Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

June 5, 1986

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Request for Exemption from 10 CFR 50,
Appendix R for Drywell Expansion Gap
NRC Docket Nos. 50-237 and 50-249

References (a): Letter from J. A. Zwolinski to D. L. Farrar dated February 25, 1986.

(b): Letter from C. J. Paperiello to Cordell Reed dated February 26, 1986.

(c): Letter from D. L. Farrar to J. G. Keppler dated May 6, 1986.

Dear Mr. Denton:

The reference (a) and (b) letters requested that Commonwealth Edison review the drywell expansion gap for Dresden Units 2 and 3 with respect to 10 CFR 50, Appendix R requirements. This request resulted from the fire which occurred in the Dresden Unit 3 expansion gap on January 20, 1986. Reference (c) provided our assessment of the impact of the fire and addressed compliance with Appendix R. This assessment documented that safe shutdown can be achieved and maintained in the event of an expansion gap fire although all Appendix R requirements are not satisfied. Therefore, pursuant to 10 CFR 50.12, Commonwealth Edison requests an exemption from the requirements of 10 CFR 50, Appendix R, section III.G.3 for fire detection and fixed fire suppression in the Dresden Units 2 and 3 drywell expansion gaps. This exemption is needed since we believe it is not possible to install the required detection and suppression system in the expansion gap. In addition, we request your review and concurrence with the independence between alternate shutdown systems as described in the enclosure.

The exemption request and supporting fire hazards analysis are provided in the enclosure to this letter. The enclosure was written to reflect plant conditions after all previously proposed modifications and final safe shutdown procedures are in place. The fire hazards analysis demonstrates that the existing and proposed fire protection features at Dresden assure that safe shutdown can be achieved and maintained in the event of a fire in the expansion gap. This satisfies the underlying purpose of Appendix R, therefore our request for exemption satisfies the special circumstance criterion in 10 CFR 50.12(a)(2)(ii), "Application of the regulation in the particular circumstances...is not necessary to achieve the underlying purpose of the rule."

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Rec'd w/check $150.00

In further support of our request, we believe it is virtually impossible to install effective detection and suppression in the drywell expansion gap due to the physical configuration of the gap (i.e., a two inch foam filled gap sandwiched between the steel drywell liner and at least 4 foot thick concrete). As such, we feel that installation of detection and suppression in such an area would result in undue hardship and costs that are significantly in excess of those contemplated when the regulation was adopted. This consideration falls within special circumstance 50.12(a)(2)(iii).

Based on the above discussion and the information in the enclosure, we feel our exemption request is consistent with 10 CFR 50.12 and does not compromise the underlying purpose of Appendix R. We are currently preparing a similar request for Quad Cities and will submit it when completed.

In accordance with 10 CFR 170, a fee remittance in the amount of $150.00 is enclosed.

If you have any questions regarding this request, please contact this office.

One signed original and five (5) copies of this letter and the enclosure are provided for your use.

Very truly yours,

J. R. Wojnarowski
Nuclear Licensing Administrator

lm

cc: R. Gilbert - NRR
J. G. Keppler - Region III
NRC Resident Inspector - Dresden

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DRESDEN 2 & 3

New Appendix R Exemption Request For

The Drywell Expansion Gap

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CHAPTER 11

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11.0 APPENDIX R DRYWELL EXPANSION GAP EXEMPTION REQUEST

Per the provisions of 10 CFR 50.12, Commonwealth Edison Company (CECo) requests exemption from the requirements of Section III.G.3 of Appendix R to 10 CFR 50 that the drywell expansion gap, relying on alternative shutdown capability, be provided with fire detection and fixed fire suppression.

Justification for this exemption is presented in Section 11.2.

11.1 DRYWELL EXPANSION GAP DESCRIPTION

The drywell consists of a steel containment shell surrounded by a concrete shield structure. The steel containment is a pressure vessel with a spherical lower portion and a cylindrical upper portion. Thermal expansion, as a result of normal reactor operation or postulated accidents, will cause the steel shell to expand both radially and vertically. To accommodate this expansion, space has been provided between the concrete shield structure and the steel shell above the foundation transition zone. This space is a gap of approximately 2 inches and precludes any restrained thermal expansion load on the steel containment or the concrete shield. At the foundation level, a sand pocket was used to soften the transition between the foundation and the containment vessel.

To facilitate the pouring of the concrete without reducing the required gap space during construction, prefabricated crushable polyurethane foam sheets were installed over the exterior surface of the steel containment. Epoxy impregnated fiberglass tape was applied over all joints in the polyurethane foam, and 1/4 to 3/8-inch thick fiberglass-epoxy prefabricated cover panels were then installed over the polyurethane foam. Once the concrete has hardened, the materials in the annular space do not serve any design function and are no longer required.

11.2 JUSTIFICATION FOR LACK OF COMPLETE DETECTION AND SUPPRESSION IN THE EXPANSION GAP

11.2.1 Introduction

There is no detection or suppression provided in the expansion gap and it would be difficult if not impossible to provide it due to the physical constraints. The subsequent analysis will justify the lack of detection and automatic suppression throughout the gap.

11.2.2 Fire Protection Systems

While no detection or suppression systems are present in the gap, fire detectors and manual hose stations are located in the reactor building fire zones adjacent to the electrical and mechanical drywell penetrations. A fire in the gap can be detected by these detection systems and the fire can be extinguished by applying water through the annular gap around the penetrations using the manual hose stations. Portable fire extinguishers are located throughout the reactor building.

11.2.3 Safe Shutdown Equipment

The only safe shutdown components located in the expansion gap are electrical conductors inside the electrical penetration assembly canisters. Tables 11.2-1 and 11.2-2 list the safe shutdown equipment operated or associated with cables that pass through these penetrations for Units 2 and 3, respectively.

The taps for reactor level indicators 2(3)-263-106A and 2(3)-263-106B are also routed through the gap in mechanical penetrations on both units.

11.2.4 Fire Hazards Analysis

The 2-inch gap is filled with polyurethane sheets that are covered with a fiberglass cover panel. Polyurethane is a polyester base material with a heat of combustion of 12,000 Btu/lb, an auto-ignition temperature of 1000^{o} F, and a piloted ignition temperature of 500^{o} F to 700^{o} F.

The 2-inch gap is separated from the inerted drywell fire area by the steel containment shell. Separation of the expansion gap from the rest of the reactor building is by minimum 4-feet 0-inch thick structural concrete that is penetrated by mechanical and electrical penetrations.

In Unit 3, the concrete wall separates the expansion gap from two separate fire areas (Fire Areas RB3-I and RB3-II). In Unit 2, the concrete wall also separates the expansion gap from two fire areas. These are Fire Areas RB2-I and RB2-II.

Also providing a barrier to fire spread are the electrical cable penetration assemblies and the mechanical penetrations. There are three standard types of electrical penetration assemblies present; Low Voltage Power and Control Cable Penetration, High Voltage Power Cable Penetration, and the Shielded Cable Penetration. Each type of electrical penetration has the same basic configuration shown in Figure E-1. An assembly is sized to be inserted in the penetration nozzles which are 12-inch schedule 80 steel pipe (wall thickness of 0.688 inches). They are furnished as part of the containment structure and the design and fabrication of each assembly is in accordance with the requirements of the ASME Boiler & Pressure Code, Section III, Class B Vessel. The assembly extends approximately 1 foot beyond the drywell wall on both sides of the penetrations. The drywell wall, in the vicinity of the electrical penetrations, is at least 6 feet thick.

The mechanical penetrations are of two types; those which accommodate thermal movement (hot) and those which experience relatively little thermal stress (cold). The hot fluid line penetrations have a guard pipe between the hot line and the penetration nozzle in addition to a double-seal arrangement (see Figure E-2, Sheet 1). This permits the penetration to be vented to the drywell should a rupture of the hot line occur within the penetration. The guard pipes are designed to the same pressure and temperature as the fluid line and is attached to a multiple flued head fitting, a one-piece forging with integral flues or nozzles. This fitting was 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. The bellows accommodates the thermal expansion of the steam pipe and drywell relative to the steam pipe. A double bellows arrangement permits remote leak testing of the penetration seal. The lines have been constrained at each end of the penetration assembly to limit the movement of the line relative to the containment, yet will permit pipe movement parallel to the penetration.

The penetration details of cold piping lines are shown on Figure E-2, Sheet 2. These penetrations have a double-seal arrangement, however, the guard pipe provided for the hot piping line penetrations is not provided.

The annular space around the electrical and mechanical penetrations is unsealed.

There are two major concerns for a fire in the expansion gap.

1. Can a fire starting in the gap or in a specific fire area adjacent to a gap spread to another fire area via the gap where safe shutdown components of an alternate or redundant shutdown path are located?

2. Can the reactor be shut down if a fire occurs inside the gap during operation?

In addressing the first concern, it should be noted that the drywell is inerted during normal operation. Thus, spread of the fire from the expansion gap to the drywell is impossible. Since the concrete is a minimum 4-feet 0-

inches thick, the discussion is limited to justifying that the electrical and mechanical penetration assemblies provide a barrier to fire spread from the gap to Fire Areas RB2-I and RB2-II in Unit 2 and Fire Areas RB3-I and RB3-II in Unit 3.

Since the polyurethane foam is located on the drywell side of the concrete wall, the only mechanism for fire spread from the expansion gap through electrical penetration assemblies to the fire areas outside the drywell or vice versa is by conduction of sufficient heat through the penetration assembly to reach the autoignition temperature of the cables (600^{o}F) or the foam (1000^{o}F). This is an unlikely event due to the construction of the assembly. As can be seen in Figure E-1, the penetration assembly is a metal canister into which a sleeve, two header plates and cable support plates have been inserted. Electrical conductors are contained within the sleeve and are passed through the sleeve through openings in the header plates. A potting compound has been applied at each end of the penetration to seal between the header plates and cable. The highest temperatures of the drywell side of the steel shell during the January 20, 1986 polyurethane fire was 500^{o}F (see Reference 1). An analysis has shown that at a distance of 3 feet from a hot spot on the steel shell, the maximum temperature was 94^{o}F (see Figure E-3). Thus, if the hot spot was next to a penetration, the temperature at the outside of the penetration, which is about 6 feet away, would be very low. Furthermore, conservative calculations indicate that if an 1800^{o} exposure (i.e., flame impingement) were to occur in either the polyurethane foam or the reactor building, it would take at least 24 hours to conduct sufficient heat through the stainless steel penetration to threaten ignition of combustible materials on the outside surface of the drywell wall. Therefore, it is unlikely that a fire would spread through an electrical penetration assembly into another fire area or from the fire area into the gap.

For mechanical penetrations, as is the case with the electrical penetration assemblies, the polyurethane foam is located on the drywell side of the concrete wall, thus, the only mechanism for fire spread from the expansion gap to the fire areas outside the drywell is by heat transmission through the annulus around the pipe or conduction through the pipe penetration. Since there are no combustible materials in contact with the pipes in the vicinity of the penetrations, it is unlikely that a fire would spread out of the gap. This conclusion is supported by an analysis of the January 20, 1986 fire. Analysis of the January 20, 1986 fire shows that on the steel shell at a distance of 3 feet from any hot spot, the temperature was 94^{o}F. Therefore, at the outside end of the penetrations, the temperatures of the penetration could not have been high enough to ignite any combustible material in the vicinity of the penetration. (The calculations previously referenced are sufficiently conservative to also account for thermal radiation effects through the annulus around mechanical penetrations.)

The concrete wall and the electrical and mechanical penetration also act as a barrier to the spread of fire from the reactor building into the expansion gap. The justification for this statement is the same as that given above for why a fire cannot spread from the expansion gap into another fire area.

As discussed above, a fire in the expansion gap cannot spread into bounding Unit 2 Fire Areas RB2-I or RB2-II or into bounding Unit 3 Fire Areas RB3-I or RB3-II via the electrical and mechanical penetrations. Attention is now turned to the second concern which is whether the reactor can be shut down if a fire occurs inside the gap during operation.

The construction of the assembly and the analysis of the January 20, 1986 fire makes it unlikely that a fire in the expansion gap could prevent the electrical penetration assemblies from performing their function. However, Tables 11.2-3 and 11.2-4 conservatively address the situation where the assemblies are affected. As can be seen in the tables, shutdown is not affected because of the following:

1. The affected safe shutdown valve is normally in the proper safe shutdown position and a fault in the cable will not change that position,

2. The mechanical function of the Target Rock valve and the safety valves is not affected by an expansion gap fire, thus RPV pressure control will remain available,

3. Instruments are available to monitor reactor vessel level that have their essential and associated circuits routed independent of the expansion gap, and

4. Manual actions can be performed to open valves required for cold shutdown or close valves in lines that are not used as fluid paths for hot shutdown.

The results of the analysis of these possible effects indicate that a fire that spreads throughout the entire gap area would not prevent achieving a safe shutdown. For a fire in the Unit 2 expansion gap, hot shutdown of Unit 2 can be achieved and maintained using shutdown path C and in the event of a fire in the Unit 3 expansion gap, hot shutdown of Unit 3 can be achieved and maintained using shutdown path D.

One final explanation is required. As pointed out above, the taps for reactor level indicators 2(3)-263-106A and 2(3)-263-106B are routed through the gap. A fire in the gap should not affect these instruments for two reasons:

1. The amount of polyurethane around the penetration is limited. That is, once the material has been burned away the temperature of the penetration and that of the fluid inside will return to their ambient level, and

2. The taps for the two instruments are separated by a distance of 45 feet. Thus, at worst only one of the instruments will be unaffected by a fire at any given time. This is supported by the events of the January 20, 1986 fire where the fire traveled less than 30 feet in 6 hours.

11.2.5 Conclusions

This analysis justifies the exemption from complete fire detection and fixed fire suppression in the drywell steel containment expansion gaps in Units 2 and 3. The technical basis for this justification is summarized as follows:

1. The expansion gap is separated by barriers that will prevent the fire from spreading to other fire areas.

2. The fire detection systems in the reactor building will alert the plant to a fire condition in the gap.

3. Manual suppression is readily available near the mechanical and electrical penetrations.

4. A safe shutdown path will be available to achieve and maintain hot and cold shutdown.

11.2.6 References

1. "Evaluation for the Effects of the Dresden Unit 3 Polyurethane Fire," May 1986.

TABLE 11.2-1

SAFE SHUTDOWN EQUIPMENT OPERATED BY CABLES THAT PASS THROUGH UNIT 2

DRYWELL PENETRATIONS

PENETRATION NO.	SAFE SHUTDOWN EQUIPMENT
X-205E	M02-1301-1
	2-203-3C
	2-203-3D
	2-203-3E
	LI2-263-106A&B
	LI2-263-116
	LI2-263-117
	A02-1301-17
	A02-1301-20
	M02-1001-1B
	M02-0202-4A
X-200B	M02-1301-4
	2-203-3A
	2-203-3B
	A02-1301-17
	A02-1301-20
	M02-1001-1B
X-204S	M02-1301-1
	M02-1301-2
	M02-1301-3
	M02-1301-4
	A02-1301-17
	A02-1301-20
	M02-0202-4B

TABLE 11.2-2

SAFE SHUTDOWN EQUIPMENT OPERATED BY CABLES THAT PASS THROUGH UNIT 3

DRYWELL PENETRATIONS

PENETRATION NO.	SAFE SHUTDOWN EQUIPMENT
X-204M	M02-1301-1
	3-203-3C
	3-203-3D
	3-203-3E
	M03-0202-4A
	A03-1301-17
	A03-1301-20
	M03-1001-1B
X-204S	M03-1301-4
	3-203-3A
	3-203-3B
	A03-1301-17
	A03-1301-20
	M03-1001-1A
X-200C	M03-2301-4
	M03-0202-4B

TABLE 11.2-3

POSSIBLE EFFECTS OF A FIRE ON

UNIT 2 SAFE SHUTDOWN EQUIPMENT

EQUIPMENT	EFFECT
MO2-1301-1	No effect. This valve is normally open and must remain open for hot shutdown. The cables passing through the penetration supply power to the valve motor and control a limit switch. A fault in these cables or a loss of these cables will not change the valve position.
MO2-1301-4	No effect. This valve is normally open and must remain open for hot shutdown. The cables passing through the penetration supply power to the valve motor and control a limit switch. A fault in these cables will not change the valve position.
2-203-3A	A fire that affects these cables could disable the Target Rock valve. However, the mechanical function of the valve and the safety valves will be available for RPV pressure control.
2-203-3B 2-203-3C 2-203-3D 2-203-3E	A fire that affects these cables could disable these electromatic valves. However, the mechanical function of the Target Rock valve and the safety valves will be available for RPV pressure control.
LI2-263-106A&B LI2-263-116 LI2-263-117	A fire in the gap that affected these cables could disable these indicators. However, other indicators are available to monitor reactor level that have their essential and associated circuits routed independent of the gap.
MO2-1301-1 MO2-1301-2 MO2-1301-3 MO2-1301-4 AO2-1301-17 AO2-1301-20	In the event that a fault in these cables affects valves AO2-1301-17 and AO2-1301-20, valve AO2-1301-16 can be manually closed. A fault due to a fire could close valves MO2-1301-1, MO2-1301-2, MO2-1301-3, and MO2-1301-4. This will not prevent achieving a safe shutdown, since a fault in the HPCI cables routed in the same penetration will not change the HPCI valve position.

TABLE 11.2-3 (Cont'd)

EQUIPMENT	EFFECT
A02-1301-17 A02-1301-20	In the event that a fault in one of these cables affects these valves, valve 2-1301-16 can be manually closed.
M02-2301-4	No effect. This valve is normally open and must remain open for hot shutdown. The cables passing through the penetration supply power to the valve motor and control a limit switch. A fault in these cables will not change the valve position.
M02-1001-1A	The power feeds to this valve are routed through the penetration. In order to get to cold shutdown, the valve must be opened. After the drywell is made accessible, these valves can be manually opened.
M02-1001-1B	The power feeds to this valve are routed through the penetration. In order to get to cold shutdown, the valve must be opened. After the drywell is made accessible, these valves can be manually opened.
M02-0202-4A	The power feeds to this valve are routed through the penetration. In order to get to cold shutdown, the valve must be closed. After the drywell is made accessible, these valves can be manually opened.
M02-0202-4B	The power feeds to this valve are routed through the penetration. In order to get to cold shutdown, the valve must be closed. After the drywell is made accessible, these valves can be manually opened.

TABLE 11.2-4

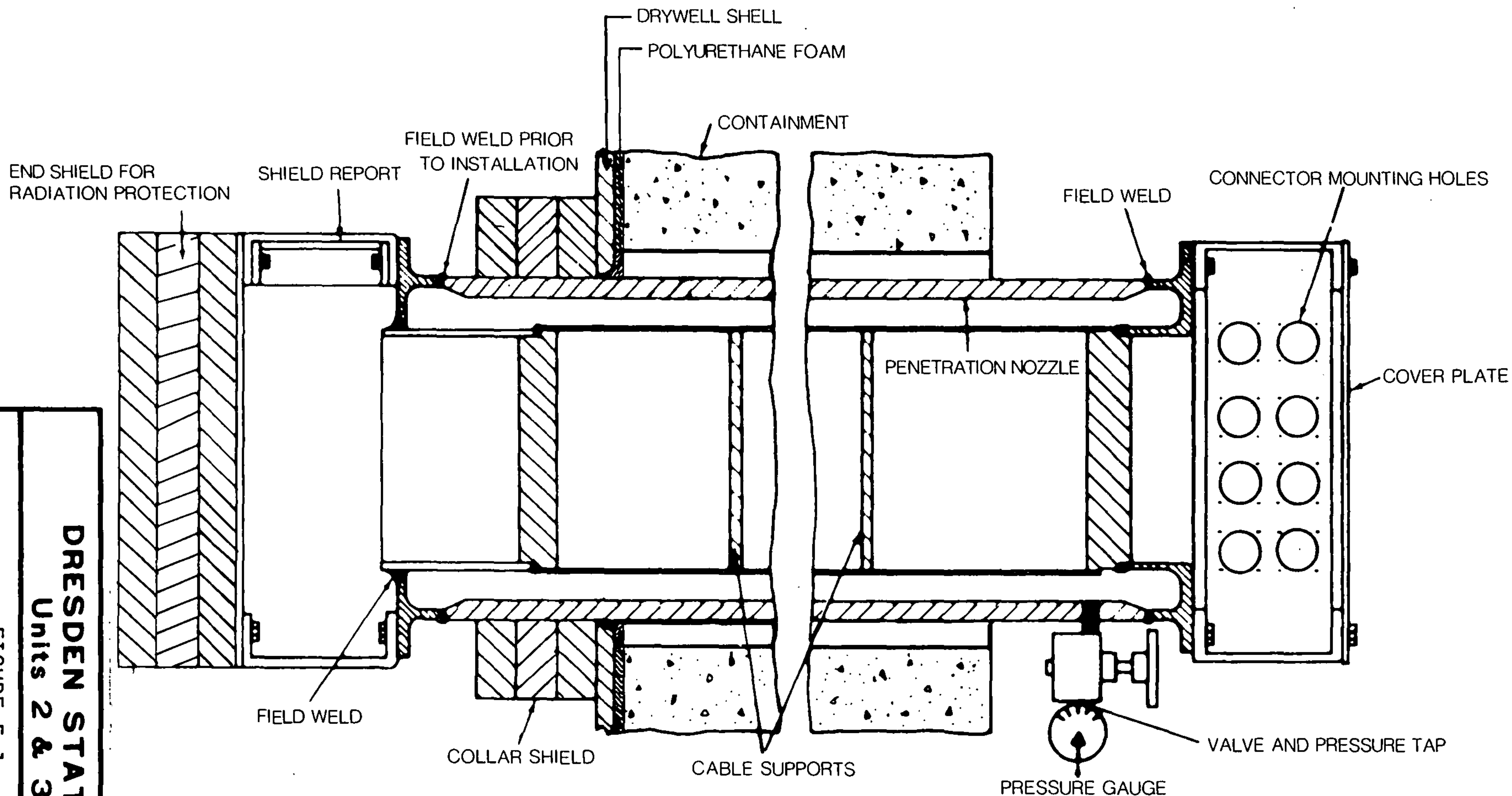
POSSIBLE EFFECTS OF A FIRE ON UNIT 3

SAFE SHUTDOWN EQUIPMENT

EQUIPMENT	EFFECT
M03-1301-1	No effect. This valve is normally open and must remain open for hot shutdown. The cables passing through the penetration supply power to the valve motor and control a limit switch. A fault in these cables or a loss of the cables will not change the valve position.
M03-1301-4	No effct. This valve is normally open and must remain open for hot shutdown. The cables passing through the penetration supply power to the valve motor and control a limit switch. A fault in these cables or a loss of the cables will not change the valve position.
M03-2301-4	No effect. This valve is normally open and must remain open for hot shutdown. The cables passing through the penetration supply power to the valve motor and control a limit switch. A fault in these cables or a loss of the cables will not change the valve position.
3-203-3A	A fire that affects these cables could disable the Target Rock valve. However, the mechanical function of this valve and the safety valves will be available for RPV pressure control.
3-203-3D 3-203-3E	A fire that affects these cables could disable these electromatic valves. However, the mechanical function of the Target Rock valve and the safety valves will be available for RPV pressure control.
A03-1301-17 A03-1301-20	In the event that a fault in one of these cables affects these valves, valve 3-1301-16 can be manually closed.
M03-1001-1A	The power feeds to this valve are routed through the penetration. In order to get to cold shutdown, the valve must be opened. After the drywell is made accessible, these valves can be manually opened.

TABLE 11.2-4 (Cont'd)

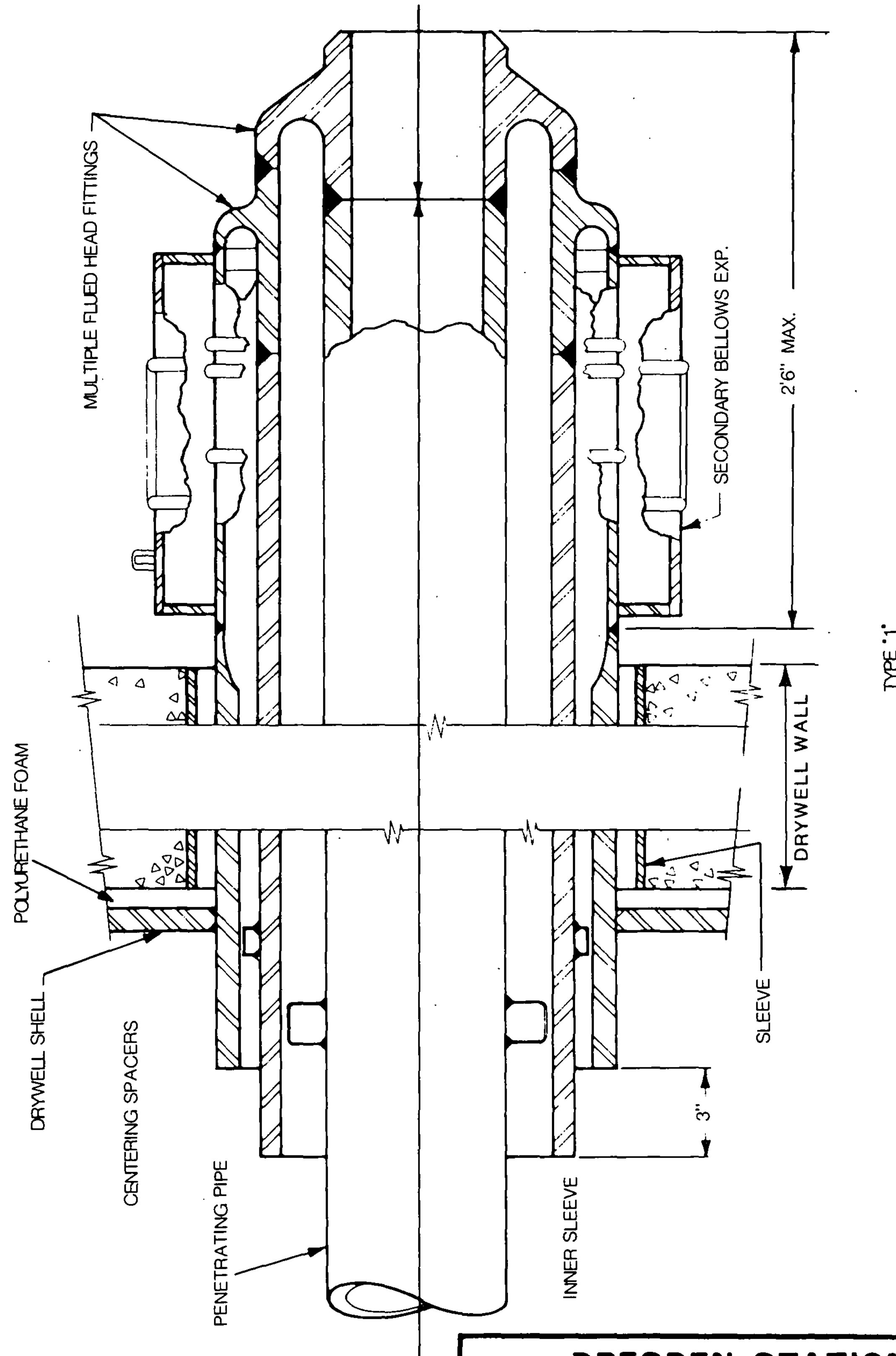
EQUIPMENT	EFFECT
M03-1001-1B	The power feeds to this valve are routed through the penetration. In order to get to cold shutdown, the valve must be opened. After the drywell is made accessible, these valves can be manually opened.
M03-0202-4A	The power feeds to this valve are routed through the penetration. In order to get to cold shutdown, the valve must be closed. After the drywell is made accessible, these valves can be manually opened.
M03-0202-4B	The proper feeds to this valve are routed through the penetration. In order to get to cold shutdown, this valve must be closed. After the drywell is made accessible, these valves can be manually opened.



DRESDEN STATION
Units 2 & 3

FIGURE E-1
TYPICAL ELECTRICAL PENETRATION
ASSEMBLY CANISTER

6850-1
04-86-389

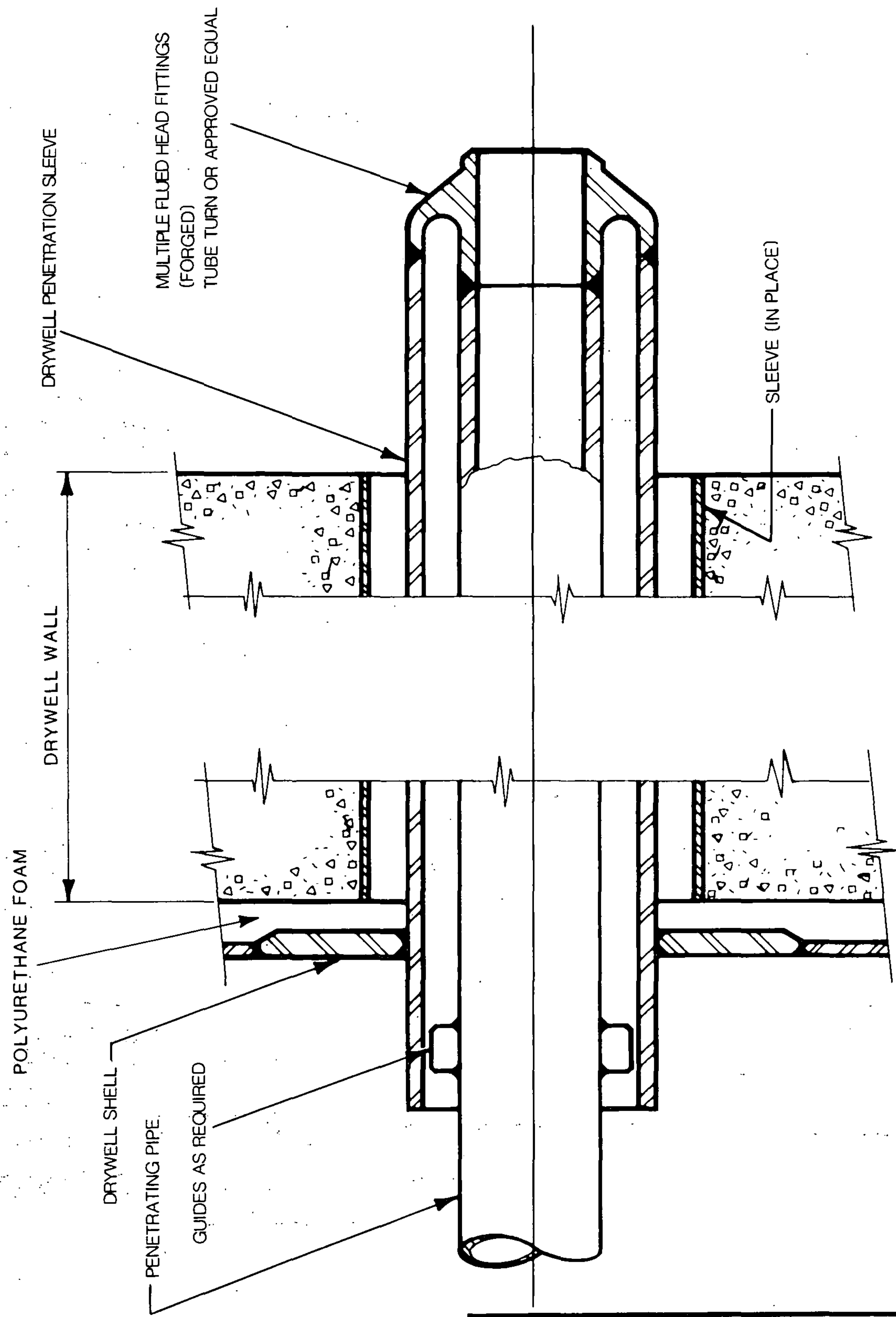


DRESDEN STATION
Units 2 & 3

FIGURE E-2

TYPICAL MECHANICAL
PENETRATION ASSEMBLIES
(SHEET 1 OF 2)

6850-2
04-86—389



DRESDEN STATION
Units 2 & 3

FIGURE E-2

TYPICAL MECHANICAL
PENETRATION ASSEMBLIES
(SHEET 2 OF 2)

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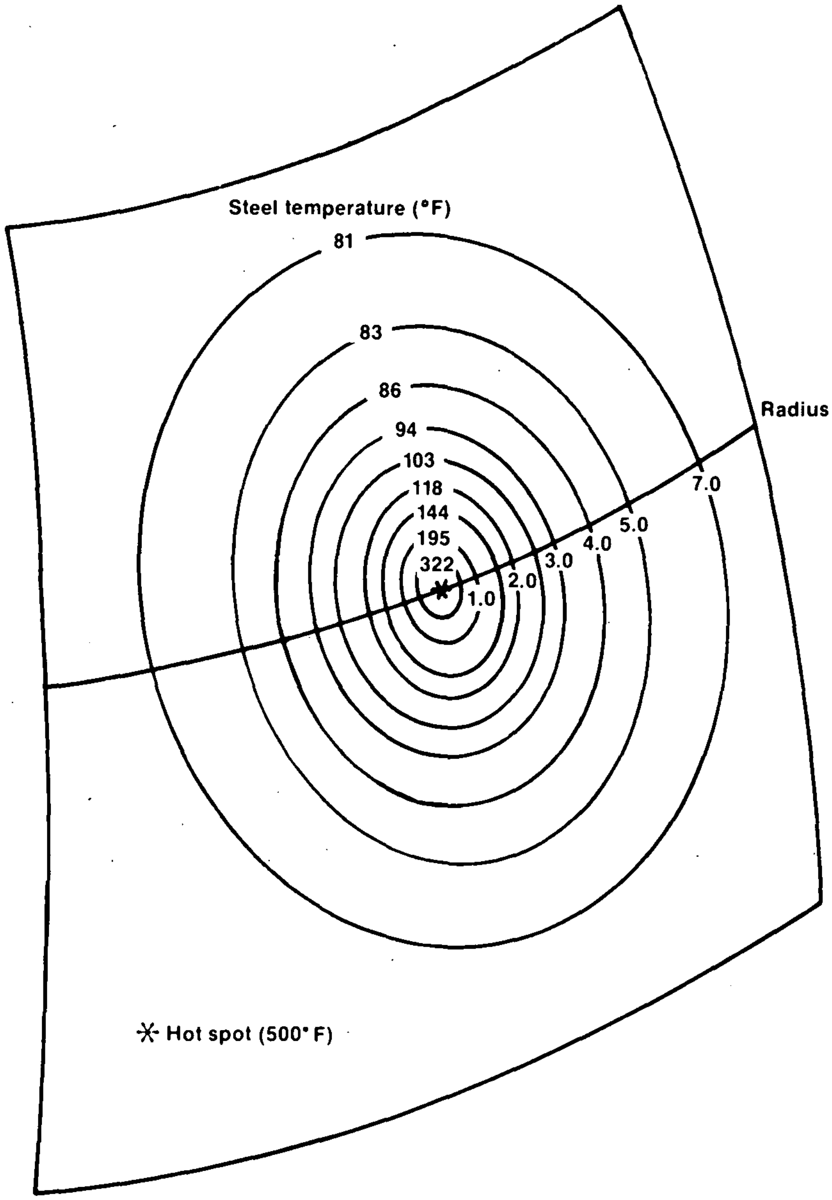

DRESDEN STATION
Units 2 & 3

FIGURE E-3

STEEL CONTAINMENT TEMPERATURE PROFILES

6800-3
03-86—30