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September 16, 1988

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

Subject: Dresden Station Unit 3
ADS Cable Modification
NRC Docket Nos. 50-249

Dear Mr. Murley:

The purpose of this letter is to provide documentation of discussions on June 7, June 17 and August 17, 1988 with the NRC regarding the ADS design basis. In addition, this letter provides the results of the ADS cable modification study.

Attachment A provides a summary of the June 7 and 17, 1988 teleconferences with the NRC regarding the ADS design basis. During those discussions, CECo and Sargent & Lundy described how the ADS system complied with its design basis. In order to enhance the system design, however, CECo again indicated the intent to implement an upgrade. This intention had been discussed earlier, immediately following the April 22, 1988 Appendix R Exit Meeting at Dresden.

Attachment B provides the modification conceptual design study which was initiated to support the upgrade.

Subsequent, to the June 7 and 17, 1988 teleconferences, the NRC notified CECo of a clarification to 10 CFR 50, Appendix R requirements and requested interim fire protection measures until the subject upgrades are implemented. CECo prepared and informally transmitted Attachment C to the NRC in preparation for a teleconference to discuss interim measures. This teleconference was held on August 17, 1988. The Attachment D meeting notes summarize

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the August 17, 1988 teleconference discussion, including proposed interim measures and design change completion schedules for Dresden Station. Region III indicated that interim measures and modification completion schedules for Quad Cities Station would be discussed at a later date.

Please contact this office should further information be required.

Very truly yours,

J. A. Silady
Nuclear Licensing Administrator

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Attachments A: Summary of NRC Conference Calls (June 7 and June 17, 1988) on ADS Design Basis

B: ADS Spurious Actuation Study

C: Draft Response to NRC Appendix R Concerns on ADS Spurious Operation

D: Notes of NRC Conference Call (August 17, 1988) on ADS Appendix R Concerns

cc: A.B. Davis - Regional Admin., RIII
B.L. Siegel - Project Manager, NRR
T.M. Ross - Project Manager, NRR

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ATTACHMENT A

I. INTRODUCTION

During the recent 10CFR50 Appendix R Audit at Dresden Station a concern was raised regarding spurious operation of the automatic depressurization system (ADS). Commonwealth Edison Co. provided the audit staff with the ADS design. Upon review of this design a specific concern was raised regarding routing of several ADS conductors in the same cable for Dresden Unit 3. Commonwealth Edison explained that the safe shutdown analysis had addressed this configuration. The electromatic relief valves were not defined as a high low pressure interface and since spurious operation of ADS requires multiple hot shorts within this cable tray, spurious operation was not considered.

Subsequent to the Appendix R audit several teleconferences were held with NRR to further discuss ADS design. NRR requested confirmation that the ADS system cable routing met the applicable design criteria for Dresden station. NRR specifically identified cable 33934 as the cable of concern. Commonwealth Edison Co. provided NRR with the ADS cable separation design basis and noted that the existing design complies with this design basis. The following paragraphs describe in detail how the existing configuration meets the original design basis. However, to improve the ADS design CECo has committed to a modification to further reduce the possibility of spurious operation of the ADS.

II. SYSTEM DESCRIPTION AND DESIGN BASIS

The ADS provides backup to the HPCI system to depressurize the reactor vessel for small area breaks. It is part of the Emergency Core Cooling System (ECCS). Collectively, the systems making up the ECCS provide redundancy to avoid undetected common failure mechanisms; however, the ADS was not designed to be protected from single failures except as described below.

This system consists of four electromatic relief valves, one Target Rock valve and the associated logic circuitry. The system can be operated manually or automatically. For automatic actuation, the system requires coincident indication of reactor water low-low level and drywell high

pressure which is maintained for a period of two minutes. Both the control logic circuits and power circuits are, for redundancy, provided with power from separate divisional dc sources. The Division I power source is from the batteries of the same unit as the automatic pressure relief system in question and the Division II power is from batteries of the opposite unit. While redundant sources of power exist, redundant feeds to these circuits do not exist and the original design of the plant did not call for them.

III. DESCRIPTION OF CABLE OF CONCERN

A. Cable and Conductors

The cable of concern #33934 is a 12 conductor control cable utilized to interlock the automatic initiation logic with the final actuation relays for both A and B relay logic strings of the Dresden - Unit 3 Automatic Depressurization System. Two separate sources of 125 Vdc control power are contained within this one 12 conductor cable.

B. Effects of Faults

Cable 33934 was analyzed to ascertain whether or not the upstream supply buses (125 Vdc Turbine Building Main Bus 3A-1 and 3B-1) would be adversely affected by a fault in this cable. The results of this analysis show that the load breakers supplying the ADS control circuitry and/or the load circuitry fuses will open upon Cable 33934 faulting. Therefore, the upstream supply buses are not endangered and coordination exists between the supply breakers to the buses and the subject load side interrupting devices (Reference Sargent & Lundy Calculation 7927-59-19-1, Rev. 0).

C. System Interaction

Since the ADS backs up the HPCI system, failures on one system should not result in the failure of the other. In 1975, an analysis was performed to determine the effect of pipe breaks outside the primary containment (Special Report No. 37, February 1975). A review of this

analysis showed that breaks in the HPCI system could not affect the operation of the ADS.

IV. RELATION OF CONCERN TO ORIGINAL DESIGN BASIS

The General Electric Company (GE), in order to illustrate compliance with the (then) proposed IEEE Std-279 and to justify any exceptions, issued Topical Report NEDO 10139, dated June 1970. This report describes the controls and instrumentation of the Reactor Protection System and each Core Standby Cooling System. A point-by-point comparison of the features of each system to the requirements of IEEE Std-279 is provided in this report.

The following are pertinent excerpts on ADS from the subject GE report:

NEDO 10139	Description
Section 3.5.1.1 (pg. 3-105)	"The electrical control circuitry is powered by DC from two separate batteries. The power supplies for the redundant control circuits (channels) are selected and arranged to maintain tripping capability in the event of electrical power circuit failure. Electrical elements in the control system energize to cause opening of the relief valves."

Section 3.5.2.6 (pg. 3-111)	However, in addition to the control logic being in a separate division complete in itself with its own station battery control and instrument bus; it has a second source of control power from the same battery as the high pressure coolant injection system, but from a separate circuit. Each valve also has automatically transferable backup power as illustrated in Figure 3-43."
Figure 3-43 (pg. 3-122)	"Note: Fuses must be coordinated with distribution breakers to avoid jeopardizing HPCI control power in the event of wireway fault."

The above ADS criteria, taken directly from the GE NEDO document, is presented above since it relates to the several NRC concerns expressed about ADS Cable 33934. These concerns, as we understand them, are the use of two separate and redundant DC supplies and the effects it might have on proper HPCI operation. The above original criteria provides for the utilization of both DC power sources and the above discussed line break analysis and coordination study ensures the availability of these redundant systems.

V. DETAILS OF ACTIONS BEING TAKEN

To further enhance ADS reliability beyond the minimum requirements set forth for the system, CECo will pursue separating the wiring presently contained within Cable 33934.

To determine the most effective means to accomplishing this objective, CECo-BWR Engineering has authorized an engineering study. As previously requested, any proposed design modification resulting from this study will be submitted to the NRC for review prior to implementation.

ATTACHMENT B

ADS SPURIOUS ACTUATION STUDY

DRESDEN - UNIT 3
QUAD CITIES - UNITS 1 & 2

TABLE OF CONTENTS

I. BACKGROUND

In response to industry questions on Appendix R of 10CFR Part 50, the Nuclear Regulatory Commission (NRC) issued Generic Letter 86-10. Section 5.3.1 of this generic letter provided guidance on which circuit failure modes had to be assumed when performing spurious actuation analyses. The following excerpt is from the subject generic letter:

Letter 86-10	Description
Section 5.3.1	"For ungrounded dc circuits, if it can be shown that only two hot shorts of the proper polarity without grounding could cause spurious operation, no further evaluation is necessary except for any cases involving Hi/Lo pressure interfaces."

Our interpretation of the above statement is that multiple hot shorts in ungrounded dc systems need not be considered unless they are in a system defined as a high/low pressure interface.

In evaluating spurious valve operations for the Automatic Depressurization System (ADS), we applied the above criteria. Since ADS is not defined as a high to low pressure interface, multiple hot shorts were not considered a credible event.

The NRC performed an Appendix R audit on April 22, 1988, at Dresden Station and raised a concern that some action (e.g., physical separation of circuits contained in some cables) should be considered for ADS.

In a July 22, 1988, telephone conference call with the NRC - Office of Nuclear Reactor Regulation (NRR), we were informed of the staff's "current" interpretation in this area. NRR stated that when evaluating spurious operations of the Automatic Depressurization System multiple

shorts between cables (even in the same tray) need not be considered, but multiple shorts within any given cable should be considered.

This interpretation, in affect, says that the probability of getting shorts between cables in the proper sequence to cause spurious operation is extremely low and is therefore not considered credible. Wherein shorts between conductors of a single cable is a credible event and should be considered.

Based upon our previously performed spurious operational analyses for the ADS relief valves and applying the above staff interpretations, we have identified on Dresden Unit 3 and Quad Cities Units 1 & 2 several cables which have conductors that will require further separation to prevent spurious operation of more than one relief valve.

II. PURPOSE

The purpose of this study was to determine how to achieve separation of the identified ADS cabling to meet the NRC's "current" circuit failure mode interpretation of Appendix R requirements. In addition, Dresden Station management has requested that separation of ADS cabling be pursued as an operational good practice due to concern that damage to one cable (whether or not fire induced) could result in the simultaneous opening of all relief valves

III. EXISTING CONDITIONS

At Dresden Station Unit 3 ADS cables 33934 and 33674, are the cables identified for which multiple hot shorts between conductors in either cable could spuriously operate multiple relief valves. Both cables are 12 conductor control cables. Cable 33934 is used to interlock the automatic initiation logic with the final actuation relays, while Cable 33674 is provided for testing purposes only. Cables 33934 and 33674 are routed in tray/conduit from Panel 903-32 located in the auxiliary electric equipment room to Panel 2203-32 located on the mezzanine floor of the Unit 3 Reactor Building. Each cable is approximately 570 feet in

length (530 feet in tray and 40 feet of conduit). Since these cables are multi-conductor there are numerous combinations of shorts/opens which could occur if the cable is damaged.

Several consequences of shorts/opens of conductors in Cable 33934 could be:

a. partial or complete impairment of ADS automatic initiation logic (manual operation unaffected) and/or,
b. actuation of circuit protective devices (fuses/breakers) to clear fault(s) or,
c. spurious actuation of multiple relief valves.

Several consequences of shorts/opens of conductors in 33674 could be:

a. bypass a portion of the automatic initiation logic for relief Valve 203-3D and/or 203-3E
b. spurious actuation of Valve 203-3D and/or Valve 203-3E
c. nothing, other than impair the test feature.

The above identified conditions do not exist on Dresden Unit 2. This is due mainly to the location of the final actuation relays of the automatic initiation logic. On Dresden Unit 2, these relays are within a panel located in the auxiliary electric equipment room while at the other units in question these relays are located within the local reactor building rack. In addition, the above identified ADS test cable (33674) is unique to Dresden Unit 3.

At Quad Cities Station Units 1 & 2, Cables 13934 and 23934 are configured such that multiple hot shorts between conductors within each cable could spuriously operate multiple relief valves. Cable 13934 is approximately 560 feet in length (485 feet in tray and 75 feet in conduit). Cable 23934 is approximately 825 feet in length (750 feet in tray and 75 feet in conduit). The function performed by the cables and the panels they run between is similar to that already described above for Cable 33934 at Dresden Unit 3.

IV. REVIEW, RESULTS, AND RECOMMENDATIONS

We have reviewed the ADS circuits for which the above identified cables are utilized and have determined which conductors we recommend to be in a separate cable(s) to meet the presently defined NRC criteria.

For Dresden Unit 3, we propose the following:

a. to route one new 7/c control cable in which the positive polarity and wiring associated with the 107A relay would be included (currently the white, red, and red-black color-coded wires of cable 33934).
b. to route another new 7/c control cable in which the positive polarity and wiring associated with the 107B relay would be included (currently the org, blue, and blue-black color-coded wires of Cable 33934).
c. to include the test circuit wiring for Valve 203-3D in one of the above cables (currently the org, blue, white-black and red-black, color-coded wires of Cable 33674).

In addition, to go one step further, we have reviewed the present tray loadings (static and thermal conditions) and have determined that these new cables can be installed in a separate tray from that which is used for Cable 33934 and 33674.

Utilizing these separate cables (33934 and 33674 plus the above described two (new) 7/c cables) will ensure that combinations of shorts or opens within any one cable will not be sufficient to initiate a spurious blowdown of multiple relief valves.

Similar changes, to that which is described above, are also recommended for Quad Cities Units 1 & 2.

NOTES:

1. Engineering includes: Preliminary and Final Project Plans II & III, equipment requirement schedules, designing the routing and supports for two 7/c cables per unit, Modification Design Packages, walkdowns, and revise/issue 20 drawings per unit.

2. Labor includes: Installing two cables and its associated conduit and supports, cable terminations, wall/floor seals and required testing.

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ATTACHMENT C

DRESDEN STATION
QUAD CITIES STATION

08-03-88

DRAFT RESPONSE TO NRC APPENDIX R CONCERNS ON
ADS SPURIOUS OPERATION

In a recent teleconference, between Commonwealth Edison Co. (CECo) and the NRC, the NRC stated that the current staff interpretation of Appendix R to 10CFR Part 50 and its clarifications when evaluating spurious operation of the automatic depressurization (ADS) system, is that multiple cable to cable hot shorts need not be considered while multiple hot shorts within a cable should be considered. The Dresden and Quad Cities evaluation was performed prior to this interpretation and does not consider multiple hot shorts (e.g. cable to cable or within cable) unless the valves were a high/low pressure interface. The four electromatic relief valves and one target rock valve which are actuated by the ADS are not defined as a high/low pressure interface. At both stations cables exist for which multiple hot shorts of conductors within these cables, could cause spurious actuation of the ADS.

Based on the current staff interpretation of multiple hot shorts mechanisms, spurious operation of the ADS should be considered. CECo has initiated a modification study to further reduce the potential for spurious operation of the ADS. This modification study is a result of station and NRC concern that this configuration should be improved. CECo has provided documentation that the existing configuration meets the original design basis. The purpose of this letter is to discuss the station features which minimize the potential for spurious operation concurrent with loss of all reactor water makeup and provide a means to mitigate spurious operation if it occurred.

At Dresden Station Unit 3 cables 33934 and 33674 are associated with the ADS for which multiple hot shorts between conductors in each cable, could spuriously operate multiple relief valves. Cable 33934 is used to interlock the automatic initiation logic circuitry with final actuation relays, while cable 33674 is provided for testing purpose only. Cables 33934 and 33674 are routed through fire zones 2.0, 8.2.4, 8.2.5.C, 8.2.6.C and 1.1.1.3. Each of these fire zones is provided with fire detection and/or fire suppression in the areas where the cables are routed. The protection features available in

each fire zone are discussed in Attachment A1.

The above identified condition does not exist on Dresden Unit 2. This is due mainly to the location of the final actuation relays of the automatic initiation logic. On Dresden Unit 2, these relays are within a panel located in the auxiliary electric equipment room, while at the other units in question these relays are located within a local reactor building rack. In addition, the above identified test cable is unique to the Dresden Unit 3 automatic depressurization system.

Dresden station presently controls transient combustible by means of Dresden Administrative Procedure (DAP) 3-3. This procedure requires the fire marshal to review transient combustible prior to introduction in the plant. This review will specify what type of protective measures that must accompany the introduction of the combustible. In addition, the fire marshal can set limits on the amount of combustibles brought into an area and the time which they can remain there.

Ignition sources, ie, heat sources, used in the plant are controlled through use of DAP 3-2. This procedure requires the areas where heat sources are used to be evaluated by the fire marshal via inspection that adequate protection measures are in place prior to and during the particular activity.

At Quad Cities Station Units 1 and 2 cables 13934 and 23934 associated with the ADS are configured such that multiple hot shorts between conductors within each cable, could spuriously operate multiple relief valves. Cable 13934 is routed through fire zones 8.2.7.A, 8.2.7.8, 1.1.1.3 and 6.3 and cable 23934 is routed through fire zones 8.2.7.D, 1.1.2.3, 8.2.5 and 6.3. These zones contain fire detection and/or fixed automatic suppression. A description of the fire protection features of each fire zone is given in Attachment B1.

Control of transient combustibles at Quad Cities station is accomplished administratively under procedure QAP 1700-1 "Flammable & Combustible Material Control" which requires fire marshal review and approval of significant transient combustibles loadings with respect to amount, type and proposed placement. Welding, cutting and other types of hot work are controlled by QMMP 1510-21 "Fire Prevention for Welding & Cutting" which requires a welding

job checklist be completed before work commences. This checklist is reviewed later by the fire marshal. This permit provides detailed information about the job to facilitate the Fire Marshals review, and it specifies the actions required to ensure safe completion of the hot work.

In addition to the features which minimize the potential of a severe plant fire, safe shutdown procedures at both stations specify an early action which direct the operator to remove power to all four electromatic relief valves and the target rock valve. This action ensures that all five valves are disabled until they are needed.

Commonwealth Edison believes that based on the fire protection features provided and the control of combustibles and ignition sources, it is a sufficiently low probability to have a severe plant fire which causes spurious operation of ADS and damages all reactor water makeup sources. Furthermore, even in this unlikely event, Commonwealth Edison has safe shutdown procedures which direct the operator to disable all four electromatic relief valves and the target rock valve and reestablish reactor water makeup. Based on the above features, CECo believes that modifications to reduce even further the possibility of spurious operation of ADS could be scheduled to be completed in a timely manner.

ATTACHMENT A1

Dresden Station Fire Protection Features

Fire Zone 2.0

This is the Control room. Ceiling level ionization detectors are provided through the room. In addition, this room is continuously manned and portable fire extinguishers positioned throughout the room will allow immediate response to any fire.

Fire Zone 8.2.4

This is the Unit 3 cable tunnel. This fire zone is protected throughout by smoke detection and a wet-pipe sprinkler system including closed spray nozzles to protect the cable trays. Manual fire fighting equipment is available on the ground floor of the turbine building.

Fire Zone 8.2.5.C

This is the central area of the turbine building ground floor. The cables are routed in the area bounded by column/row 44-45/F-H. This portion of the fire zone is protected by smoke detection and a wet-pipe sprinkler system. Manual hose stations and portable fire extinguishers are available within close proximity to the cables.

Fire Zone 8.2.6.C

This is the central area of the turbine building mezzanine floor. The cables are routed in the area bounded by column/row 44-45/H. Smoke detection and a wet-pipe sprinkler system protects this portion of the zone. Manual hose stations and portable fire extinguishers are located within close proximity to the cables.

Fire Zone 1.1.1.3

This is the mezzanine floor of the Unit 3 reactor building. Smoke detectors are located throughout the area where the cables are routed. In addition, manual hose stations and portable fire extinguishers are located throughout the floor

ATTACHMENT B1

Quad Cities Station Fire
Protection Features

Fire Zone 1.1.1.3

This is the mezzanine floor of the Unit 1 reactor building. Smoke detectors are installed throughout the areas of this floor where Cable 13934 is routed. In addition, portable fire extinguishers and four hose stations, each equipped with 100 feet of hose, are located in the zone.

Fire Zone 1.1.2.3

This is the mezzanine floor of the Unit 2 reactor building. Smoke detectors are installed throughout the areas of this floor through which Cable 23934 is routed. In addition, portable fire extinguishers and hose stations, each equipped with 100 feet of hose, are located in the zone.

Fire Zone 6.3

This is the auxiliary electric equipment room. Ionization detectors are located throughout the fire zone. In addition, portable fire extinguishers are located in the zone.

Fire Zone 8.2.5

This is the Unit 2 cable tunnel. Ionization detectors and a wet-pipe sprinkler system are located throughout this fire zone. Closed head directional nozzles are provided for the individual cable trays. Manual

suppression systems have not been installed in the tunnel, hose stations, equipped with 100 feet of hose, and portable fire extinguishers are located in the fire zones above.

Fire Zone 8.2.7.A

This is the south end of the turbine building. Fire detectors are installed above those areas where cable 13934 is routed. In addition, water hose stations, a CO_2 hose reel and portable fire extinguishers are located within this fire zone.

Fire Zone 8.2.7.B

This is the south-central portion of the turbine building. An automatic wet-pipe sprinkler system protects this zone. In addition, hose stations and portable fire extinguishers are present in this zone.

Fire Zone 8.2.7.D

This is the north-central portion of the turbine building. Cable 23934 is routed through the area bounded by column/row 7-8/G-H. This is the northeast corner of the high-pressure heater bay. Ionization detectors and wet-pipe sprinklers protect this area. Fire hose stations and portable fire extinguishers are located throughout this zone.

ATTACHMENT D

SARGENT & LUNDY
ENGINEERS
CHICAGO

ATTACHMENT D

Project Nos. 7927-59
7923-46

Commonwealth Edison Company
Dresden Station - Unit 3
Quad Cities Station - Units 1 & 2

Notes of NRC Conference Call
on August 17, 1988
Subject: Automatic Depressurization
System (ADS) 10CFR Part 50 Appendix R Concerns

THOSE PARTICIPATING:

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M. E. Hill	Sargent & Lundy (S&L)

1. Purpose

The purpose of this telephone conference call was to discuss proposed interim fire protection measures being considered by Dresden Station management. These actions are necessitated based upon the NRC's "current" interpretation of credible ADS cable fault mechanisms and CECo's commitment to perform future modification work to address the NRC concerns. Mr. J. Holmes (NRC) did perform a site inspection of the affected ADS cables and their routing on August 15, 1988.

August 22, 1988

2. Modification Status

CECo stated that the proposed Dresden Unit 3 modification to rectify the ADS spurious actuation concerns raised by the NRC is currently scheduled for the next 18 month outage (i.e., the fall of 1989).

CECo stated that they will attempt to accelerate the modification process and install the changes for Unit 3 during the upcoming required dual unit outage portion of the Unit 2 refuel outage in November/December of this year.

3. Interim Measures

All areas, through which the subject cables are routed, contain automatic suppression and detection systems except for the mezzanine floor of the Dresden Unit 3 Reactor Building which only has a detection system.

Therefore, the following interim measures are being implemented for the affected areas of the Reactor Building Mezzainine floor:

a) The fire marshall will declare the area a combustible free zone and inform appropriate personnel, update the necessary documentation, and adequately mark the area.

b) A portable cart with fire suppression equipment will be positioned within the area.

c) A combustible loading inspection will commence on a per shift basis by the station operators.

All of the above actions will commence immediately and be in effect until the actual modification is installed and declared operational.

The NRC found the above fire protection actions acceptable for the interim if the modification is installed this year.

If for some reason the modification does not get implemented this year, the NRC will (at that time) review these interim actions to ascertain if the measures are sufficient until the modification is installed in late 1989 .

CECo noted that ADS cabling changes will also be required at Quad Cities Units 1 & 2 and that similar interim measures can be implemented. The NRC responded that their review to date was only for Dresden Station and that they will (in the near future) review the situation at Quad Cities Station and only then determine the level of interim measures they will find acceptable.

Action: (CECo) Implement above interim fire protection measures immediately.

Action: (S&L) Proceed to schedule the proposed ADS modification work for Dresden Unit 3 for the upcoming November 1988 outage period.

M. E. Hill

M. E. Hill

MEH:jjs
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