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DEC 14 1982

Mr. J. M. Pilant, Director
 Licensing & Quality Assurance
 Nebraska Public Power District
 P. O. Box 499
 Columbus, Nebraska 68601

Dear Mr. Pilant:

Subject: Draft SER on Appendix R Exemption Request

Re: Cooper Nuclear Station

We have completed our review of your Appendix R exemption requests and have enclosed our Draft SER.

We request that you review this Draft SER, which was informally transmitted to your staff at an earlier date, for accuracy of technical content and inform us within one week of receipt of this letter of any corrections you consider necessary. With respect to followup action regarding exemption denials, there are three options: (1) appeal denials to NRR management; (2) propose another alternative that requires an exemption; or (3) make modifications to meet the specific requirements of Appendix R.

Since you have requested an appeal meeting which will be scheduled for sometime in January, the first option is already in effect.

In addition, if, for any denied exemptions, you choose to propose an alternative which also requires an exemption, it should be filed under the provisions of Section 50.12 of 10 CFR Part 50. If you choose to propose such an alternative we request that you do so within 60 days of receipt of this letter.

Also, for any denied exemptions, you propose to make modifications which meet the specific requirements of Section III.G of Appendix R, no additional submittal is necessary, unless the modifications are to provide alternative shutdown capability. In the latter case, you will be given six months to provide the description of the modifications for alternative shutdown capability.

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Mr. J. M. Pilant

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If you have any questions regarding this letter or the Draft SER, please contact your Project Manager.

Sincerely,

Original signed by
D. B. Vassallo

Domenic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing

Enclosure:
Draft SER

cc w/enclosure:
See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

EVALUATION OF APPENDIX R EXEMPTION

REQUEST FOR COOPER NUCLEAR STATION

1.0 Introduction

By letter dated June 28, 1982 the licensee requested exemptions from Section III.G of Appendix R within 7 plant fire areas and a general exemption from the requirements of Section III.G to the extent that it requires 3-hour fire rated boundaries for the separation of fire areas.

Section III.G.2 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 combustibles or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or
- c. Enclosure of cables 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 these conditions are not met, Section III.G.3 requires alternative shutdown capability independent of the fire area of concern. It also requires a fixed suppression system in the fire area of concern if it contains a large concentration of cables or other combustibles.

These alternative requirements are not deemed to be equivalent for all configurations, however, they provide equivalent protection for those configurations in which they are accepted.

Because it is not possible to predict the specific conditions under which fires may occur and propagate, the design basis protective features are specified in the rule rather than the design basis fire. Plant specific features may require protection different than 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 systems and associated circuits used to achieve and maintain safe shutdown are free of fire damage. Fire protection configurations must either meet the specific requirements of Section III.G or alternative fire protection configurations must be justified by a fire hazard analysis.

Our general criteria for accepting alternative fire protection configurations are the following:

- The alternative assures that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control stations is free of fire damage.

- . The alternative assures that fire damage to at least one train of equipment necessary to achieve cold shutdown is limited such that it can be repaired within a reasonable time (minor repairs with components stored on-site).
- . Fire retardant coatings are not used as fire barriers.
- . Modifications required to meet Section III.G would not enhance fire protection safety 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 Analytical Method

The licensee employed an analytical method to demonstrate the inherent protection afforded to existing safe shutdown systems. The intent of this method was to provide common parameters by which individual fire areas could be judged, to demonstrate that verbatim compliance with Section III.G of Appendix R would not enhance the fire protection for safe shutdown.

The method can be summarized as follows:

- the redundant cables and components of concern are identified.
- Their geometry and configuration within the fire area are described.
- The type of cable insulation and failure criteria are specified.
- The minimum quantity of flammable liquid needed to produce sufficient heat flux and heat energy to damage the cables is calculated, considering several heat transfer modes, i.e. radiation, plume impingement, and stratification.

The analysis determines the heat flux into the room needed to cause electrical failure of redundant cables. This heat flux is converted to a quantity of flammable liquid, usually acetone, of approximately 10 to 20 gallons, in a circular pool configuration.

We and our contractor Brookhaven National Laboratory have reviewed the analytical method. We have determined that the results of the methodology, as applied, do not demonstrate the equivalence of the protection provided for safe shutdown to the specific alternatives set forth in Section III.G of Appendix R. For example:

- . The method does not consider the heat released to the room by secondary fires involving in-situ combustibles. The method uses an electrical failure criteria with the thermal energy release to the room by a single exposure fire. When the cables of concern are at the conditions of electrical failure, other cables within the enclosure are burning and also releasing energy to the room.
- . The method does not consider the increased heat release rate of a given fire when it occurs against a wall or in a corner; the method only considers the heat release of a fire as it occurs in an open area.
- . The method does not consider the effects of excess pyrolyzate resulting from the degradation of plastics burning in the stratified layer.
- . The method does not consider all of the alternatives set forth in Section III.G. i.e., 3-hour fire barrier, 1-hour fire barrier with suppression system, twenty-foot separation free of combustibles with automatic suppression and alternate or dedicated shutdown capability independent of the area. The method only considers separation without automatic suppression and uses a stratification model which does not include the effects of separation.

The licensee has not used the results of this analysis to compare the protection provided with that specified in Section III.G. The licensee has only stated that the accumulation of the calculated quantity of flammable liquids in the required configuration is an unrealistic condition, and will be prevented by administrative controls. We do not deem this to be a valid argument because there is no positive means of preventing the accumulation of transient materials in individual plant areas. As documented in Inspection and Enforcement Branch Reports, recent inspections at plants such as Davis Besse (50-346/82-03, April 1, 1982), Duane Arnold (50-331/81-25, January 11, 1982), D.C. Cook (50-315/82-11, December 31, 1981), and Nine Mile Point (50-220/82-09), have demonstrated that substantial quantities of hazardous substances such as 55 gallon drums of waste oil are located in even highly restricted and controlled entry areas.

We have not relied upon the results of the licensee's analysis in our evaluation. We have evaluated each exemption request using our standard method of review:

- a) Review the information submitted and that existing in the docket file to determine the configuration of the redundant components,
- b) Evaluate the existing fire protection, proposed modifications, and other compensating features or mitigating factors to determine the overall level of fire protection in the area of concern, and
- c) Determine if the overall level of safety is equivalent to that provided by Section III.G of Appendix R.

This method has been used for all Appendix R reviews to date, because under the Appendix R philosophy, it is not considered possible to predict the severity of or probability of fire occurrence in individual areas.

3.0 Service Water Intake Structure

3.1 Discussion

The service water intake structure is separated from adjacent areas by 4-hour rated concrete walls, floors, and ceiling assemblies. The ceiling height is approximately 12.5 feet. The four service water pumps are located on a north-south orientation, with pump A and C being redundant to pumps B and D. The maximum horizontal separation of redundant pumps is approximately 16.5 feet. One of the four pumps is required for safe shutdown. The pump power cables are separated by greater than 20 feet, and are located approximately 10 feet above the floor level.

The combustible loading in the area consists of cables in conduit, a diesel driven fire pump, and approximately five gallons of lubricating oil in each pump.

A flame detection system is installed in the area. Portable fire extinguishers and manual fire hose stations are available in adjacent areas.

The licensee proposes to relocate the diesel driven fire pump outside of the service water intake structure and to extend automatic suppression and detection to cover all parts of the fire area.

3.2 Evaluation

In the service water intake structure, the licensee proposes to provide automatic suppression and detection, however the separation of redundant pumps is less than 20 feet as specified by Section III.G. The diesel driven fire pump will be removed from the area and all cables are in conduit. Therefore, the only significant in-situ combustible in the fire area is the pump motor lubricating oil. We agree with the licensee that the probability of ignition of the oil

is low because the lubricating oil has a high flashpoint (approximately 450°F) and that sufficiently hot surfaces do not exist in this fire area to cause the ignition of the lube oil.

The low probability of ignition of the lube oil in conjunction with the existing separation distance provides reasonable assurance that the proposed automatic detection and suppression systems will be activated before the redundant service water components are damaged.

3.3 Conclusion

Based on our evaluation, we conclude that with the proposed modifications, the level of safety provided in the service water intake structure area will be equivalent to the technical requirements of Section III.G of Appendix R and therefore, the licensee's request should be granted.

4.0 Control Building Basement

4.1 Discussion

The control building basement is an L-shaped space located at elevation 882 ft. 6 in. and is bounded by floors, walls, and ceiling assemblies consisting of four-hour fire rated concrete barriers. The ceiling height is approximately twenty feet. The redundant equipment in the fire area consists of the four service water booster pumps and associated cables as well as other redundant cables for the diesel generators. Redundant cables are separated by one foot in the north part of the room and by less than three feet in the southwest corner of the room. All cables are IEEE-383 qualified and routed in conduit. The in-situ fuel load consists of approximately ten gallons of lubricating oil.

Smoke detection, portable fire extinguishers, manual hose stations and manual foam suppression is available in the area.

The licensee bases the exemption request on the following:

- a) All cables are IEEE-383 qualified and routed in conduit.
- b) The in-situ combustibile loading is light
- c) Smoke detection is provided
- d) The area has not been altered since the 1977 FHA was approved
- e) An analytical model was employed to show that the magnitude of an exposure fire needed to damage redundant components is significantly higher than reasonably expected.

4.2 Evaluation

This area does not have an automatic suppression system or twenty feet of separation free of intervening combustibles. There is no alternate shutdown capability independent of this area.

Because of the close proximity of redundant safe shutdown cables that are not protected by an automatic suppression system, an exposure fire could damage both trains prior to the response of the fire brigade. There will be a time lag between the ignition of the fire, detector response, and the arrival of the fire brigade. The existing protection does not provide reasonable assurance that redundant cables of both trains will not be damaged in this time interval. Cables which are IEEE 383 qualified and routed in conduit will have resistance to flame spread, however an incident heat flux of sufficient magnitude will cause the thermal degradation and ultimate failure of the cable insulation and jacket.

The existing protection in this fire area does not provide a level of fire protection equivalent to Section III.G. Modifications such as the installation of an automatic sprinkler system or one-hour fire rated barriers would provide the requisite level of safety.

4.3 Conclusion

Based on our evaluation, the level of existing protection for the control building basement does not provide a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption should be denied.

5.0 Cable Spreading Room and Cable Expansion Room

5.1 Discussion

The cable spreading room is an L-shaped room of approximately 7100 square feet with a 13 foot ceiling. Boundary walls, floors, and ceiling assemblies are 4-hour rated concrete barriers. Both divisions of control and instrumentation cables for safety-related systems pass through the area. Redundant trains in some cases are separated by less than two feet. Where redundant trains are separated by less than five feet vertically, the top of the lower cable tray is fitted with a sheet metal cover and a ¼-inch asbestos board barrier is laid on the bottom of the upper cable tray. All power cables are routed in steel conduit. The combustible loading in the area is approximately 50,000 BTU's/ft².

Smoke detection, manual fire hose stations, manual CO₂ hose reels, and an automatic, preaction suppression system are provided in the area.

The cable expansion room is a rectangular room approximately 12 feet by 31 feet with a 13 foot ceiling. The cable expansion room boundaries are four-hour rated fire barriers. The cable expansion room is located between the cable spreading room and the reactor building. Both divisions of power, control and instrumentation cables pass through this fire area in horizontal, stacked cable trays and conduit

banks, from five feet above the floor to three feet below the ceiling. Cable trays are provided with steel covers and asbestos board liners, previously described. Several redundant trains are separated by less than two feet. This area is provided with portable extinguishers, manual hose stations, and an automatic wet pipe sprinkler system.

5.2 Evaluation

These areas are not in compliance with Section III.G. because the minimum separation distance free of intervening combustibles between redundant trains of cables is 2 feet, and there is no alternate shut-down capability independent of this room.

The compensatory features provided are the fire propagation retardants in the form of asbestos boards and metal tray covers on certain trays. Except for the above compensatory features, the configuration of the rooms, the quantity of in-situ combustibles, the type of cable insulation, the potential for the accumulation of combustible materials, and the installed fire protection systems are what is typically found in cable spreading rooms. Because most if not all safety and shutdown systems could be affected by a single fire in this area, the compensatory features do not provide equivalent protection to an alternate shut-down system independent of these areas.

5.3 Conclusion

Based on our evaluation the level of existing protection for the cable spreading room and cable expansion room does not provide a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R, and therefore, the exemption should be denied.

6.0 Auxiliary Relay Room

6.1 Discussion

This fire area is rectangular in shape, approximately 1050 square feet in area, with a 14-foot ceiling. Walls, floor and ceiling assemblies are 4-hour rated concrete barriers. This fire area contains redundant relay panels and cables for both hot and cold shutdown systems and redundant motor control centers. The separation between redundant relay panels is approximately five feet. The separation between redundant motor control centers is greater than 10 feet. Division II cable trays pass directly over the Division I relay panels approximately eleven feet above the floor. The combustible loading in the room consists primarily of cable insulation and is approximately 15,000 BTU's/ft².

The licensee states that inadvertent operation of an automatic suppression system could adversely affect electrical equipment in the area.

A smoke detection system is provided in the relay room. Portable fire extinguishers and manual hose stations are available in an adjacent corridor.

The licensee bases this exemption request on the following:

- a) All cables are equivalent to IEEE 383 qualified.
- b) The steel equipment cabinets also provide a level of fire retardancy.
- c) The licensee has evaluated the potential damaging effects of electrical faults within a cabinet and an exposure fire external to the cabinet by means of an analytical model.

6.2 Evaluation

The auxiliary relay room does not comply with Section III.G because it does not have twenty feet of separation between redundant trains

free of intervening combustibles, an automatic suppression system, or alternate shutdown capability.

The licensee's model shows that a fire within one cabinet does not have the potential to cause significant damage to redundant equipment in another cabinet prior to response of the area detection system and the response of the fire brigade.

In regard to exposure fires, the licensee's analysis demonstrates that a fire of only 100 seconds duration will cause disfiguration and discoloration of components such as switches mounted on the surfaces of electrical panels. Because an exposure fire from the accumulation of transi. combustibles could be of significantly longer duration than 100 seconds, the metal electrical cabinets do not provide protection equivalent to twenty feet of separation free of combustibles or a one-hour fire barrier in conjunction with automatic suppression or an alternate shutdown capability independent of the area.

6.3 Conclusion

Based on our evaluation the level of existing protection for the auxiliary relay room does not provide a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption should be denied.

7.0 Reactor Building, Northeast and Northwest Corner Rooms

7.1 Discussion

The fire area includes the northeast and northwest corners of the reactor building, outside primary containment. Boundary walls, floors, and ceiling assemblies are four-hour fire rated concrete barriers. The fire area has a ceiling height of 27 feet and a floor area of approx-

mately 7400 square feet. The redundant safe shutdown components in this area include control cables of two divisions, motor control centers and control rod drive hydraulic unit cables. In the northeast corner of the room, redundant trains of cable tray stacks and conduit banks are located approximately 20 feet above the floor and are separated by less than two feet. A partial automatic water suppression system is provided in this part of the fire area. The bottom cable tray in each stack is provided with a sheet metal cover and the tray above is provided with an asbestos liner, as in other plant areas.

In the Northwest part of the area, conduits of one division are routed within five feet vertically of the other division cable trays. Both divisions of motor control centers are within twenty feet of each other, and conduits of both divisions pass within two feet of each other. No automatic suppression is provided for this part of the fire area.

The licensee contends that the use of cables qualified to IEEE Std. 383, which are routed in conduit and/or covered metal cable trays will act to inhibit the propagation of fires and will allow time for detection and suppression to occur before both divisions of components are damaged.

The licensee proposes to install a "marinite-type fire impingement baffle" beneath the division I cable tray.

7.2 Evaluation

This area is provided with a detection system and partial automatic suppression system. It does not comply with the requirement for twenty feet of separation free of intervening combustibles and an automatic suppression system throughout the area or alternate shutdown capability independent of the area.

The features in this area which are offered as compensation for the lack of Section III.G protective features are the sheet metal covers and asbestos liners in cable trays and the proposed 'marinite-type fire impingement baffle'. Neither of these can be considered equivalent to a one-hour fire rated barrier, as they may only inhibit fire damage for several minutes. The fire area does not present any other features that would compensate for the lack of protective features specified by Section III.G or provide reasonable assurance that one train will be maintained free of fire damage.

7.3 Conclusion

Based on our evaluation, the existing protection for the reactor building Northeast and Northwest Corner Rooms does not provide a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption should be denied.

8.0 Control Room

8.1 Discussion

The control room is separated from all other areas of the plant by 3-hour fire rated barriers. Fire protection is provided by ionization smoke detectors with manual fire suppression provided by stand-pipe hose stations and portable fire extinguishers. The combustible loading in this area consists of wood, paper, plastic, and vinyl base-board. Cables and components of all redundant safe shutdown trains are located in the control room. Redundant divisions are in separate cabinets, but are separated by less than 20 feet free of intervening combustibles. This fire area is continuously manned by operating personnel, trained in fire fighting.

8.2 Evaluation

The protection for this area does not comply with Section III.G because there is neither (1) 20' feet horizontal separation free of combustibles between redundant systems or a one hour fire barrier, and an automatic suppression system nor (2) alternate shutdown capability independent of the area and a fixed suppression system.

Redundant circuits located in the same electrical panel can be damaged by fires either within the panel or in transient combustibles outside the panel. Redundant circuits located in physically separate panels can also be damaged by exposure fires outside the panels. By use of an analytical model, described in Section 2.0, the licensee has analyzed the damage to potential of a fire within a cabinet and an exposure fire external to electrical equipment in the metal control room cabinets. The licensee's analysis shows that a fire within one cabinet does not have the potential to cause significant damage to redundant equipment prior to response of the area detection system and the response of the fire brigade. The analysis also shows that an exposure fire of 100 seconds duration will cause discoloration and disfiguration of electrical components mounted in cabinets. The analysis does not provide assurance that a fire of longer duration would not damage both divisions.

Although the licensee has the capability to take local control of essential systems, the control room is not electrically isolated from the control stations; therefore, a fire in the control room or in the area of any emergency control station could affect both areas, thus resulting in the inability to safely shutdown the plant. Because the nature of the electrical panels in this area make protection in accordance with Section III.G.2 of Appendix R impractical, the licensee should provide an alternate shutdown system for the area in accordance with Section III.G.3 of Appendix R. The alternate shutdown system

should meet the requirements of Section III.L of Appendix R. The alternate shutdown capability should be electrically and physically isolated from the control room so that a fire in the control room or in the area of alternate shutdown capability which destroys redundant circuits will not affect the ability to safely shut down the plant from the other area. With the alternate shutdown capability installed, a suppression system is not required in the area.

8.3 Conclusion

Based on our evaluation, we find that the existing protection in this area does not provide a level of fire protection equivalent to the technical requirements of Section III.G, therefore, the exemption should be denied.

9.0 Fire Area Boundaries

9.1 Discussion

The boundaries of some fire areas are not 3-hour rated fire barriers. For example, in some cases penetrations of the barriers are completely open while in other areas, the penetration seals are rated at less than 3 hours. Specific types of these deviations are as follows:

- a) Fire doors of less than 3-hour rating
- b) Cable penetrations of less than 3-hour rating,
- c) Pipe chases without penetration seals between floors, and
- d) HVAC ducts without 3-hour rated fire dampers.

The licensee has not identified which fire barriers do not have a 3-hour rating, however, and has indicated that the justification for such deviations are provided in the licensee's 1977 fire hazards analysis (FHA).

The 1977 FHA was accepted as meeting our guidelines, and divisional boundaries of less than 3-hours were accepted on the basis of the combustible loading exposing the barrier. Subsequent to our acceptance of the licensee's FHA, a new fire protection rule, Appendix R to 10 CFR 50, was issued. The new rule requires that previously approved configurations of fire protection for safe shutdown capability be verified as providing a level of fire safety equivalent to Section III.G of Appendix R via the exemption process and justified by a fire hazards analysis for the specific alternative provided.

9.2

8.3 Evaluation

The licensee requests a general exemption from our requirements to provide a 3-hour rated barrier at the fire areas boundaries.

We have again reviewed the licensee's FHA to determine if it contains adequate justification that the fire protection provided for redundant safe shutdown equipment provides a level of safety equivalent to the technical requirements of Appendix R. When fire barriers of less than three hours fire endurance were previously found acceptable, the low in-situ combustible loading exposing the barrier was used as the basis for acceptance. The fire protection required by Appendix R includes protection from an exposure fire involving either in-situ or transient combustibles. The licensee's 1977 FHA does not consider the effects of exposure fires involving transient combustible materials. Therefore, it does not provide sufficient justification for the exemption.

The existing fire barriers, do not provide a level of fire protection equivalent to Section III.G of Appendix R, therefore, we do not have reasonable assurance that an exposure fire in these areas can be prevented from damaging redundant trains of cables and equipment needed for safe shutdown.

9.3 Conclusion

Based on our evaluation, the protection provided by the existing fire barriers does not provide a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption should be denied.

Summary

Based on our evaluation, the licensee's request for exemptions from Section III.G of Appendix R for the following area should be granted:

- Intake Structure

The licensee's request for exemptions from Section III.G of Appendix R for the following areas should be denied:

- Control building basement
- Cable spreading room and cable expansion room
- Auxiliary relay room
- Reactor building NE and NW corner rooms
- Control room
- 3-hour fire boundaries

Principal Contributor: R. Eberly