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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Quad Cities Nuclear Power Station, Units 1 and 2
Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: NRC Request for Additional Information

Reference:
(1) S. N. Bailey letter to O. D. Kingsley dated April 17, 2001, "Quad Cities - Request for Additional Information (TAC NOS. MA9157, MA9158, MA9685, MA9686, MB0486, and MB0487)"
(2) J. P. Dimmette letter to USNRC dated June 2, 2000, "Title 10 CFR 50, Appendix R Exemptions"
(3) J. P. Dimmette letter to USNRC dated August 3, 2000, "Title 10 CFR 50, Appendix R Exemptions"
(4) J. P. Dimmette letter to USNRC dated November 1, 2000, "Title 10 CFR 50, Appendix R Exemptions"

The purpose of this letter is to respond to the Request for Additional Information (RAI) provided in Reference (1). The RAI pertains to Exelon's application to withdraw certain exemptions to 10 CFR 50, Appendix R (References (2), (3) and (4)). The attachment to this letter provides our response to the subject RAI.

A006

bcc: Project Manager – NRR
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SVP Letter File

Should you have any questions concerning this letter, please contact Mr. W. J. Beck at (309) 654-2241, extension 2800.

Respectfully,

Timothy J. Tulon
Site Vice President
Quad Cities Nuclear Power Station

Attachment: Response to Request for Additional Information

Enclosure: Fire Protection Engineering Evaluation Q-ECDS-00-165

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

ATTACHMENT
Response to Request for Additional Information

1. *For the withdrawal request for the exemption titled, "Justification for Removal of Control Power to Defeat High Impedance Faults (Quad Cities Fire Protection Report, Volume 4, Section 9.1)," in the letter dated June 2, 2000, provide a copy of the procedure for accomplishing the removal of the switches. Provide separately, if not included in the procedure, a list of any tools that are required to remove these switches, a description of the process to remove the switches, and a description of any special training required to remove the switches.*

<u>RESPONSE</u>

Station procedures direct the removal of the control power disconnect switches during a fire event. Specifically, the Quad Cities Appendix R Procedures (QCARPs) direct this activity as necessary. A typical procedure step is as follows (taken from QCARP 0050-02):

> Bus 24-1, **remove** NR CLOSE fuses only and **verify open:**
>
> a. Cubicle 1, Diesel Generator 2 Feed to Bus 24-1.
> b. Cubicle 10, Bus 24-1 and Bus 14-1 Tie Breaker.
> c. Cubicle 4, Bus 24 to Bus 24-1 Feed Breaker.

No special tools are required to perform this action. The device used at Quad Cities to isolate control power is referred to as a pullout switch or load-break switch. These devices are generally located in the relay panel directly above the affected breaker. Although the switches do contain fuses, the fuses are housed within the device and are not directly accessed during the removal process. The switches are clearly designed for manual electrical isolation, and are easily removed, readily identified, and require no special tools for removal. Personal protective gear, high voltage gauntlets, nomex apron and a face shield are provided to the operator for this operation. These items are located in cabinets located near the switchgear where the activity occurs. This protective equipment is used during normal breaker operation. Operators receive training on the manipulations of these devices and use of the personal protective equipment.

2. *For the withdrawal request for the exemption titled, "Exemption to Appendix R, Section III.G.3, For Suppression in the Vicinity of Electrical Equipment (Quad Cities Fire Protection Report Volume 4, Section 1.0)," in the letter dated June 2, 2000:*

   a) *Has the re-validated program considered Generic Letter (GL) 86-10 since GL 86-10 supercedes GL 83-33, where applicable?*

RESPONSE

The recent upgrades to the Appendix R program, including the Appendix R Optimization Project completed in November 2000, have been implemented consistent with the GL 86-10 guidelines. Historically, the Appendix R program re-validation refers to upgrades performed in the mid-1980's at Quad Cities Nuclear Power Station. The impetus for these upgrades was the issuance of GL 83-33, which clarified certain safe shutdown requirements. The guidance contained in GL 83-33 prompted a comprehensive review of the plant's safe shutdown capabilities. The NRC issued additional Appendix R implementing guidance several years later in GL 86-10. The re-validation effort (which spanned approximately five years) adopted the GL 86-10 guidance once issued. The NRC approved the Appendix R upgrades resulting from the re-validation effort in Safety Evaluation Report (SER) dated April 20, 1988.

b) *It is stated in the Basis for Exemption Withdrawal section that this exemption was superseded by exemption requests resulting from the re-validation efforts. Provide: 1) a reference to the exemption which resulted from the re-validation efforts, and 2) a discussion of how the re-validation exemption supersedes the June 23, 1983, exemption on this issue.*

RESPONSE

1) The exemption requests related to Appendix R, Section III.G.3 were submitted in Exelon letter to USNRC dated June 25, 1986. These exemptions were approved by the NRC in a SER dated July 21, 1988. The submittal included exemptions related to detection and suppression in both the reactor and turbine building fire areas and encompassed the "historical" exemptions approved by the NRC in SER dated June 23, 1983.

2) GL 83-33 clarified certain Appendix R requirements. The guidance provided in GL 83-33 prompted a comprehensive review of our Appendix R program to ensure adequate safe-shutdown capabilities existed. The re-validation effort included development of a revised safe shutdown analysis and, as necessary, exemptions to Appendix R Sections III.G.1, III.G.2 and III.G.3. These exemptions encompass the historical exemptions approved by the NRC in July 1983.

3. *For the withdrawal request for the exemption titled, "Exemption to Appendix R, Section III.G.2, for Three Hour Fire Barriers in Fire Zone 1.1.1.1 of Unit 1 and 1.1.2.1 of Unit 2 (Quad Cities Fire Protection Report, Volume 4, Section 1.0)," in the letter dated June 2, 2000:*

a) *Has the re-validated program considered GL 86-10 since GL 86-10 supercedes GL 83-33, where applicable?*

RESPONSE
See response to question 2.a above.

b) *It is stated in the Basis for Exemption Withdrawal section that this exemption was superseded by exemption requests resulting from the re-validation efforts. Provide: 1) a reference to the exemption which resulted from the re-validation efforts, and 2) a discussion of how the re-validation exemption supersedes the June 23, 1983 exemption on this issue.*

RESPONSE

1) The exemption requests related to Appendix R, Section III.G.2 were submitted in Exelon letter to USNRC dated June 25, 1986. These exemptions were approved by the NRC in a SER dated July 21, 1988. The submittal included exemptions related to separation in the reactor building basement areas (fire areas 1.1.1.1 and 1.1.2.1 for Unit 1 and Unit 2 respectively) which encompass the "historical" exemptions approved by the NRC in SER dated June 23, 1983.

2) GL 83-33 clarified certain Appendix R requirements. The guidance provided in GL 83-33 prompted a comprehensive review of our Appendix R program to ensure adequate safe-shutdown capabilities existed. The re-validation effort included development of a revised safe shutdown analysis and, as necessary, exemptions to Appendix R Sections III.G.1, III.G.2 and III.G.3. These exemptions encompass the historical exemptions approved by the NRC in July 1983.

4. *In the letter dated November 1, 2000, each exemption withdrawal request provides an explanation of why a fire in the expansion gap would not spread to outside the expansion gap, but no basis is provided to show that a fire confined within the expansion gap would not adversely affect redundant safe shutdown equipment which penetrates the expansion gap. Provide a technical justification for concluding that a fire confined within the expansion gap would not adversely affect redundant safe shutdown components routed through the expansion gap.*

RESPONSE
The Mark I containment design used at Quad Cities Nuclear Power Station provides an expansion gap between the steel containment wall and outer concrete biological shield. Exelon has evaluated the physical features associated with the expansion gap and has determined (based on a formal fire protection evaluation) that a fire in the expansion gap is not expected to impact safe shutdown cabling and associated electrical penetrations. This is due to the electrical penetration design features which provide a substantial fire barrier between the expansion gap and cabling. The electrical penetrations are inerted during power operation and the fire protection evaluation shows the cables are

adequately protected and can perform their required function. Additionally, no credible ignition source exists in the drywell expansion gap. This fire protection evaluation is documented in Q-ECDS-00-165. A copy of Q-ECDS-00-165 may be found enclosed.

5. *GL 86-10, Enclosure 1, Section 5, addresses 10 CFR Part 50, Appendix R, Section III-G-2, but does not state that this guidance applies to 10 CFR Part 50, Appendix R, III.G.3 applications. Each exemption withdrawal request in the letter dated November 1, 2000, references GL 86-10 as justification that an exemption is not required, since evaluations are permitted where fire detection and suppression do not provide full area coverage. Provide the technical basis for concluding that 10 CFR Part 50, Appendix R, III.G.3, detection and suppression systems may be evaluated based on the guidance provided GL 86-10, Enclosure 1, Section 5.*

RESPONSE

Enclosure 2 to GL 86-10, Question 3.4.4, addresses partial area coverage for fixed suppression systems required by Appendix R, Section III.G.3. The response to this question addresses Section III.G.3 detection and suppression requirements by re-iterating the guidance contained in GL 86-10, Enclosure 1, Item 5 as follows:

> "...suppression less than full area coverage may be adequate to comply with the regulation. Where full area suppression and detection is not installed, licensees must perform an evaluation to assess the adequacy and necessity of partial suppression and detection in an area. The evaluation must be performed by a fire protection engineer and, if required, a systems engineer. Although not required, licensees may submit their evaluations to the staff for review and concurrence. In any event, the evaluations must be retained for subsequent NRC audits..."

6. *In the letter dated November 1, 2000, it is stated in each exemption withdrawal request that a technical evaluation has been completed which demonstrates that the protection features provide an adequate level of protection, but the application does not provide the basis for this evaluation. Provide a basis and technical justification that the protection features are adequate to protect against the hazards in the area.* (Note: The November 1, 2000 letter only requested withdrawal of the expansion gap exemptions for Unit 1 and Unit 2).

RESPONSE

The Mark I containment design used at Quad Cities Nuclear Power Station provides an expansion gap between the steel containment wall and outer concrete biological shield. Exelon has completed a formal fire protection evaluation that concludes a fire in the drywell expansion gap would not adversely impact the ability to safely shutdown the plant. This fire protection evaluation is documented under Q-ECDS-00-165. A copy of Q-ECDS-00-165 may be found enclosed.

Fire Protection Engineering Evaluation
Q-ECDS-00-165

GL 86-10/Appendix R Evaluation
Drywell Expansion Gap

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FIRE PROTECTION ENGINEERING EVALUATION
DRYWELL EXPANSION GAP

1.0 PURPOSE

The purpose of this technical evaluation is to evaluate the expansion gap that is situated within the containment barrier which separates primary containment from the Reactor building proper. This evaluation demonstrates that the existing barrier configuration is adequate considering the hazards in the area and in the prevention of fire spread. The containment boundary separates primary containment fire area DW-1 (Unit 1) and DW-2 (Unit 2) from various fire areas in each respective Reactor building. For the purpose of this discussion, the boundary configuration is the same for both Units 1 and 2. The containment/drywell barrier is considered an equivalent 3-hour boundary. This evaluation discusses the impact of the expansion gap within the barrier as respects:

- fire spread
- safe shutdown capability
- previous exemption requests

This technical evaluation replaces in entirety, Exemption 8.2 (Reference 4.1). The Exemption for the lack of detection and suppression in the expansion gap is not required, and it will be replaced with a GL 86-10 fire protection evaluation that assesses the adequacy of the fire barrier boundary to withstand the hazards associated with the area as indicated in Enclosure 1, Interpretations of Appendix R, Section 4 (Reference 4.6).

2.0 SCOPE

This technical evaluation applies to the containment boundary which separates primary containment from various fire areas in the Reactor building including that portion of the drywell which abuts the MSIV room steam tunnel. The containment/drywell barrier contains a 2" expansion gap that is completely enclosed and sandwiched between the inner steel liner (drywell) and the outer concrete shell (containment). The fire areas/zones adjacent to and including DW-1 and DW-2 are identified in Table 1.

3.0 DESIGN AND LICENSING AND BASES

The following documents contain the design and licensing bases for Quad Cities:

3.1. Letter dated February 19, 1988 from (ComEd) to (NRC), "Safety Evaluation Report Comments."
3.2. Revised Safety Evaluation for Exemptions from 10 CFR 50, Appendix R, Section III.G, dated July 21, 1988
3.3. Quad Cities Station, Units 1 and 2, Fire Hazards Analysis Report, CRN 97-02, April 1998
3.4. Quad Cities Station, Units 1 & 2, Safe Shutdown Report, CRN 98-09
3.5. 10 CFR50, Appendix R
3.6. Quad Cities Updated Final Safety Analysis Report
3.7. Fire Protection Reports, Vol. 4, Exemption Request, Rev. 2

4.0 REFERENCES

4.1. Fire Protection Reports, Vol. 4, Exemption Request, Rev. 2
4.2. Information Notice 86-35, Fire in Compressible Material at Dresden Unit 3, dated May 15, 1986

4.3. Letter from J. R. Wojnarowski (ComEd) to H.R. Denton (NRC), "Quad Cities Station Units 1 and 2 Request for Exemption from 10 CFR 50, Appendix R for Drywell Expansion Gap," dated July 22, 1986. (This letter transmitted the original Exemption Request)
4.4. Letter from T. Ross (NRC) to L. D. Butterfield (Com Ed), "Safety Evaluation for Exemptions from the Fire Protection Requirements of 10 CFR 50, Appendix R, Section III.G, dated December 11, 1987. (This letter transmitted the original SER granting the Exemption)
4.5. Letter from T. Ross (NRC) to H. Bliss (Com Ed), "Revised Safety Evaluation for Exemptions from 10 CFR 50, Appendix R, Section III.G," dated July 21, 1988. (This letter transmitted the revised SER for the Exemption)
4.6. NRC Generic Letter 86-10, "Implementation of Fire Protection Requirements"
4.7. Calculation No. QDC-4100-M-0691, Rev. 1, Combustible Load Calculation
4.8. Quad Cities Station, Units 1 and 2, Fire Hazards Analysis Report, CRN 97-02, April 1998
4.9. Quad Cities Station, 1 & 2, Safe Shutdown Report, CRN 98-09
4.10. Standard NES-MS-5.1, Rev. 0, "Combustible Loading Standard"
4.11. Quad Cities Updated Final Safety Analysis Report
4.12. NES-MS-05, Rev. 0, "GL 86-10 Evaluation Standard"

5.0 DEFINITIONS

Fire Area - That portion of a building or plant that is separated from other areas by 3-hour rated fire barriers (walls, floors, or roofs) with any openings or penetrations protected with seals or closures having a fire resistive rating equal to that of the barrier. Exceptions are justified with engineering evaluations.

Fire Barrier – Those components of construction (walls, floors and roofs) that are rated by approving laboratories in hours for resistance to fire to prevent spread of fire.

Fire Zone – Subdivisions of fire areas in which the fire suppressions are designed to combat particular types of fires. The concept of fire zone aids in defining to the fire fighter the fire parameters and actions which would be necessary.

6.0 EVALUATION METHODOLOGY AND RESULTS

This evaluation was performed using a traditional fire hazard analysis approach. The specific areas were identified with background information collected and reviewed. The associated fire protection and post-fire safe shutdown features were identified and analyzed. Conclusions reached were by field observations which were performed to validate the information obtained from source documents. Fire Protection Engineers, with input from System Engineering and Operations, developed and reviewed the evaluation which was developed using NES-MS-05, Rev. 0, "GL 86-10 Evaluation Standard."

6.1. Description

The drywell consists of an inner steel liner that is surrounded by a 5-foot thick concrete shell extending from the 569' elevation to the Reactor building refuel floor at 690' 6". All penetrations in this boundary are sealed to give the barrier a 3-hour fire rating. The drywell floor is approximately 23-foot thick concrete. The ceiling is a steel drywell head covered by shield plugs. The shield plugs consist of a reinforced concrete annular ring with three removable stacked shield plugs with a total thickness of 6-feet. The top of this shield plug is at 690'6" elevation. Above the foundation transition zone, the drywell is separated from the reinforced concrete shell by a gap of approximately 2 inches to accommodate thermal expansion. In order to create this 2-inch gap during construction, polyurethane foam sheets were installed over the exterior of the steel liner. An epoxy impregnated fiberglass tape was used over the joints, with 1/4" and 3/8" thick fiberglass epoxy prefabricated cover panels installed over the foam sheets, and then a 5-foot thick concrete shell was poured over this material. The foam sheets are sandwiched between the steel liner and the concrete shell and serve as the 2-inch gap. The foam material serves no other purpose.

6.2. Assumptions

All fire protection features are appropriately maintained to meet their intended design function.

6.3. Safe Shutdown Equipment

6.3.1. Reactor Building

The Reactor buildings are divided into four fire areas: Unit 1 Reactor building, Unit 2 Reactor building, Unit 1 Primary Containment, and Unit 2 Primary Containment.

6.3.1.4. Fire Area Unit 1 Reactor Building (RB-1N and RB-1S)

The Unit 1 Reactor building (RB-1) fire area consists of the refuel floor and all elevations below in the Unit 1 Reactor building excluding primary containment. The fire zones contained within this fire area are listed in Table 1. The Quad Cities Safe Shutdown Report identifies the safe shutdown methods for this fire area and the key safe shutdown equipment and their functions (Table 3.0-1 and section 4.0 in Reference 4.9)

6.3.1.4. Fire Area Unit 2 Reactor Building (RB-2N and 2S)

The Unit 2 Reactor building (RB-2) fire area consists of the Unit 2 Reactor building excluding the refuel floor and primary containment. The fire zones contained within this fire area are listed in Table 1. The Quad Cities Safe Shutdown Report identifies the safe shutdown methods for this fire area and the key safe shutdown equipment and their functions (Table 3.0-2 and section 4.0 in Reference 4.9).

6.3.1.3 Fire Area Unit 1 Primary Containment (DW-1)

The Unit 1 primary containment is located within the Unit 1 Reactor building. The fire zone in this fire area is listed in Table 1. The Unit 1 primary containment is inerted during normal power operation and, therefore, not subject to fire damage.

6.3.1.3 Fire Area Unit 2 Primary Containment (DW-2)

The Unit 2 primary containment is located within the Unit 2 Reactor building. The fire zone in this fire area is listed in Table 2. The Unit 2 primary containment is inerted during normal power operation and, therefore, not subject to fire damage.

6.4. Fire Protection Equipment

The fire zones adjacent to primary containment for Units 1 and 2 are provided with either automatic suppression, fire detection, or manual suppression equipment (See Table 1). These systems were selected and designed to match specific fire hazards for safety and operational protection within each particular fire zone. There is no fire protection provided inside the 2-inch gap, however, fire hose stations and portable extinguishers are provided for manual fire fighting throughout these areas.

6.5. Fire Hazards Analysis

The drywell is constructed of a steel containment liner that is surrounded by a 5-foot thick concrete shell structure. This substantial barrier construction has the capability of providing an equivalent 3-hour fire boundary. All penetrations into the drywell are sealed using recognized Mark I containment sealing methods. The containment as well as the penetrations are inerted during plant operation.

The containment is spherical on the bottom and cylindrical at the top with a removable steel head. The head and shell of the drywell are fabricated of SA-212 Gr B plate manufactured to A-300 requirements. Normal environment in the drywell during plant operation is 1.2 to 1.4 psig with a nitrogen atmosphere of less than 4% oxygen by volume.

Access to the drywell is provided by the drywell head, one personnel airlock, one control rod drive removal hatch, and one bolted equipment hatch. The head is held in place by bolts and is sealed with a double tongue-and-groove seal arrangement. The locking mechanism on each personnel airlock door is designed so that a tight seal will be maintained under either internal or external pressure. The hatch covers are bolted in place and sealed with a double tongue-and-groove seal

Above the foundation, the drywell is separated from the reinforced concrete by a gap of approximately 2 inches to accommodate thermal expansion. The normal operation of the reactor will cause the steel liner to expand in all directions. This expansion has to be accommodated and it is done so by providing a 2-inch space (gap) around the steel liner except for the bottom, which rests on a pocket of sand. In order to create this 2-inch gap during construction, polyurethane foam sheets were installed over the exterior of the steel liner. An epoxy impregnated fiberglass tape was used over the joints, then 1/4 and 3/8-inch thick fiberglass epoxy prefabricated cover panels were installed over the foam sheets, and then concrete was placed over this material. These sandwiched materials serve as the 2-inch gap and are totally enclosed between the steel liner and concrete shell.

The polyurethane foam material was chosen for its resistance to the environmental conditions likely to exist during its service life. Normal in-service temperature will be only 150-180F. Further, this material is self-extinguishing in accordance with ASTM-D1692, but nonetheless, polyurethane foam is still classified as a combustible material in the Quad Cities Fire Hazard Analysis (Reference 4.8) and in the Combustible Loading Standard (Reference 4. 10).

Drywell penetrations, as listed in UFSAR Table 6.2-7 (Reference 4.11), extend from the drywell liner through the concrete and are surrounded with concentric pipe sleeves. Piping penetrations are of two general types: i.e., those which accommodate movement, and those which experience relatively little movement. An example of a piping penetration for which movement provisions are made is shown in UFSAR Figure 3.8-37 (Reference 4.11). These penetrations have a guard pipe between the fluid line and the penetration nozzle in addition to a double-seal arrangement. The guard pipes are designed to the same pressure and temperature as the fluid line and are attached to a multiple flued head fitting. These fittings were designed to the ASME Pressure Vessel Code Section VIII. The penetration sleeve is welded to the drywell and extends through the biological shield where it is welded to a bellows which in turn is welded to the guard pipe. Lines which open directly to the containment do not have separate penetration sleeves and are welded directly to the containment shell. The drywell shell is reinforced at these penetrations by means of inserts as shown in UFSAR Figure 3.8-38 (Reference 4.11). The mechanical penetrations are inerted the same as the containment atmosphere.

Electrical penetrations are functionally grouped into low voltage power and control cable penetration assemblies, high voltage power cable penetration assemblies, and shielded cable penetration assemblies. The electrical penetrations are pressurized/nitrogen inerted and have the same basic configuration shown in UFSAR Figure 3.8-39 (Reference 4.11). An assembly is inserted in the 12-inch schedule 80 penetration nozzles which are furnished as part of the containment structure. Headerplates, constructed of stainless steel, are provided at each end of the penetration assembly.

The design and fabrication of each type of penetration assembly is in accordance with the ASME Boiler and Pressure Code, Section III, Class B Vessel, and materials of construction are self-extinguishing in accordance with ASTM-D635.

The location of the expansion gap and foam sheeting with respect to the penetrations is shown on attached Figures E-1 and E-2, sheets 1 and 2. Theses are the basic configurations for each of the mechanical and electrical containment penetrations. Based on these configurations, it is apparent that the foam sheeting material within the expansion gap is completely isolated from the penetration opening and from the penetrating objects. The separation is provided by steel sleeves and plating. Therefore, there is no direct contact or fire exposure to or from the foam sheeting. Furthermore, welded-end steel fittings, sleeves, or headerplates provide a complete airtight containment enclosure around the penetration openings.

During plant operation, there are no direct paths for fire, heat, smoke or flames to traverse a penetration or impinge directly upon the foam sheeting. Additionally, there are no sources of ignition inside or adjacent to the expansion gap. The foam sheeting does not present itself as an intervening combustible since there is no equipment that directly penetrates into the expansion gap area. All penetrating objects go through a steel sleeve which is physically separated from the expansion gap and its associated foam sheeting.

To further demonstrate the effects of fire origination in various sample locations, fire development and spread are prevented by virtue of limited ignition sources, non-intervening combustibles, a nitrogen inerted atmosphere, and minimal combustibles inside the penetrations. For example:

a) Inside the penetration, the inerted atmosphere would limit fire damage and fire spread amongst the cables. Fire propagation is not likely beyond the penetration due to limited combustibles and oxygen deprivation within the completely sealed and nitrogen inerted enclosure. Therefore, fire spread is prevented to the Reactor building general area. The inert atmosphere within containment mitigates fire spread to containment. Cable damage inside a penetration is the same as fire damage in the adjacent Reactor building since all cable and equipment pass through the Reactor building to containment. Safe shutdown is maintained by normal RB-1/RB-2 methods.
b) Inside the expansion gap, the only combustible is the sheeting which is totally enclosed by steel plating and a 5-foot thick reinforced concrete barrier which will prevent fire spreading to containment and the Reactor building general areas. There are no ignition sources, or safe shutdown equipment, or cables situated inside the expansion gap. Therefore, fire in the expansion gap is highly unlikely during normal plant operation and it would not prevent safe shutdown.
c) In the Reactor building general floor areas outside containment, equipment and cables could be damaged by fire; however, safe shutdown is provided by the methods identified for fire areas RB-1/RB-2. Fire spread from the Reactor building to the expansion gap is prevented by the 5-foot thick concrete containment barrier and the steel enclosures/plating around the containment penetrations, thus also preventing fire spread from the Reactor building to primary containment.

Detection and/or automatic suppression are provided as required for combustible hazards. Due to the lack of contiguous combustible materials and the physical sealing methods used for primary containment, it is likely that any fire would be confined in the area of origination. Due to the existence of plant procedures to control transient combustibles, it is unlikely that any unevaluated hazards will be located in these fire zones. Additionally, plant procedures govern hot work activities to protect against ignition sources exposing combustible materials. It should be noted that the conditions which existed at the time of the Dresden fire, (Reference 4.2), i.e., containment pipe replacement, breached penetrations, containment boundary open with reactor shutdown and de-fueled, are not present during normal plant operation and have no impact on safe shutdown capability. The smoldering material fire at Dresden was extinguished using water from a nearby fire hose.

The construction of the containment boundary provides adequate fire withstand capability to prevent fire spread and to maintain safe shutdown capability. Due to the physical isolation of the expansion gap, construction of the barrier, the existence of early warning detection in the general Reactor building areas where the majority of penetrations exist, the other fire protection features, the low combustible loading in all areas, and the procedural controls for ignition sources and hot work, any fires originating within the Reactor building, penetration enclosure, or expansion gap will not spread between these fire zones. Therefore, the loss of safe shutdown capability is not credible.

6.6. Conclusion

The containment barrier configuration is adequate in the prevention of fire spread between primary containment and the Reactor building. Furthermore, the combustible material within the expansion gap does not result in an increased fire hazard beyond that which has already analyzed for the Reactor building and primary containment. The technical bases for these conclusions are based on:

- The expansion gap is completely enclosed and isolated from equipment and cables by a 5-foot concrete barrier and steel. The barrier provides adequate resistance to fire spread.
- A limited amount of combustibles are situated in the penetrations. Additionally, there are no intervening combustibles between the expansion gap and the penetrations which would facilitate fire spread to other areas such as the Reactor building, containment, or to other penetrations.
- The foam sheeting does not directly expose safe shutdown equipment or cabling.
- There are no sources of ignition inside or adjacent to the expansion gap.
- Fire detection is provided in the Reactor building fire zones adjacent to the electrical and mechanical drywell penetrations on the ground and mezzanine floors to alert the plant to a fire condition.
- Manual fire fighting equipment is available throughout the Reactor buildings.
- Procedural controls are provided governing transient combustibles and hot work ignition sources.
- Safe shutdown equipment is available to achieve and maintain hot and cold shutdown in the event of a fire in the expansion gap and the Reactor building fire areas.

Section III.G.1 of 10CFR50, Appendix R requires fire protection of safe shutdown capability be provided such that fire damage is limited so that one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is undamaged and that systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours. The fire areas that these fire zones are part of (Fire Areas RB-1 and RB-2) use an alternate shutdown capability as required by 10CFR50 Appendix R Section III.G.3. The intent of 10CFR50, Appendix R, Sections III.G and III.L is met by the existing barriers between primary containment and the Reactor building. The addition of detection systems, automatic suppression systems and/or upgrades to the barrier would not significantly improve the level of fire protection for these fire areas.

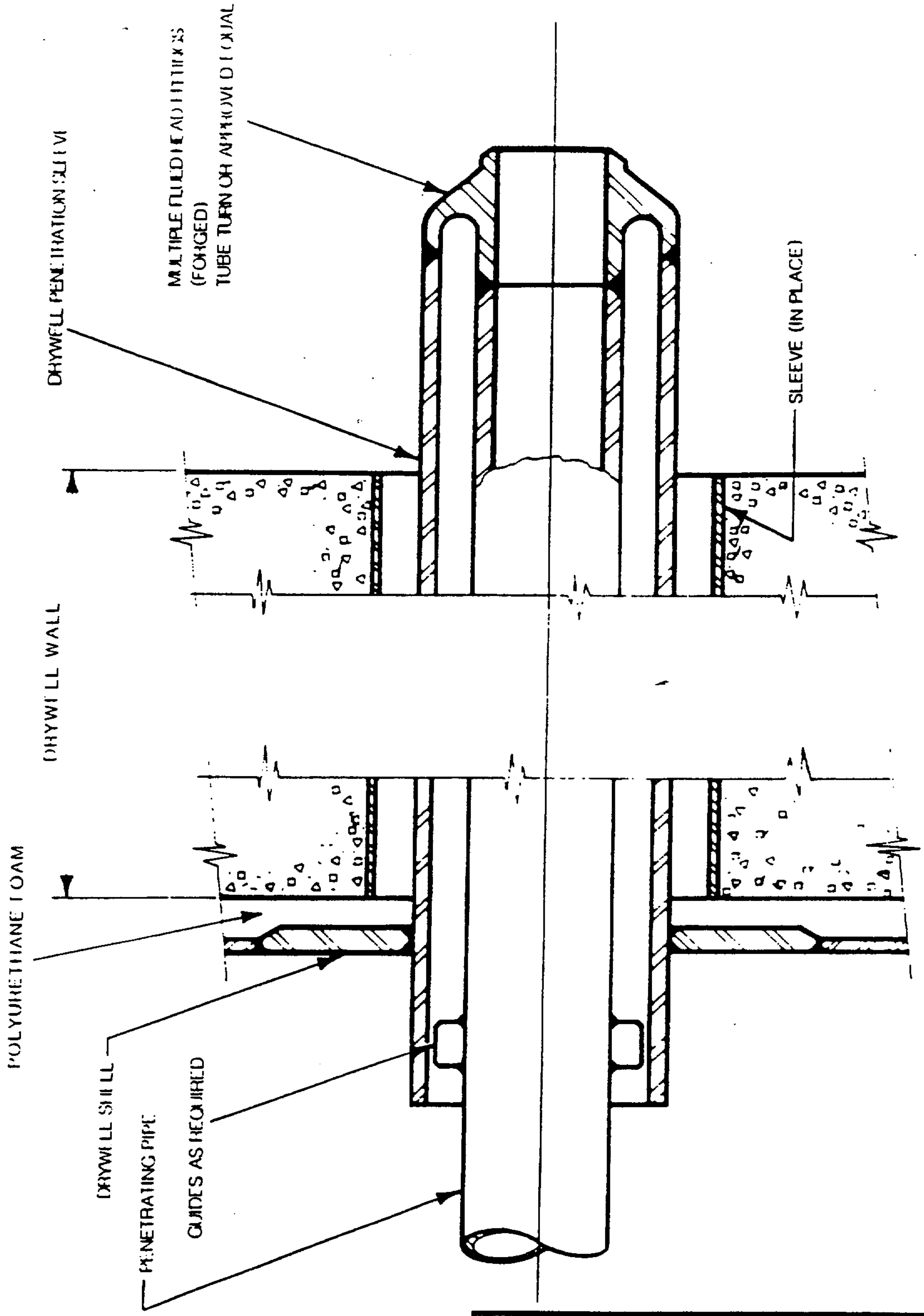
7.0 ATTACHMENTS

Table 1, Fire Zones in Unit 1 and Unit 2 Reactor Buildings Adjacent to the Primary Containment
Figure E-1, Typical Electrical Penetration Assembly Canister
Figure E-2, sheets 1 and 2, Typical Mechanical Penetration Assemblies

Table 1

Fire Zones in Unit 1 and Unit 2 Reactor Buildings Adjacent to the Primary Containment

Fire Zone	Fire Area	Fire Protection Features		
		Detection	Suppression	Combustible Loading
1.2.1 U1 Primary Containment	DW-1	-	Inerted	N/A
Adjacent areas				
1.1.1.1.S Basement south elev. 554'	RB-1S	Linear heat for cable trays	Partial wet pipe sprinkler	low
1.1.1.1.N Basement north elev. 554'	RB-1N	Linear heat for cable trays	Partial wet pipe sprinkler	low
1.1.1.2 Ground floor 595'	RB-1N	Area smoke	Local preaction sprinkler	low
1.1.1.3 Mezz. Floor 623'	RB-1N	Area smoke	Manual suppression	low
1.1.1.4 Main floor 647'	RB-1N	-	Manual suppression	low
1.1.1.5 Reactor floor 666'	RB-1N	-	Manual suppression	low
1.1.1.6 Refuel floor 690'	RB-1N	-	Manual suppression	low
1.2.2 U2 Primary Containment	DW-2	-	Inerted	N/A
Adjacent areas				
1.1.2.1.S Basement south elev. 554'	RB-2S	Linear heat for cable trays	Partial wet pipe sprinkler	low
1.1.2.1.N Basement north elev. 554'	RB-2N	Linear heat for cable trays	Partial wet pipe sprinkler	low
1.1.2.2 Ground floor 595'	RB-2N	Are smoke	Manual suppression	low
1.1.2.3 Mezz. Floor 623'	RB-2N	Area smoke	Manual suppression	low
1.1.2.4 Main floor 647'	RB-2N	-	Manual suppression	low
1.1.2.5 Reactor floor 666'	RB-2N	-	Manual suppression	low

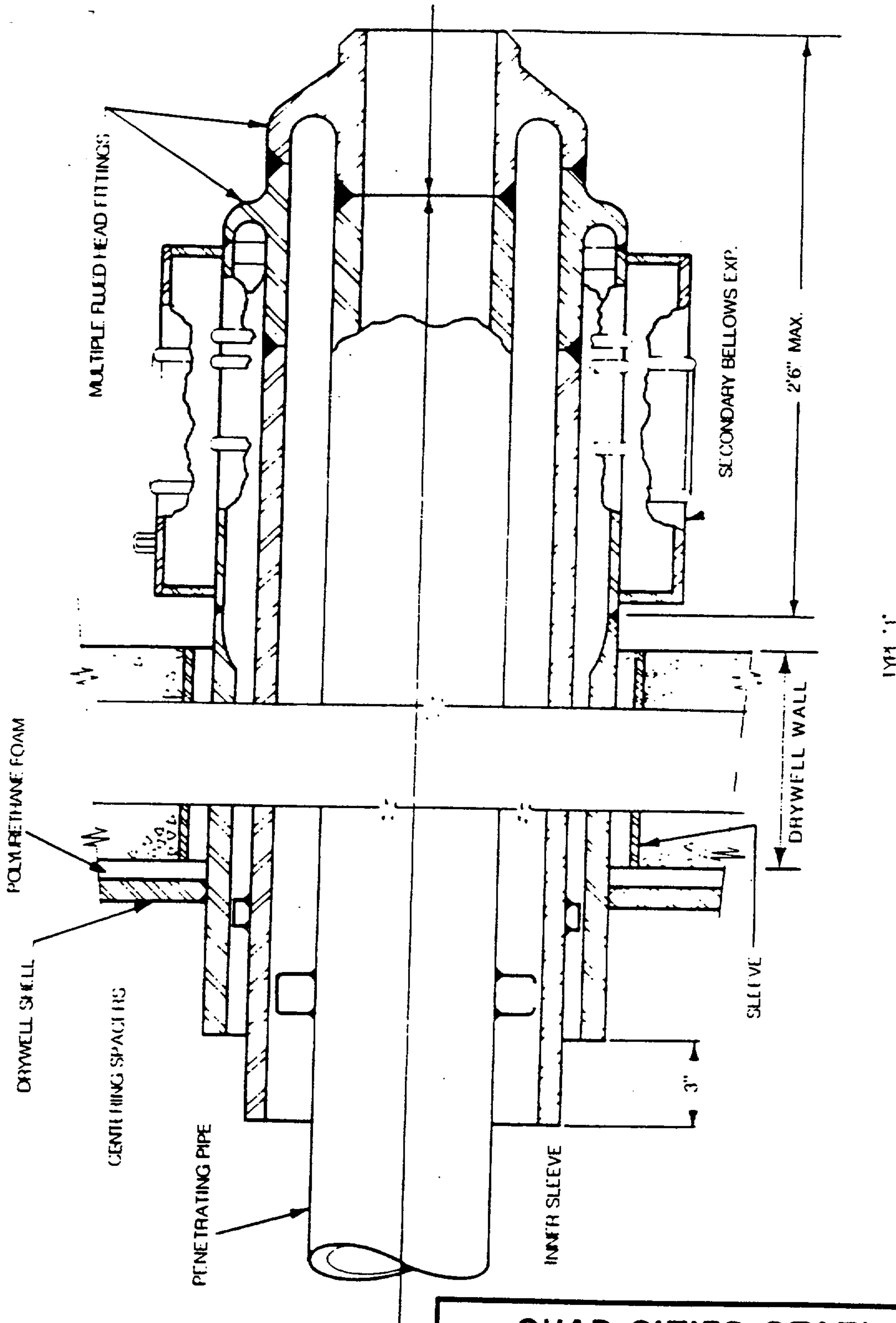


QUAD-CITIES STATION
Units 1 & 2

FIGURE E-2

TYPICAL MECHANICAL
PENETRATION ASSEMBLIES

(SHEET 2 OF 2)

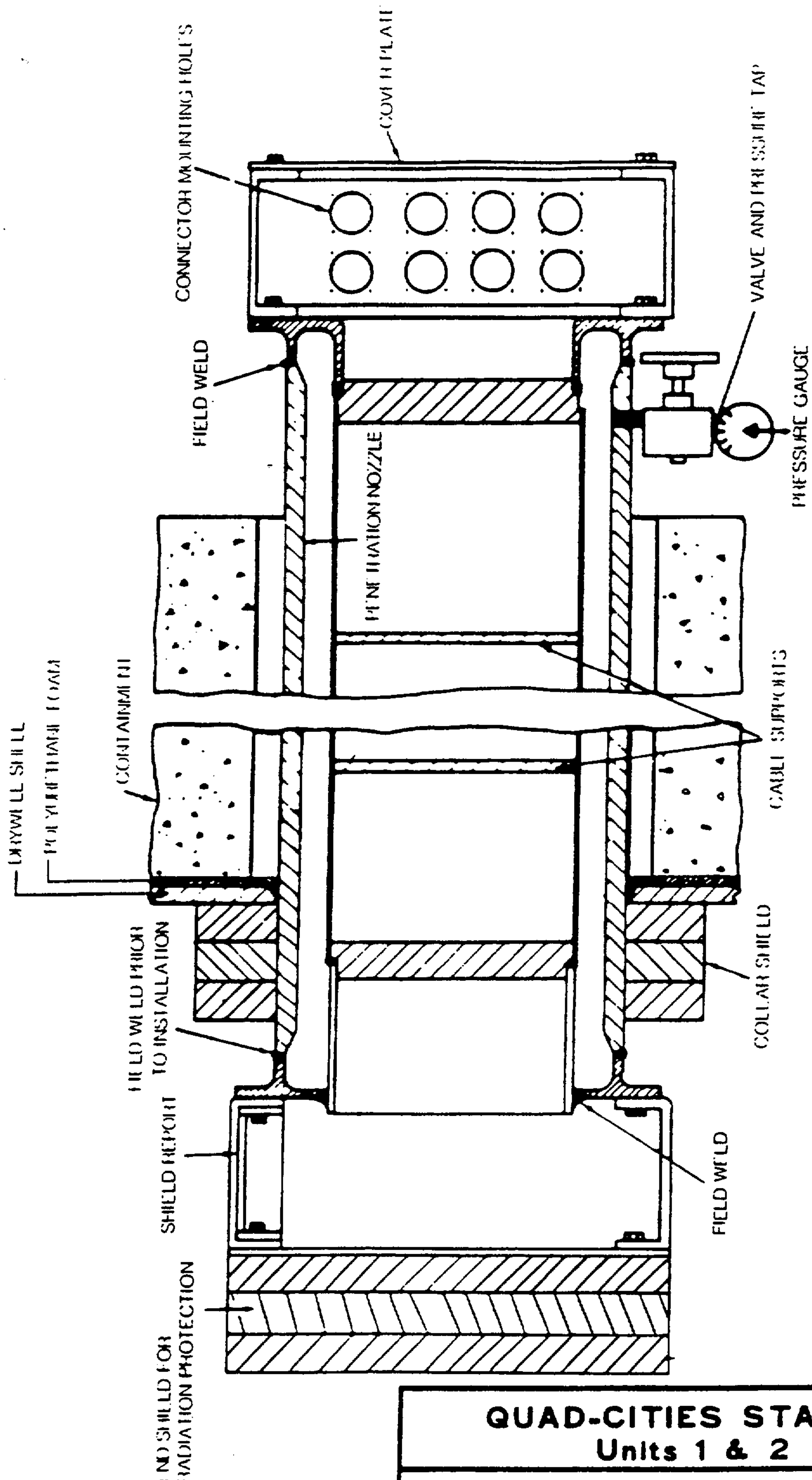


QUAD-CITIES STATION
Units 1 & 2

FIGURE E-2

TYPICAL MECHANICAL PENETRATION ASSEMBLIES

(SHEET 1 OF 2)



QUAD-CITIES STATION
Units 1 & 2

FIGURE E-1

TYPICAL ELECTRICAL PENETRATION
ASSEMBLY CANISTER