed on the valve control circuit due to any circuit faults caused by fire. The licensee committed to complete the circuit modifications prior to Cycle 9 startup scheduled for the Spring of 1987. In the June 22, 1982 letter, the licensee proposed a procedural change to lock open the MCC power breakers for valves MO-1900 and MO-1902. These valves provide the high-low pressure interface for the RHR reactor head spray line. Subsequently, the licensee has stated that the high-low pressure interface will be maintained by an existing in-line check valve and that locking open the MCC power breakers during normal plant operation is not necessary.

The combustible loading in this fire zone is low, approximately 425 Btu per square foot, which is equivalent to a fire severity of 0.33 minutes based on the ASTM E-119 time-temperature curve. The combustibles consist of cable insulation located in two trays at least 10 feet above and to

the side of valves MO-2003 and MO-2004. One cable tray is protected by a 3-hour fire rated fire wrap which further reduces the combustible material available in the zone. The other cable tray is located at least 24 feet to the side of MO-2003 and MO-2004. There is significant spatial separation between the trays, conduit, and motor operators for Division I valves MO-2004 and MO-2005 and the Division II redundant valves MO-1904 and MO-1905.

General area fire detection or automatic fire suppression is not provided for Fire Zone 2D. Portable extinguishers and manual hose stations are available in adjacent Fire Zones 2A/2B.

2.2.3 Reactor Building, Elevation 786 feet, 0 inch, Laydown Area and Reactor Water Cleanup (RWCU) Area, Fire Zones 3A/3B

Fire Zones 3A/3B incorporate the laydown area and the reactor water cleanup area of the reactor building on elevation 786 feet, 0 inch.

Division I and II redundant core spray isolation valves are located in Fire Zones 3A/3B. Each core spray line has a normally open outboard valve and a normally closed inboard valve. Both valves are located outside of the dry well. The valves are MO-2135 and MO-2137 for Division II and MO-2115 and MO-2117 for Division I.

Core spray injection valve MO-2137 is required to operate for safe shutdown, and valve MO-2135 is required to remain in its normally open position. The valve, motor operator, conduits, and cable trays associated with MO-2137 are protected by a 3-hour rated enclosure using TSI Thermolag material. The conduit to the motor operator for valve MO-2137 is protected by 3-hour rated cable wrap and flexible fire barrier material as previously described.

The electrical circuits for valve MO-2135, including flexible conduit, are also protected to preclude spurious closing of the valve during safe shutdown. The licensee has stated that the valve and valve motor operator are not required during shutdown because the valve does not need to change position to support safe shutdown.

The Division II core spray valves are located on the north side of the fire zone, and Division I valves are on the south side. They are approximately 75 feet apart with several intervening barriers such as the dry well.

Fire Zone 3A has a fixed combustible loading of approximately 27,000 Btu per square foot, which is equivalent to a fire severity of 23 minutes based on the ASTM E-119 time-temperature curve. Fire Zone 3B has a combustible loading of approximately 20,500 Btu per square foot with an equivalent fire severity of approximately 16 minutes.

There are 37 ionization smoke detectors on the ceilings throughout Fire Zones 3A/3B. General area fire suppression is not provided. Portable extinguishers and manual hose stations are provided within the zones.

2.3 Evaluation

The above fire zones do not comply with the technical requirements of Section III.G.2.a of Appendix R due to the lack of fire barrier enclosures for the motor operators of the safe shutdown valves and the installation of flexible conduit fire wrap which has not been tested for a 3-hour fire resistance rating.

Fire Zone 1A contains redundant trains of RHR valves that provide suppression pool cooling. If the safety relief valves are ever utilized for plant shutdown, suppression pool cooling would be required to achieve and maintain hot shutdown. The combustible loading in this fire zone is low, approximately 830 Btu per square foot. There are no intervening combustibles between the redundant valves which are separated by approximately 30 feet. The licensee has stated that suppression pool cooling would not be required prior to the time it would be possible to manually open the RHR flow path to the pool based on the combustible loading in the zone and that the manual closing mechanism for the required valves would remain operable. Based on the protection of the valve circuits, the low combustible loading, the lack of intervening combustibles between redundant valves, and the capability for manual operation at a time exceeding the duration of a fire, sufficient passive protection exists for Fire Zone 1A to ensure the ability to achieve and maintain safe shutdown.

Fire Zone 2D contains safe shutdown equipment for both divisions, specifically Division I RHR valves MO-2003 and MO-2004, which are only required to operate to achieve and maintain cold shutdown. They are not required to achieve or maintain hot shutdown. The electrical portion of the valves is protected to assure that spurious operation would not interfere with safe shutdown. The combustible loading in this fire zone is low, approximately 425 Btu per square foot. There is significant spatial separation between the redundant Division I and Division II valves. The licensee has determined that if a fire occurred in this area, the manual closing mechanisms for the required valves would remain operable. Based on the protection of the valve circuits, the low combustible loading, the spatial distance between redundant valves, and the capability for manual operation at a time exceeding the duration of an expected fire, sufficient passive protection exists for Fire Zone 2D to ensure the ability to achieve and maintain safe shutdown. Regarding the high-low pressure interface isolation valves on the RHR letdown line, MO-1908 and MO-1909, the NRC staff finds that the proposed modifications in the control circuit will isolate the control circuit for the valve from the control room through the auxiliary pressure switch and thus prevent its spurious opening due to a fire in the control room, so long as the reactor pressure exceeds 135 psig. Additionally, the opening of the valve when the reactor pressure is at or below 135 psig is not a concern since the reactor pressure would be well below the RHR system design pressure. In their recent discussions with the NRC staff, the licensee also stated that all the circuitry associated with the operation of the auxiliary pressure switch will be independent of the control room. Based on the above, the staff has determined that the proposed modifications for the control

circuitry of one of the valves, in conjunction with the already completed separation of redundant power and control cables for the two valves in all the zones outside the control room, will prevent a single fire in any one fire zone causing spurious opening of both the valves, and will thus assure the integrity of the high-low pressure interface formed by the valves. Regarding the RHR reactor head spray line high-low pressure interface valves, MO-1900 and MO-1902, the staff agrees with the licensee that locking open the MCC power breakers for these valves is not needed since the existing in-line check valve will prevent the breach of the interface.

Fire Zones 3A/3B contain Division I and Division II redundant core spray isolation valves. Core spray injection valve MO-2137 is required to operate for safe shutdown, and valve MO-2135 is required to remain in its normally open position. As described in Section 2.2.3, the valve, motor operator, conduits, and cable trays associated with MO-2137 are protected by a 3-hour rated enclosure. Therefore, the specific requirement of Section III.G.2.a of Appendix R is met for this valve, except for the flexible conduit to the motor operator, which is protected by the flexible fire barrier material. The electrical circuits for valve MO-2135 are protected to preclude spurious closing of the valve during safe shutdown. This protection is provided by 3-hour cable fire wrap and flexible fire barrier material as described previously.

Ionization smoke detectors are provided throughout Fire Zones 3A/3B. These detectors alarm in the main control room. Line-type heat detectors are provided in cable trays protected with 3-hour fire wrap. If a fire occurs, it should be detected in its incipient stage and alarmed in the main control room. The fire brigade will be dispatched to the fire zone to extinguish the fire using the portable extinguishers and manual hose stations provided. Until the fire is extinguished, the 3-hour rated cable wrap, the flexible cable wrap material, the spatial separation between redundant valves, and the ionization smoke detectors all provide sufficient protection to ensure the ability to achieve and maintain safe shutdown.

2.4 Conclusion

Based on the above evaluations, the NRC staff concludes that the existing fire protection combined with the proposed modifications, provides a level of fire protection equivalent to the technical requirements of Section III.G.2.a of Appendix R. Therefore, the exemption requests for the aforementioned valve motor operators and flexible conduit fire wrap can be granted.

Based on the above, the staff further concludes that the licensee's proposed approach for handling the high-low pressure interface concerns identified above are acceptable.

3.0 REACTOR BUILDING, ELEVATION 716 FEET, 9 INCHES, TORUS AREA - FIRE ZONE 1A

3.1 Exemption Requested

An exemption was requested from the specific requirements of Section III.G.2.b to the extent that it requires an automatic fire suppression and fire detection system throughout the identified zone.

3.2 Discussion

The licensee has identified Fire Zone 1A as not meeting the requirements of Section III.G.2.b because automatic fire suppression and detection systems are not installed throughout the zone.

Fire Zone 1A incorporates the entire torus area on elevation 716 feet, 9 inches. The torus area contains Division I and Division II safe shutdown equipment. Redundant functions are located on opposite sides of the room except for valves and circuits described in Section 2.0.

The divisions of cables and equipment are generally segregated within Fire Zone 1A such that Division II occupies the northwest half of the zone and Division I occupies the southeast half. There is over 50 feet of spatial separation between the divisions with large noncombustible equipment between the redundant areas.

Fire Zone 1A has a floor area of approximately 10,815 square feet. The fixed combustible loading of Fire Zone 1A is approximately 836 Btu per square foot, which is equivalent to a fire severity of 0.67 minutes.

Nearly one-half of the combustible loading is assumed to be 500 pounds of wood scaffolding that has been removed from the zone.

An exemption was previously requested and granted from the requirements to provide automatic suppression and detection throughout Fire Zone 1A. The exemption was approved based on the extremely low fire loading and significant spatial separation with no intervening combustibles between the redundant divisions. As part of the previously approved exemption request, the licensee committed to provide 1-hour rated fire wrap in conjunction with spot automatic suppression systems to protect certain valves. Changes to this commitment are discussed in Sections 2.2.1 and 2.3.1.

3.3 Evaluation

The fire protection for Fire Zone 1A does not comply with the technical requirements of Section III.G.2.b of Appendix R because automatic fire suppression and detection systems are not installed throughout the area.

Fire Zone 1A contains both Division I and Division II safe shutdown equipment. A major factor that reduces the fire risk in this zone is that passive protection is afforded for the redundant divisions by over 50 feet of spatial separation between the divisions, by the central placement of the dry well, and by the existence of large noncombustible equipment (torus) between the redundant cables.

Until the fire is extinguished, the separation and intermediate barriers between safe shutdown systems, the lack of intervening combustibles, and the low combustible loading of Fire Area 1A all would provide sufficient passive protection to ensure that one safe shutdown division would remain free of fire damage.

3.4 Conclusion

Based on the above evaluation, the NRC staff concludes that the existing fire protection, in conjunction with modifications described in Section 2.0 provides a level of fire protection equivalent to the technical requirements of Appendix R. Therefore, the exemption request from the requirement for automatic fire suppression and detection systems throughout the fire zone should be granted.

4.0 o DOOR NO. 202 (BETWEEN FIRE ZONE 1D AND FIRE ZONE 1A)

o DOOR NO. 203 (BETWEEN FIRE ZONE 1D AND FIRE ZONE 2B)

4.1 Exemption Requested

Exemptions were requested from the requirements of Section III.G.2.a to the extent that it requires the separation of cables, equipment, and associated non-safety circuits of redundant trains by a fire barrier with a 3-hour fire resistance rating.

4.2 Discussion

The licensee has identified Fire Zones 1A, 1D, and 2B as not meeting the requirements of Section III.G.2.a because unlabeled watertight doors are installed in the zones' boundaries. Each fire zone is located on elevation 716 feet, 9 inches of the reactor building. Fire Zone 1A is the torus room, Zone 1D is the RHR corner room, and Zone 2B is Stair No. 4. The boundaries between these zones serve as III.G.2.a fire barriers.

Doors 202 and 203 are watertight doors in the boundaries separating these fire zones. By letter dated January 10, 1983, the licensee stated that Door No. 202 did not have a fire rated label; that the manufacturer currently makes an identical door with a steel flange which is rated as a 3-hour fire door; and that the existing door would be modified in accordance with the manufacturer's instructions to upgrade the door to a 3-hour rated door. In the same letter, Door No. 203 was characterized as a 1-1/2-hour rated stairwell door between Zone 1D and Zone 2B.

An exemption was previously requested and granted for Door No. 203 as being sufficiently rated for the boundary between Fire Zones 1D and 1B. However, it is the same as Door No. 202 and is unlabeled. Therefore, the licensee decided to modify both watertight doors to upgrade them to 3-hour rated doors.

Subsequent to this decision, it was discovered that the modification required to upgrade the doors to 3-hour rated would degrade the watertight capability. The 3-hour rated door was fire tested with a neoprene

gasket; however, the fire test resulted in flame propagation through the door via the gasket material at 21 minutes into the test. Because of the flame propagation, the door was not approved for a 3-hour rating if the neoprene gasket material is used. Therefore, to upgrade the doors this material was replaced by the licensee with fire retardant gasketing material (Ferratex #8201) which does not react to immediate flame or burn freely, and is capable of maintaining the required watertight integrity.

Door No. 202 separates the RHR corner room (Zone 1D) from the torus room (Zone 1A). Door No. 203 separates the RHR corner room (Zone 1D) from Stair No. 4 (Zone 2B).

The overall combustible loading for the torus room (Fire Zone 1A) is low, corresponding to an equivalent fire severity of 4 minutes. The closest installed combustibles to Door 202 in the torus room are cable trays located 25 feet west of the door and more than 20 feet above the floor. Door 202 is normally locked and is not used for access. Transient combustibles are not found near the door.

The equivalent fire severity for the RHR corner room (Fire Zone 1D) is approximately 11 minutes. The combustibles consist of approximately 32 gallons of lube oil contained in equipment at the floor level and 440 pounds of cable insulation. The closest combustible to Doors 202 and 203 in Fire Zone 1D is a cable tray along the south wall of the zone, approximately 8 feet away from Door 202 and 13 feet above the floor. The lube oil is located in pumps approximately 25 feet east of Door 202 and is separated from Door 203 by an 8-foot-high shield wall. Transient combustibles associated with a dressout area are typically located within the shield wall area adjacent to Door No. 203 in Fire Zone 1D.

There are no combustibles on the stair side of Door 203 (Fire Zone 2B) since Stair No. 4 (Fire Zone 2B) is devoid of fixed combustibles and is maintained free of transient combustibles.

The RHR corner room (Fire Zone 1D) which accesses both doors is provided with ionization smoke detectors which alarm in the main control room.

4.3 Evaluation

The above fire zone boundaries do not comply with the technical requirements of Section III.G.2.a of Appendix R because 3-hour rated fire doors are not installed. Watertight doors are installed in lieu of 3-hour rated fire doors. The combustible loading in areas adjacent to each of the installed watertight doors is low.

Ionization smoke detectors are provided in Fire Zone 1D which is adjacent to the watertight doors. These detectors will detect a fire in Fire Zones 1D, 1A, or 2B that challenges the watertight doors' boundary. The alarms for these detectors are annunciated in the main control room. The fire brigade will be dispatched and would extinguish the fire manually with the hose lines or portable extinguishers provided.

Based on their similarity to tested and approved fire doors, watertight Door Nos. 202 and 203 would exhibit substantial fire resistance characteristics. The doors have been modified in accordance with the manufacturer's instructions to upgrade the doors to be 3-hour rated, except for the provision of the gasket material. The gasket material initially supplied with the doors has been replaced with gasket material with improved flame/heat resistance characteristics. There are no fixed combustibles on either side of the doors that would present a flame propagation path through the boundary.

Until the fire is extinguished, the substantial fire resistance of the doors, the lack of combustibles near each watertight door, the low combustible loading of adjacent fire zones, and the fire detection provided in Fire Zone 1D will provide sufficient protection to ensure that one shutdown division would remain free of fire damage and that a fire in the above zones would not propagate through Doors 202 or 203.

4.4 Conclusion

Based on the above evaluation, the staff concludes that the existing fire protection features provide a level of protection equivalent to the technical requirements of Section III.G.2.a of Appendix R. Therefore, the exemption request for the aforementioned watertight doors can be granted.

5.0 EQUIPMENT HATCH BETWEEN FIRE ZONE 3B AND FIRE ZONE 4B

5.1 Exemption Requested

An exemption was requested from the requirements of Section III.G.2.a to the extent that it requires the separation of cables, equipment, and associated non-safety circuits of redundant trains by a fire barrier with a 3-hour fire resistance rating.

5.2 Discussion

The licensee has identified that the fire barrier between Fire Zones 3B and 4B does not meet the requirements of Section III.G.2.a because of an open hatch.

Fire Zone 4A, elevation 812 feet, 0 inch, contains both trains of control room heating, ventilation, and air conditioning (HVAC) chillers. This equipment is located in the north portion of Fire Zone 4A. Fire Zone 4A is connected to Fire Zone 4B through a narrow corridor. Fire Zone 4B does not contain any safe shutdown equipment or cables. Fire Zone 4B, however, does communicate with Fire Zones 3A/3B, elevation 786 feet, 0 inch, through a large open vertical equipment hatch in the floor of Zone 4B. Fire Zones 3A/3B contain alternate shutdown capability (ASC) panels and equipment that are used should a control room evacuation be required.

Fire Zone 4A is separated from Fire Zone 3A by a 3-hour fire rated floor/ceiling assembly. Fire Zone 4B is open to Fire Zone 3B through the

19-foot x 19-foot open equipment hatch. The equipment hatch is bounded on the north and south by concrete block and metal siding walls which form part of the radioactive laundry area. The west side of the equipment hatch is bounded by the reactor building wall, which leaves the east side of the hatch as the only communication path from Zone 3B to Zone 4B.

An automatic deluge spray system is installed over the hatch in the ceiling of Fire Zone 3B. The system is automatically actuated by detectors at the hatch's perimeter. The deluge system can be manually actuated in Fire Zone 3B.

In addition, a partial wet-pipe sprinkler system is installed in Fire Zone 4B covering the radioactive laundry areas and corridor adjacent to the hatchway. Sprinkler protection is also provided in the area of the redundant HVAC chillers.

The total fire load for Fire Zone 4B, including transient combustibles, is 4,307 Btu per square foot, which is equivalent to a fire severity of 3.2 minutes.

The total combustible load for Fire Zone 4A is 7,381 Btu per square foot, resulting in an equivalent fire severity of 5.4 minutes.

The distance from the equipment hatch to the cables and equipment used for alternate shutdown in Fire Zone 3A exceeds 70 feet. There are no combustibles which pass through the hatch's opening. Approximately 25 feet of the distance between the chillers and the hatch is protected by a suppression system.

Detection is provided throughout Zones 3A/3B and 4A/4B.

The licensee previously requested and was granted an exemption to the full zone suppression requirement for the protection of the redundant control room HVAC equipment in Zone 4A, considering there is a fire in Zone 4A. Subsequently, the licensee has identified the following scenario:

A fire starts in Zones 3A/3B and disables auxiliary shutdown capability. This is acceptable since no control room evacuation is required and shutdown can be accomplished from the control room. The fire propagates through the open hatch to Zone 4B, then propagates to the HVAC area in the northern part of Zone 4A, disabling the main control room HVAC chillers, thereby potentially affecting shutdown from the control room.

The licensee has requested an exemption for this scenario because of the open hatch.

5.3 Evaluation

The fire zone boundary between Zones 3B and 4B does not meet the requirements of Section III.G.2.a because of the open hatch.

With an open hatch, fire could damage ASC panels/equipment in Fire Zone 3B and the control room chillers in Fire Zone 4A if it propagated through the hatch. However, the combustible loading in these zones is low, consisting primarily of cable insulation in trays.

Smoke detectors are provided throughout Zones 3A/3B and 4A/4B. Because of the detectors, a fire in these zones will be detected in its incipient stage. The alarms from the detectors are annunciated in the main control room. The fire brigade will be dispatched and will extinguish the fire manually with hose lines or portable extinguishers.

Areas in these fire zones containing significant combustibles, and the area adjacent to the hatch opening and the redundant control room chillers are provided with partial wet-pipe sprinkler systems. An automatic deluge spray system is installed over the hatch at the ceiling of Zone 3B. There are no combustibles which pass through the hatch's opening.

Until the fire is extinguished by the fire brigade or automatic suppression systems, the spatial separation between the control room chillers and the ASC area, the low intervening combustibles, the low combustible loadings, the deluge water spray and wet-pipe sprinkler systems, and the general area fire detection will provide sufficient protection to ensure that the control room chillers or the ASC equipment area would remain free of fire damage. We also have reasonable assurance that a fire in the above fire zones will not prevent a safe plant shutdown.

5.4 Conclusion

Based on the above evaluation, the staff concludes that the existing fire protection features provide a level of protection equivalent to the technical requirements of Section III.G.2.a of Appendix R. Therefore, the exemption request for the aforementioned hatch between Fire Zones 3B/4B can be granted.

6.0 o FIRE DAMPERS FD-010 AND FD-012 (BETWEEN FIRE ZONE 1A AND FIRE ZONE 1C)

o FIRE DAMPER FD-021 (BETWEEN FIRE ZONE 7A AND FIRE ZONE 7C)

o FIRE DAMPER FD-111 (BETWEEN FIRE ZONE 3B AND FIRE ZONE 4A)

6.1 Exemption Requested

Exemptions were requested from the requirements of Section III.G.2.a to the extent that it requires the separation of cables, equipment, and associated non-safety circuits of redundant trains by a fire barrier with a 3-hour fire resistance rating.

6.2 Discussion

The licensee has identified the following duct penetrations which do not meet the requirements of Section III.G.2.a because the installation of

3-hour rated fire dampers is not in accordance with the manufacturer's installation instructions. For clarity, fire damper numbers used in the licensee's submittal are used in this discussion.

6.2.1 Fire Dampers FD-010 and FD-012

Fire dampers FD-010 and FD-012 are installed on the surface of the fire barrier wall between Fire Zone 1A and Fire Zone 1C. The dampers are two section, vertical type with a mullion that separates the sections.

The surface-mounted installation consists of a 3-hour rated fire damper installed in an 8-inch channel frame attached to the perimeter of the penetration. The frame is protected with 3-hour rated fire resistive material (Thermolag). Proper expansion clearances are provided between the fire damper, the 8-inch channel frame, and the damper retaining angles.

Since the duct transition penetrates the wall at an angle, the conventional fire damper installation within the wall is not feasible. The licensee has stated that single-section dampers have been successfully tested in a surface mounted configuration similar to that used for the two-section dampers.

6.2.2 Fire Dampers FD-021 and FD-111

Fire dampers FD-021 and FD-111 are installed within fire barriers in accordance with the manufacturer's installation instructions. The dampers are retained within the fire barrier by retaining angles installed on the fire damper sleeve.

Due to the proximity of a perpendicular wall on one side of each of the fire damper penetrations, the installation of one of the eight specified retaining angles is not possible. The licensee states that the testing of this situation has been performed successfully according to manufacturers requirements. However, it is not clear that testing for the specific physical configurations of fire dampers FD-021 and FD-111 has been performed.

6.3 Evaluation

The aforementioned fire dampers do not comply with the technical requirements of Section III.G.2.a of Appendix R because the dampers are not installed in accordance with the manufacturer's installation instructions.

Successful fire tests of similar configurations have been performed by the damper manufacturer. The duct that contains these dampers is of substantial steel construction which reduces the probability of fire propagation through the penetrations. We have reasonable assurance that a fire would not propagate between the fire zones through the referenced fire dampers and prevent a safe plant shutdown.

Review of the damper installations indicates that the dampers now in place provide protection equivalent to dampers installed in accordance with the manufacturer's instructions.

6.4 Conclusion

Based on the above evaluation, the staff concludes that the existing fire protection features provide a level of protection equivalent to the technical requirements of Section III.G.2.a of Appendix R. Therefore, the exemption requests for fire dampers FD-010, FD-012, FD-021, and FD-111 can be granted.

7.0 PROTECTION OF EXPOSED STRUCTURAL STEEL FOR RATED BARRIERS

7.1 Exemptions Requested

Exemptions were requested from Section III.G.2.a to the extent that it requires structural steel forming part of or supporting required fire barriers be protected to provide a fire resistance equivalent to that of the barrier.

7.2 Discussion

The licensee has identified several areas which do not meet the requirements of Section III.G.2.a because structural steel forming part of or supporting required fire barriers is not fireproofed.

The licensee met with the staff on September 5, 1984, to discuss several exemptions from the requirement to protect structural steel forming part of or supporting required fire barriers. The basis for the proposed exemptions was that the peak temperature of the structural steel would not exceed 1100°F when exposed to fires postulated in the licensee's fire hazards analysis. Structural steel associated with required fire barriers and found to exceed 1100°F had already been fireproofed. During the meeting, the staff indicated that the peak temperature calculations performed should explicitly model local temperature effects due to the spatial relationship of combustible materials and structural steel, flame plume effects, and fire zone ventilation.

By letter dated October 31, 1984, the licensee submitted an evaluation of the temperature response of structural steel based on peak temperature calculations. The evaluation uses a mathematical model to calculate the potential time-temperature profile of fires in each fire zone. Two fire modeling methodologies are employed in the analysis: a fully developed enclosure fire model is used to evaluate the average gas mixture temperature in the enclosure; secondly, the local heating effects on steel members are assessed by flame and fire plume impingement calculations. These models formed the basis of the structural steel evaluation.

If the peak temperature calculations show that the time-temperature profile in an area will exceed 1100°F within 3 hours, additional evaluation is performed to calculate the corresponding temperature response of

the supporting structural steel. If the steel temperature exceeds 1100°F within 3 hours, the licensee has committed to protect the steel with 3-hour rated fireproofing. If the steel temperature does not reach 1100°F, an exemption from the requirements to provide structural steel fireproofing is requested.

The results of the reanalysis indicated that several specific structural steel members did not fail, i.e., did not attain the failure temperature of 1100°F when analyzed under localized heating effects model and the enclosure fire model. Those that failed would be fireproofed. The results of the reanalysis are summarized in Tables 1 and 2 of the licensee's October 31, 1984 letter.

The peak steel temperatures attained in certain fire zones were reduced below 1100°F by reducing or controlling the combustible loading within the area. The licensee has committed to institute operational procedures to ensure that the combustible load limit assumed by the calculations is not exceeded.

7.3 Evaluation

The fire zone boundaries identified in Table 1 of the licensee's October 31, 1984 letter do not comply with the technical requirements of Section III.G.2.a of Appendix R because structural steel forming part of or supporting fire barriers is not fireproofed.

The licensee has performed peak temperature calculations that explicitly model local temperature effects due to the spatial relationship of combustible material to structural steel, flame plume effects, and fire zone ventilation. The overall approach described and implemented by the licensee is technically sound. The fire models employed have been documented and the methodology employed represents a compromise between accuracy in real fire environment simulation and practicality of implementation. Our review indicates that this compromise results in a conservative evaluation. The approach used by the licensee is based on Limerick's methodology that has been previously submitted on other dockets and approved by the staff.

We were concerned that because of the lack of fireproofing on structural steel, a fire could lead to the structural failure of the steel and subsequently the required fire barrier. However, based on the licensee's evaluation, we have reasonable assurance that a fire in the identified fire zones would not affect required structural steel fire zone boundaries and prevent a safe plant shutdown. Also, there is unlikely to be a significant increase in fire loading due to transient activities in the identified fire zones.

7.4 Conclusion

Based on the above evaluation, the staff concludes that the results of the structural steel analysis provide a level of fire protection equivalent to the technical requirements of Section III.G.2.a of Appendix R. Therefore, the exemption requests from fireproofing structural steel which does not reach 1100°F should be granted.

8.0 o REACTOR BUILDING, ELEVATION 716 FEET, 9 INCHES, NORTHEAST CORNER ROOM - FIRE ZONE 1C

o REACTOR BUILDING, ELEVATION 735 FEET, 7-1/2 INCHES, SOUTHWEST CORNER ROOM - FIRE ZONE 1G

o REACTOR BUILDING, ELEVATION 757 FEET, 6 INCHES, NORTH AND SOUTH CRD MODULE AREAS - FIRE ZONES 2A/2B

o PUMP HOUSE, ELEVATION 727 FEET, 0 INCHES TO 747 FEET, 6 INCHES, SUMP AND PIPING AREA - FIRE ZONE 16F

o FIRE DAMPERS BETWEEN FIRE ZONES 7B/7C, 10B/10A, 10B/10E, 10B/11A, AND 10D/10F

8.1 Discussion

By letters dated December 19, 1983 and April 26, 1983, exemptions were granted from the requirements of Appendix R, Section III.G for the above zones. The exemptions were to the extent that Appendix R requires full zone automatic suppression, 1-hour fire protection of redundant cable and equipment, or 3-hour fire dampers in boundaries between fire zones.

Subsequently, the licensee elected to protect the necessary safe shutdown equipment with alternative modifications. The licensee has committed to make alternative modifications that are in full compliance with Appendix R, Section III.G.2. Since the exemption requests were previously granted, they are, therefore, no longer required.

9.0 SUMMARY

Based on the evaluation, we find that the level of fire protection in the areas/zones listed below is equivalent to that achieved by compliance with the technical requirements of Section III.G of Appendix R and, therefore, the licensee's request for exemption in these areas/zones can be granted:

1. o Reactor Building, Elevation 716 feet, 9 inches, Torus Area - Fire Zone 1A

o Reactor Building, Elevation 757 feet, 6 inches, RHR Valve Room - Fire Zone 2D

o Reactor Building, Elevation 786 feet, 0 inch, Laydown Area and Reactor Water Cleanup (RWCU) Area, Fire Zones 3A/3B

Lack of fire barrier enclosures for valves and valve motor operators in the untested installation of flexible conduit fire wrap. Refer to Section 2.0 for additional information.

2. Reactor Building, Elevation 716 feet, 9 inches, Torus Area - Fire Zone 1A

Lack of automatic fire suppression system throughout the zone. Refer to Section 3.0 for additional information.

3. o Door No. 202 (Between Fire Zone 1D and Fire Zone 1A)

   o Door No. 203 (Between Fire Zone 1D and Fire Zone 2B)

   Non-rated watertight doors installed in barriers between redundant safe shutdown trains of cables and equipment. Refer to Section 4.0 for additional information.

4. Equipment Hatch Between Fire Zone 3B and Fire Zone 4B

   Open hatch exists between redundant trains of cables and equipment. Refer to Section 5.0 for additional information.

5. o Fire Dampers FD-010 and FD-012 (Between Fire Zone 1A and Fire Zone 1C)

   o Fire Damper FD-021 (Between Fire Zone 7A and Fire Zone 7C)

   o Fire Damper FD-111 (Between Fire Zone 3B and Fire Zone 4A)

   Installation of 3-hour rated fire dampers are not in accordance with the manufacturer's installation instructions. Refer to Section 6.0 for additional information.

6. Protection of Exposed Structural Steel for Rated Barriers

   Lack of fireproofing for structural steel forming part of or supporting fire barriers between redundant trains of cables and equipment. Refer to Section 7.0 for additional information.

   The level of fire safety in the areas listed below complies with the technical requirements of Section III.G of Appendix R. Therefore, the previously approved exemption requests for these areas are no longer required. Refer to Section 8.0 for additional information.

   o Reactor Building, Elevation 716 feet, 9 inches, Northeast Corner Room - Fire Zone 1C

   o Reactor Building, Elevation 735 feet, 7-1/2 inches, Southwest Corner Room - Fire Zone 1G

   o Reactor Building, Elevation 757 feet, 6 inches, North and South CRD Module Areas - Fire Zones 2A/2B

   o Pump House, Elevation 727 feet, 0 inch, to 747 feet, 6 inches, Sump and Piping Area, Fire Zone 16F

   o Fire Dampers Between Fire Zones 7B/7C, 10B/10A, 10B/10E, 10B/11A, and 10D/10F

Principal Contributors: J. Stang, T. Chandrasekaran

Dated: October 14, 1987

7590-01

UNITED STATES NUCLEAR REGULATORY COMMISSION

IOWA ELECTRIC LIGHT AND POWER COMPANY
CENTRAL IOWA POWER COOPERATIVE
CORN BELT POWER COOPERATIVE

DOCKET NO. 50-331

ENVIRONMENTAL ASSESSMENT AND FINDING OF

NO SIGNIFICANT IMPACT

The U. S. Nuclear Regulatory Commission (the Commission) is considering issuance of exemptions from certain requirements of Section III.G of Appendix R to 10 CFR Part 50 to Iowa Electric Light and Power Company (IELP/the licensee) for the Duane Arnold Energy Center located at the licensee's site in Linn County, Iowa.

ENVIRONMENTAL ASSESSMENT

Identification of Proposed Action:

The proposed action would grant exemptions from certain requirements of Section III.G of Appendix R to 10 CFR Part 50 which relate to fire protection features for ensuring that systems and associated circuits used to achieve and maintain safe shutdown are free of fire damage. The exemptions are technical since the licensee must demonstrate that fire protection configurations meet the specific requirements of Section III.G or that alternate fire protection configurations can be justified by an acceptable fire hazard analysis.

The Need for the Proposed Action:

The proposed exemptions are needed because the features described in the licensee's request regarding the existing and proposed fire protection at the plant for these items are the most practical method for meeting

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the intent of Appendix R, and literal compliance would not enhance significantly the fire protection capability at Duane Arnold.

Environmental Impacts of the Proposed Action:

The proposed exemptions will provide a degree of fire protection such that there is no increase in the risk of fires at Duane Arnold. Consequently, the probability of fires has not been increased and the post-fire radiological releases will not be greater than previously determined nor do the proposed exemptions otherwise affect plant radiological effluents. With regard to potential nonradiological impacts, the proposed exemptions involve features located entirely within the restricted areas as defined in 10 CFR Part 20. They do not affect plant nonradiological effluents and have no other environmental impact. Therefore, the Commission concludes that there are no measurable radiological or nonradiological environmental impacts associated with the proposed exemptions.

Alternatives to the Proposed Action:

Since the Commission has concluded there is no measurable environmental impact associated with the proposed exemptions, any alternatives with equal or greater environmental impact need not be evaluated. The principal alternative to the exemptions would be to not grant the exemptions requested by the licensee from the requirements of Appendix R. Such action would not enhance the protection of the environment.

Alternative Use of Resources:

This action does not involve the use of resources not considered previously in the Final Environmental Statement for the Duane Arnold Energy Center.

Agencies and Persons Consulted:

The Commission's staff reviewed the licensee's request and did not consult other agencies or persons.

FINDING OF NO SIGNIFICANT IMPACT

The Commission has determined not to prepare an environmental impact statement for the proposed exemptions. Based upon the foregoing environmental assessment, the Commission's staff concluded that the proposed action will not have a significant effect on the quality of the human environment.

For further details with respect to this proposed action, see the licensee's letters dated September 28, 1984, October 31, 1984, and October 21, 1986. These letters are available for public inspection at the Commission's Public Document Room, 1717 H Street, N.W., Washington, D.C. and at the Cedar Rapids Public Library, 500 First Street, S.E., Cedar Rapids, Iowa 52401.

Dated at Bethesda, Maryland this 2nd day of October 1987

FOR THE NUCLEAR REGULATORY COMMISSION

Martin J. Virgilio, Director
Project Directorate III-1
Division of Reactor Projects - III, IV, V
& Special Projects