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November 23, 1987

Mr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Quad Cities Station Units 1 and 2
"Transmittal of Revised Appendix R
Exemption Request"
NRC Docket Nos. 50-254 and 50-265

Reference: Letter from I.M. Johnson to T.E. Murley
dated October 1, 1987.

Dear Mr. Murley:

In the above referenced letter, Commonwealth Edison provided your staff with an Appendix R exemption request. The exemption request pertains to the separation of redundant instrumentation.

We are now providing a revised exemption request which supercedes the one provided to you and your staff in our October 1, 1987 submittal. In the revised request we have deleted the exemption pertaining to the separation of redundant reactor pressure indication. This deletion is based on exemption requests for seperation of redundant equipment on the torus level.

In this exemption request, we revised a sentence on page 11.3-1 to read as follows: "In the event of a fire in the north half of the torus it cannot be assured that the emergency lighting would remain intact".

We also revised section 11.2.3.2 and 11.2.3.4 to eliminate the statement that penetrations in the south end of the reactor buildings will be sealed or curbed. This statement, which had been deleted from previous exemption requests (since transient combustibles will be controlled by administrative procedures), was inadvertently added to the exemption request.

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Please direct any questions you may have concerning this matter to this office.

Very truly yours,

I. M. Johnson
Nuclear Licensing Administrator

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Enclosures (1): Appendix R Exemption Request

cc: T. Ross - NRR
A.B. Davis - Region III Administrator
Quad Cities Resident Inspector

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TABLE OF CONTENTS

11.0 APPENDIX R EXEMPTION REQUEST FOR SEPARATION OF REDUNDANT INSTRUMENTATION

Per the provision of 10 CFR 50.12, Commonwealth Edison Company (CECo) requests exemption from the requirement of Section III.G.2 of Appendix R for separation of redundant reactor vessel level indicating instruments in the Unit 1 and Unit 2 reactor building, separation of redundant suppression pool level indicating instruments in the Unit 1 and Unit 2 reactor buildings, and lack of fixed emergency lighting for the suppression pool level instrumentation.

The justification for these exemptions are presented in the following sections:

Section	Justification For
11.1	Separation of redundant reactor vessel level indicating instrumentation.
11.2	Separation of redundant suppression pool level indicating instrumentation.
11.3	Lack of emergency lighting for suppression pool level instrumentation.

11.1 JUSTIFICATION FOR SEPARATION OF REDUNDANT REACTOR VESSEL LEVEL INDICATING INSTRUMENTATION

11.1.1 UNIT 1

11.1.1.1 Introduction

Fire Area RB-1 contains cables for the redundant control room reactor level instrumentation (LI1-263-101, 100A&B, 106A&B; LR1-263-113, LR1-240-26). In the event of a fire in Fire Area RB-1, local instrumentation in the Unit 1 reactor building (Fire Area RB-1) would be used to monitor reactor vessel level. These locally monitored mechanical instruments are located at instrument racks 2201-5 and 2201-6 on the mezzanine floor (Fire Zone 1.1.1.3), racks 2201-7 and 2201-8 on the ground floor (Fire Zone 1.1.1.2), and on rack 2201-58 in the RCIC room (Fire Zone 11.2.3) on the torus level.

The requirements of Appendix R stipulate that more than 20 feet of horizontal space free of intervening combustibles should exist between redundant equipment and, in addition, detection and suppression should be installed throughout the area. The subsequent analysis provides justification for an exemption to this requirement for the local reactor water level instrumentation in Fire Zones 1.1.1.2, 1.1.1.3, and 11.2.3. The basis of the justification is that a fire in Fire Zones 11.2.3, 1.1.1.2 or 1.1.1.3 would not prevent operators from locally monitoring the reactor vessel level.

11.1.1.2 Fire Protection System

Fire Zones 11.2.3, 1.1.1.2, and 1.1.1.3 are provided with complete fire detection with the exception of the regenerative and nonregenerative heat exchanger room, cleanup recirculation pump rooms, and cleanup decant pump phase separator pump room in

Fire Zone 1.1.1.3. Manual hose stations and portable fire extinguishers are located throughout Fire Zones 1.1.1.2 and 1.1.1.3 and just outside the entrance to Fire Zone 11.2.3.

Motor control centers 18-1A, 18-1B, 18-3, 19-1, 19-1-1, 19-4, 19-6 and 18/19-5 are located in Fire Zones 1.1.1.3 and 1.1.1.2 (Fire Zone 1.1.1.2 is the elevation between Fire Zone 1.1.1.3 and 11.2.3). An inadvertent actuation of any fixed fire suppression system could result in failure of this equipment. Also, installation of any other type of suppression such as cardox, halon or foam would be ineffective or inappropriate in these areas because of the large volume and open stairways.

11.1.1.3 Fire Hazards Analysis

11.1.1.3.1 Fire Zone 1.1.1.2

This fire zone is the ground floor of the reactor building located above Fire Zone 11.2.3 and below Fire Zone 1.1.1.3. Instrument racks 2201-7 and 2201-8 are located in this zone. Instrument rack 2201-7 is located north of the drywell while instrument rack 2201-8 is located south of the drywell. In addition, instrument sensing lines to rack 2201-58 (Fire Zone 11.2.3, which are also associated with instruments on racks 2201-5 and 2201-6 (Fire Zone 1.1.1.3), are routed through Fire Zone 1.1.1.2.

The combustibles in Fire Zone 1.1.1.2 consist mostly of 151,600 feet of cable. This zone is the ground floor of the reactor building. It is frequently traveled and occasionally used as a staging area. Transient combustibles in the fire zone include RWP clothing and limited lubricating and cleaning fluids. These transient combustibles are controlled to minimal quantities by station administrative procedures. Lubricating and cleaning fluids are only used in approved containers. The combustible

loading in the fire zone is less than 30,000 Btu/ft^2.

The worst case postulated fire could involve the transients and cable insulation material. Any fire on this elevation would not expose the safe shutdown cables or equipment in Fire Zone 11.2.3 since the heat and products of combustion of the buoyant fire plume will use the ceiling and floors away from the torus level. All electrical penetrations are sealed in the floor and ceiling with a noncombustible material.

Available test data found in the FMRC/EPRI test reports, "Categorization of Cable Flammability" NP-1881, August 1982, provide information describing the burning characteristics of PE/PVC cable in horizontal cable trays.

The heat of combustion of PE/PVC is less than 11,000 Btu/lb. The EPRI tests show that flame spread along horizontal cable trays is very slow. The test reports for horizontal fire spread in deep stacks of horizontal cable trays agree with observations of the rate of fire spread in similar tray arrays in the reactor building at the Browns Ferry fire. The horizontal spread rate for cable tray fires is about 6 to 7 ft/hr.

Although the cable tray arrangement in Fire Zone 1.1.1.2 is far less severe than that tested in the EPRI report, the parameters from those tests can be used to show a conservative fire scenario. These parameters would indicate that only about 21 feet of cable would be consumed in a 3-hour fire. The heat would be dissipated into an extremely large room volume. Heat would also be lost to the surrounding enclosure and floor above. Convective and radiative heat transfer effects from such a fire would obviously not affect cables in Fire Zone 11.2.3 below.

Access to the instruments on the mezzanine level would be gained through the ground floor. This can be done either via the north stairwell or the south stairwell. The emergency lights lighting

these access paths are greater than 100 feet apart and thus both sets of lights would not be destroyed in a fire since the fire would not spread between the two halves of the floor as discussed in the paragraph above.

Fire detection throughout Fire Zone 1.1.1.2 will provide early warning of fire conditions in the zone. This will provide ample time for manual firefighting operations to control fire spread in the trays to much less than postulated above. Manual firefighting equipment is available in the fire zone to allow the brigade to perform this function.

Instrument racks 2201-7 and 2201-8 and their associated sensing lines are located in Fire Zone 1.1.1.2 in diametrically opposed positions on either side of the drywell. A single fire would have to travel more than 60 feet around the drywell in order to effect both sets of reactor water level instruments and sensing lines associated with the racks. Due to the large separation distance, it is not credible to postulate that both instrument racks 2201-7 and 2201-8 will be affected by a single fire, even though the intervening space is not completely devoid of combustible material. Therefore, for any credible fire in Fire Zone 1.1.1.2, reactor water level local indication instrumentation will be available on one of the two instrument racks (2201-7 and 2201-8) located in Fire Zone 1.1.1.2. It should also be noted that a fire in Fire Zone 1.1.1.1.N could potentially have the same effect on level instrumentation as a fire in the north end of Fire Zone 1.1.1.2.

11.1.1.3.2 Fire Zone 1.1.1.3

This fire zone is the mezzanine floor of the reactor building. Instrument racks 2201-5 and 2201-6 are located in this zone. Instrument rack 2201-6 is located east of the drywell while instrument rack 2201-5 is located north of the drywell. These

racks are more than 40 feet apart. In addition, reactor water level instrument sensing lines to racks 2201-7, 2201-8, and 2201-58 are routed in this zone. Redundant trains of the sensing lines are more than 30 feet apart.

The combustibles in Fire Zone 1.1.1.3 consist mostly of 75,700 feet of cable. This fire zone is normally not heavily traveled during operation. Transient combustibles are controlled to minimal quantities by station administrative procedures. The combustible loading in the fire zone is less than 20,000 Btu/ft^2.

Fire detection is provided throughout the fire zone with the exception of the regenerative and nonregenerative heat exchanger room and the cleanup decant pump phase separator pump room. This detection system will provide early warning of fire conditions which will allow the fire brigade ample time for manual suppression operations using available firefighting equipment in the fire zone.

Any fire on this elevation would not expose the safe shutdown equipment or cables in Fire Zones 1.1.1.2 or 11.2.3 since the heat and products of combustion of the buoyant fire plume will be carried to the levels above Fire Zone 1.1.1.3. Water level instrument sensing lines to the instrument racks located in Fire Zones 1.1.1.2 and 11.2.3 are routed in Fire Zone 1.1.1.3. However, due to the low fire loading in Fire Zone 1.1.1.3, the fact that the sensing lines are located below the significant hazard in the zone, i.e., cable in cable tray, and the distance of over 30 feet between redundant trains of sensing lines, it is not credible to postulate that both sets of redundant sensing lines will be damaged by a single fire in Fire Zone 1.1.1.3, even though the intervening space is not completely devoid of combustible material. Therefore, for any credible fire in Fire Zone 1.1.1.3, reactor water level local indication instrumentation will be available at a minimum on one of the two racks 2201-7 and 2201-8 located in Fire Zone 1.1.1.2.

11.1.1.4 Conclusions

The previous analysis justifies an exemption request from the requirements of total area suppression and more than 20 feet of horizontal intervening space free from combustibles between the redundant instruments. The technical bases that justify the exemption request are summarized below.

1. The 5 different local indication instrument racks and associated sensing lines are diversely located on three floors of the reactor building with large separation distances between redundant components, ensuring that at least one train of reactor water level instruments will be free of fire damage.

2. Because the instruments are mechanically operated, there is no electrical cabling whose failure could affect operation of the instruments.

3. Emergency lights are available at these instruments. The lighting in Fire Zones 1.1.1.2 and 1.1.1.3 would not be affected by a fire for the same reason the instruments in the zones would not be simultaneously affected by a fire.

11.1.2 UNIT 2

11.1.2.1 Introduction

Fire Area RB-2 contains cables for the redundant control room reactor level instrumentation (LI2-263-101, 100A&B, 106A&B; LR2-263-113, LR2-240-26). In the event of a fire in Fire Area RB-2, local instrumentation in the Unit 2 reactor building (Fire Area RB-2) would be used to monitor reactor vessel level. These locally monitored mechanical instruments are located at instrument racks 2202-5 and 2202-6 on the mezzanine floor (Fire Zone 1.1.2.3), racks 2202-7 and 2202-8 on the ground floor (Fire Zone 1.1.2.2), and rack 2202-58 in the RCIC room (Fire Zone 11.3.1) on the torus level.

The requirements of Appendix R stipulate that more than 20 feet of horizontal space free of intervening combustibles should exist between redundant equipment and, in addition, detection and suppression should be installed throughout the area. The subsequent analysis provides justification for an exemption to this requirement for the local reactor water level instrumentation in Fire Zones 1.1.2.2, 1.1.2.3 and 11.3.1. The basis of the justification is that a fire in Fire Zones 11.3.1, 1.1.2.2, or 1.1.2.3 would not prevent operators from locally monitoring the reactor vessel level.

11.1.2.2 Fire Protection System

Fire Zones 11.3.1, 1.1.2.2, and 1.1.2.3 are provided with complete fire detection with the exception of the regenerative and nonregenerative heat exchanger room, cleanup recirculation pump rooms, and cleanup decant pump phase separator pump room in Fire Zone 1.1.2.3. Manual hose stations and portable fire extinguishers are located throughout Fire Zones 1.1.2.2 and 1.1.2.3 and just outside the entrance to Fire Zone 11.3.1.

Motor control centers 28-1A, 28-1B, 28-3, 29-1, 29-1-1, 29-4, 29-6 and 28/29-5 are located in Fire Zones 1.1.2.3 and 1.1.2.2 (Fire Zone 1.1.2.2 is the elevation between Fire Zone 1.1.2.3 and 11.3.1). An inadvertent actuation of any fixed fire suppression system could result in failure of this equipment. Also, installation of any other type of suppression such as cardox, halon or foam would be ineffective or inappropriate in these areas because of the large volume and open stairways.

11.1.2.3 Fire Hazards Analysis

11.1.2.3.1 Fire Zone 1.1.2.2

This fire zone is the ground floor of the reactor building location above Fire Zone 11.3.1 and below Fire Zone 1.1.2.3. Instrument racks 2202-7 and 2202-8 are located in this zone. Instrument rack 2202-7 is located north of the drywell while instrument rack 2202-8 is located south of the drywell. In addition, instrument sensing lines to rack 2202-58 (Fire Zone 11.3.1), which are also associated with instruments on racks 2202-5 and 2202-6 (Fire Zone 1.1.2.3), are routed through Fire Zone 1.1.2.2.

The combustibles in Fire Zone 1.1.2.2 consist mostly of 126,200 feet of cable. This zone is the ground floor of the reactor building. It is frequently traveled and occasionally used as a staging area. Transient combustibles in the fire zone include RWP clothing and limited lubricating and cleaning fluids. These transient combustibles are controlled to minimal quantities by station administrative procedures. Lubricating and cleaning fluids are only used in approved containers. The combustible loading in the fire zone is less than 20,000 Btu/ft^2.

The worst case postulated fire could involve the transients and cable insulation material. Any fire on this elevation would not

expose the safe shutdown cables or equipment in Fire Zone 11.3.1 since the heat and products of combustion of the buoyant fire plume will use the ceiling and floors away from the torus level. All electrical penetrations are sealed in the floor and ceiling with a noncombustible material.

Available test data found in the FMRC/EPRI test reports, "Categorization of Cable Flammability" NP-1881, August 1982, provide information describing the burning characteristics of PE/PVC cable in horizontal cable trays.

The heat of combustion of PE/PVC is less than 11,000 Btu/lb. The EPRI tests show that flame spread along horizontal cable trays is very slow. The test reports for horizontal fire spread in deep stacks of horizontal cable trays agree with observations of the rate of fire spread in similar tray arrays in the reactor building at the Browns Ferry fire. The horizontal spread rate for cable tray fires is about 6 to 7 ft/hr.

Although the cable tray arrangement in Fire Zone 1.1.2.2 is far less severe than that tested in the EPRI report, the parameters from those tests can be used to show a conservative fire scenario. These parameters would indicate that only about 21 feet of cable would be consumed in a 3-hour fire. The heat would be dissipated into an extremely large room volume. Heat would also be lost to the surrounding enclosure and floor above. Convective and radiative heat transfer effects from such a fire would obviously not affect cables in Fire Zone 11.3.1 below.

Access to the instruments on the mezzanine level would be gained through the ground floor. This can be done either via the north stairwell or access can be gained from Unit 1. The emergency lights lighting these access paths are greater than 100 feet apart and thus both sets of lights would not be destroyed in a fire since the fire would not spread between the two halves of the floor as discussed in the paragraph above.

Fire detection throughout Fire Zone 1.1.2.2 will provide early warning of fire conditions in the zone. This will provide ample time for manual firefighting operations to control fire spread in the trays to much less than postulated above. Manual firefighting equipment is available in the fire zone to allow the brigade to perform this function.

Instrument racks 2202-7 and 2202-8 and their associated sensing lines are located in Fire Zone 1.1.2.2 in diametrically opposed positions on either side of the drywell, north and south of the drywell, respectively . One sensing line for the local reactor water level indication on rack 2202-7 is routed from near rack 2202-8 around the eastern boundary of the drywell to rack 2202-7. In addition, two redundant pair of reactor water level sensing lines to rack 2202-58 (Fire Zone 11.3.1) are routed through the southern portion of Fire Zone 1.1.2.2. These latter two lines are also associated with two local reactor water level indicators instrumentation on racks 2202-5 and 2202-6 (Fire Zone 1.1.2.3). Where any two of three level indicators (two on rack 2202-58, one on rack 2202-7) have sensing lines routed together, the third remaining level indicator has sensing lines separated from them by at least 30 feet. Given this separation, it is not credible to postulate that the reactor water level instrumentation at racks 2202-58 and 2202-7 will be affected by a single fire in Fire Zone 1.1.2.2, even though the intervening spaces are not completely devoid of combustible material. It should also be noted that a fire in Fire Zone 1.1.2.1.N could potentially have the same effect on level instrumentation as a fire in the north end of Fire Zone 1.1.2.2.

11.1.2.3.2 Fire Zone 1.1.2.3

This fire zone is the mezzanine floor of the reactor building. Instrument racks 2202-5 and 2202-6 are located in this zone. Instrument rack 2202-6 is located east of the drywell while

instrument rack 2202-5 is located south of the drywell. These racks are more than 30 feet apart. In addition, reactor water level instrument sensing lines to racks 2202-7, 2202-8, and 2202-58 are routed in this zone. Redundant trains of the sensing lines are more than 30 feet apart.

The combustibles in Fire Zone 1.1.2.3 consist mostly of 76,100 feet of cable. This fire zone is normally not heavily traveled during operation. Transient combustibles are controlled to minimal quantities by station administrative procedures. The combustible loading in the fire zone is less than 20,000 Btu/ft^2.

Fire detection is provided throughout the fire zone with the exception of the regenerative and nonregenerative heat exchanger room and the cleanup decant pump phase separator pump room. This detection system will provide early warning of fire conditions which will allow the fire brigade ample time for manual suppression operations using available firefighting equipment in the fire zone.

Any fire on this elevation would not expose the safe shutdown equipment or cables in Fire Zones 1.1.2.2 or 11.3.1 since the heat and products of combustion of the buoyant fire plume will be carried to the levels above Fire Zone 1.1.2.3. Water level instrument sensing lines to the instrument racks located in Fire Zones 1.1.2.2 and 11.3.1 are routed in Fire Zone 1.1.2.3. However, due to the low fire loading in Fire Zone 1.1.2.3, the fact that the sensing lines are located below the significant hazard in the zone, i.e., cable in cable tray, and the distance of over 30 feet between redundant trains of sensing lines, it is not credible to postulate that both sets of redundant sensing lines will be damaged by a single fire in Fire Zone 1.1.2.3, even though the intervening space is not completely devoid of combustible material. Therefore, for any credible fire in Fire Zone 1.1.2.3, reactor water level local indication instrumentation will be available at a minimum on instrument

rack 2202-58 in Fire Zone 11.3.1.

11.1.2.4 Conclusions

The previous analysis justifies an exemption request from the requirements of total area suppression and more than 20 feet of horizontal intervening space free from combustibles between the redundant instruments. The technical bases that justify the exemption request are summarized below.

1. The five different local indication instrument racks and associated sensing lines are diversely located on three floors of the reactor building with large separation distances between redundant components, ensuring that at least one train of reactor water level instruments will be free of fire damage.

2. Because the instruments are mechanically operated, there is no electrical cabling whose failure could affect operation of the instruments.

3. Emergency lights are available at these instruments. This lighting in Fire Zones 1.1.2.2 and 1.1.2.3 would not be affected by a fire for the same reason the instruments in the zones would not be simultaneously affected by a fire.

11.2 JUSTIFICATION FOR SEPARATION OF REDUNDANT SUPPRESSION POOL LEVEL INDICATORS

11.2.1 Introduction

Fire Areas RB-1 and RB-2 in the Unit 1 and Unit 2 reactor buildings contain the suppression pool level sight glass 1(2)-1602-10 and level transmitters 1(2)-1626, 1(2)-1641-5A and 1(2)-1641-5B along with the cables that provide power and connect these transmitters to control room level indicators 1(2)-1602-3, 1(2)-1640-10A and 1(2)-1640-10B. One of these indicators must be available to provide suppression pool level indication. The requirements of Appendix R stipulate that more than 20 feet of horizontal space free of intervening combustibles should exist between redundant equipment and, in addition, detection and suppression should be installed throughout the area. Since the power for the transmitters is from the MCC's located on the mezzanine floor, the sight glass would have to be used to monitor suppression pool level for a fire in the northern half of the torus level and all levels above.

The subsequent analysis provides justification for an using the level sight glass in the event of a fire in the northern half of the torus level. The basis of the justification is that a fire in the north end of Fire Zone 1.1.1.1(1.1.2.1) would not prevent operators from monitoring the suppression pool level.

11.2.2 Fire Protection System

Fire Zones 1.1.1.1 and 1.1.2.1 are protected by detection and suppression systems. Linear thermal detectors have been installed in each cable tray and below the bottom trays in these fire zones. As added protection, portions of the Division I and II trays, where they are routed within 20 feet of each other, are wrapped with a 1-hour rated fire resistive material. An automatic sprinkler system has been installed at the south wall

of these fire zones in the immediate vicinity of the cable risers that pass through the ceiling. The rest of the zone is protected by manual suppression, consisting of portable CO_2 extinguishers and hose stations.

Fire Zones 1.1.1.2 and 1.1.2.2 are also protected by detection and suppression systems. Smoke detectors have been installed throughout these fire zones and ionization detectors are installed above the drywell/torus WP compressors, 480V MCC's 18/19-5 and 28/29-5, and the ACAD air compressors. Manual suppression is provided in the fire zones, consisting of portable CO_2 extinguishers and hose stations.

11.2.3 Fire Hazards Analysis

11.2.3.1 Fire Zone 1.1.1.1

This fire zone is the Unit 1 torus level area of the reactor building. Level sight glass 1-1602-10 is located in this fire zone on the north side of the torus.

The combustibles in Fire Zone 1.1.1.1 consist mostly of 41,515 feet of cable. Transient combustibles and ignition sources in the torus are strictly controlled and cannot be practically introduced due to access limitations. The average combustible loading is less than 8000 Btu/ft^2.

The ceiling of Fire Zone 1.1.1.1 is constructed of minimum 2-foot 0-inch thick concrete with all electrical penetrations sealed with noncombustible material.

The linear fire detectors located in and adjacent to the cable trays will provide early warning of a fire. This will allow the fire brigade ample time for manual suppression operations using available firefighting equipment in this fire zone. The suppression pool level needs to be checked when torus water cooling is initiated. This occurs, at the latest, 3 hours into

the event, at which time the fire will have been been extinguished and the operators will have access to the sight glass.

11.2.3.2 Fire Zone 1.1.1.2

This fire zone is the ground floor level of the reactor building.

The combustibles in Fire Zone 1.1.1.2 consist mostly of 151,600 feet of cable. This zone is the ground floor of the reactor building. It is frequently traveled and occasionally used as a staging area. Transient combustibles in the fire zone include RWP clothing and limited lubricating and cleaning fluids. These transient combustibles are controlled to minimal quantities by station administrative procedures. Lubricating and cleaning fluids are only used in approved containers. The combustible loading in the fire zone is less than 30,000 Btu/ft^2.

The worst case postulated fire could involve the transients and cable insulation material. Any fire on this elevation would not expose the safe shutdown cables or equipment in the south half of the torus below since heat and products of combustion of the buoyant fire plume will use the ceiling and floors away from the torus. All electrical penetrations are sealed in the floor and ceiling with a noncombustible material.

Available test data found in the FMRC/EPRI test reports, "Categorization of Cable Flammability" NP-1881, August 1982, provide information describing the burning characteristics of PE/PVC cable in horizontal cable trays.

The heat of combustion of PE/PVC is less than 11,000 Btu/lb. The EPRI tests show that flame spread along horizontal cable trays is very slow. The test reports for horizontal fire spread in deep stacks of horizontal cable trays agree with observations of the

rate of fire spread in similar tray arrays in the reactor building at the Browns Ferry fire. The horizontal spread rate for cable tray fires is about 6 to 7 ft/hr.

Although the cable tray arrangement in Fire Zone 1.1.1.2 is far less severe than that tested in the EPRI report, the parameters from those tests can be used to show a conservative fire scenario. These parameters would indicate that only about 21 feet of cable would be consumed in a 3-hour fire. The heat would be dissipated into an extremely large room volume. Heat would also be lost to the surrounding enclosure and floor above. Convective and radiative heat transfer effects from such a fire would obviously not affect cables in Fire Zone 1.1.1.1 below. Thus, the operators will have access to level sight glass 2-1602-10.

Fire detection throughout Fire Zone 1.1.1.2 will provide early warning of fire conditions in the zone. This will provide ample time for manual firefighting operations to control fire spread in the trays to much less than postulated above. Manual firefighting equipment is available in the fire zone to allow the brigade to perform this function.

11.2.3.3 Fire Zone 1.1.2.1

This fire zone is the Unit 2 torus level area of the reactor building. Level sight glass 2-1602-10 is located in this fire zone on the north side of the torus.

The combustibles in Fire Zone 1.1.2.1 consist mostly of 22,456 feet of cable. Transient combustibles and ignition sources in the torus are strictly controlled and cannot be practically introduced due to access limitations. The average combustible loading in the fire zone is less than 5000 Btu/ft^2.

The ceiling of Fire Zone 1.1.2.1 is constructed of minimum 2-foot 0-inch thick concrete with all electrical penetrations sealed with noncombustible materials.

The linear fire detectors located in and adjacent to the cable trays will provide early warning of a fire. This will allow the fire brigade ample time for manual suppression operations using available firefighting equipment in this fire zone. The suppression pool level needs to be checked when torus water cooling was initiated. This occurs, at the latest, 3 hours into the event, at which time the fire will have been extinguished and the operators will have access to the sight glass.

11.2.3.4 Fire Zone 1.1.2.2

This fire zone is the ground floor level of the Unit 2 reactor building.

The combustibles in Fire Zone 1.1.2.2 consist mostly of ~26,200 feet of cable. This fire zone is the ground floor of the reactor building. It is frequently traveled and occasionally used as a staging area. Transient combustibles in the fire zone include anticontamination clothing and limited lubricating and cleaning fluids. These transient combustibles are controlled to minimal quantities by station administrative procedures. Lubricating and cleaning fluids are only used in approved containers. The average combustible loading in the fire zone is less than 25,000 Btu/ft^2.

The worst case postulated fire could involve the transients and cable insulation material. Any fire on this elevation would not expose the safe shutdown cables or equipment in the southern half of the torus below since heat and products of combustion of the buoyant fire plume will rise to the ceiling and away from the torus. All electrical penetrations are sealed in the floor and ceiling with a noncombustible material.

Available test data found in the FMRC/EPRI test reports, "Categorization of Cable Flammability" NP-1881, August 1982, provide information describing the burning characteristics of PE/PVC cable in horizontal cable trays.

The heat of combustion of PE/PVC is less than 11,000 Btu/lb. The EPRI tests show that flame spread along horizontal cable trays is very slow. The test reports for horizontal fire spread in deep stacks of horizontal cable trays agree with observations of the rate of fire spread in similar tray arrays in the reactor building at the Browns Ferry fire. The horizontal spread rate for cable tray fires is about 6 to 7 ft/hr.

Although the cable tray arrangement in Fire Zone 1.1.2.2 is far less severe than that tested in the EPRI report, the parameters from those tests can be used to show a conservative fire scenario. These parameters would indicate that only about 21 feet of cable would be consumed in a 3-hour fire. The heat would be dissipated into an extremely large room volume. Heat would also be lost to the surrounding enclosure and floors above. Convective and radiative heat transfer effect from such a fire would not affect cables in Fire Zone 1.1.2.1 below. Thus, the operators will have access to level sight glass 2-1602-10.

Fire detection throughout Fire Zone 1.1.2.2 will provide early warning of fire conditions in the fire zone. This will provide ample time for manual firefighting operations to control fire spread in the trays to much less than that postulated above. Manual firefighting equipment is available in the fire zone to allow the brigade to perform this function.

11.2.4 Conclusions

The previous analysis justifies an exemption request from the requirements of total area suppression and more than 20 feet of horizontal intervening space free from combustibles between the redundant instruments. The technical bases that justify the exemption request are summarized below.

1. The level sight glass on the torus level would not be damaged by a fire in the torus level due to the low combustible loading in the area of the sight glass.

2. Torus level monitoring is not required until 3 hours into the event when RHR torus cooling is initiated. At this time the fire will have been extinguished and the operators will have access to the sight glass.

3. Hand-held flashlights will be utilized to illuminate the sight glass when it is being read.

11.3 JUSTIFICATION FOR LACK OF EMERGENCY LIGHTING FOR SUPPRESSION POOL LEVEL INSTRUMENTATION

11.3.1 Discussion

As described in Section 11.2, for a fire in the northern portions of Fire Zones 1.1.1.1 (Unit 1 Torus Area) and 1.1.2.1 (Unit 2 Torus Area) and all Reactor Building floor levels above the torus level, suppression pool level will be determined by locally reading sight glasses LG1-1602-10 for Unit 1 and LG2-1602-10 for Unit 2. Section III.J of Appendix R would require that battery-powered emergency lighting be available to illuminate the sight glasses in the torus area when they are utilized as safe shutdown instrumentation. In the event of a fire in the north half of the torus it cannot be assured that the emergency lighting would remain in tact. Therefore an exemption to the requirement is required for the particular instance of the suppression pool sight glasses.

The two sight glasses (one per unit) are located on top of their respective torus structures. Operators will utilize portable, handheld light sources to illuminate the sight glasses when their use is required. Such light sources can be obtained by the operators in the control room and the Appendix R Safe Shutdown Procedures call for them to be issued to operators when they are required to leave the control room to perform manual safe shutdown activities. The portable light sources provide sufficient lighting levels to easily read the sight glasses.

11.3.2 Conclusion

As described in the proceeding discussion, lack of fixed emergency lighting in the torus areas for illumination of the suppression pool level sight glasses will not interfere with timely performance of safe shutdown activities. The bases for exemption from the requirement for fixed emergency lighting in this instance are summarized as follows:

1. Portable, handheld light sources will provide sufficient illumination of the sight glasses for them to be easily read.