ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8912080140 DOC.DATE: 89/11/29 NOTARIZED: NO DOCKET #
FACIL:50-331 Duane Arnold Energy Center, Iowa Electric Light & Pow 05000331
AUTH.NAME AUTHOR AFFILIATION
MINECK,D.L. Iowa Electric Light & Power Co.
RECIP.NAME RECIPIENT AFFILIATION
DAVIS,A.B. Region 3, Ofc of the Director

SUBJECT: Forwards response to notice of violation noted in Insp Rept 50-331/89-19.Corrective actions:compehensive reinspection.

DISTRIBUTION CODE: IE01D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 36
TITLE: General (50 Dkt)-Insp Rept/Notice of Violation Response

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD3-3 PD	1	1	HALL,J.R.	1	1
INTERNAL:	ACRS	2	2	AEOD	1	1
	AEOD/DEIIB	1	1	AEOD/TPAD	1	1
	DEDRO	1	1	NRR SHANKMAN,S	1	1
	NRR/DET/DIR 8H3	1	1	NRR/DLPQ/LPEB10	1	1
	NRR/DOEA DIR 11	1	1	NRR/DREP/PEPB9D	1	1
	NRR/DREP/PRPB11	2	2	NRR/DRIS/DIR	1	1
	NRR/DST/DIR 8E2	1	1	NRR/PMAS/ILRB12	1	1
	NUDOCS-ABSTRACT	1	1	OE LIEBERMAN,J	1	1
	OGC/HDS2	1	1	REG FILE 02	1	1
	RES MORISSEAU,D	1	1	RGN3 FILE 01	1	1
EXTERNAL:	LPDR	1	1	NRC PDR	1	1
	NSIC	1	1			

R I D S / A D D S

R I D S / A D D S

TOTAL NUMBER OF COPIES REQUIRED: LTTR 27 ENCL 27

Iowa Electric Light and Power Company

November 29, 1989

NG-89-3421

Mr. A. Bert Davis
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Duane Arnold Energy Center
Docket No.:50-331
Op. License No: DPR-49
Environmental Qualification Issues
Reference: Letter from D. Mineck (Iowa Electric) to A. Davis (NRC),dated October 20, 1989 (NG-89-3121)
File: A-103, A-64

Dear Mr. Davis:

This letter and attachments describe the actions that we have taken in response to the recently-discovered questions about the environmental qualification of electrical components at the Duane Arnold Energy Center (DAEC), as committed in the referenced letter. The safety significance of these questions is also addressed. Attachment 1 is our response to a Notice of Violation transmitted with Inspection Report 89-019. Attachment 10 sets out our assessment of root causes of the environment qualification problems and identifies the corrective actions that will be taken to prevent their recurrence.

Please note that much of the information contained in the attachments was presented in the referenced letter and discussed with your staff at the enforcement conference on November 8, 1989. The information is repeated in the attachments to this letter for completeness and ease of reference.

IE01

Should you have any additional concerns regarding these issues, please contact this office.

Very truly yours,

Daniel L. Mineck
Manager, Nuclear Division

DLM/NKP/pjv+

Attachments:
(1) Response to Notice of Violation Transmitted with Inspection Report 89-019
(2) Reverification of Environmental Qualification of AMP and Thomas & Betts (STAKON) Splices
(3) Potential Submergence of Electrical Components Located Above the Flood Level
(4) Qualification of Terminal Blocks in Junction Boxes with Top-Entry Conduit
(5) Qualification of Taped Splices in Instrument Circuits
(6) Equipment Qualification of Motor-Operated Valves (MOVs)
(7) Environmental Qualification of Tailpipe Pressure Switches
(8) Environmental Qualification of Victoreen Radiation Monitors
(9) Cumulative Effect of EQ Deficiencies
(10) Root Causes and Corrective Actions to Prevent Recurrence

cc: U. S. NRC Document Control Desk (Original)
N. Peterson
L. Liu
L. Root
R. McGaughy
J. R. Hall (NRC-NRR)
NRC Resident Office - DAEC
Commitment Control No. 890355, 890389

Iowa Electric Light and Power Company
Response to Notice of Violation
Transmitted with Inspection Report 89-019

NRC NOTICE OF VIOLATION

10 CFR 50 Appendix B, Criterion XVI, requires, in part, that measures be established to assure that conditions adverse to quality, including nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The corrective action taken shall be documented and reported to appropriate levels of management.

Contrary to the above, Iowa Electric (IE) failed to perform adequate corrective action in that the licensee failed to correct all instances in which AMP butt splices were installed in an unqualified configuration. An EQ walkdown performed August 7, 1989, by the licensee, identified six AMP butt splices located in a radiation harsh EQ environment that had not been taped in accordance with the licensee's previous commitments and the EQ program.

This is a Severity Level IV violation (Supplement ID).

RESPONSE TO NOTICE OF VIOLATION

1. Corrective Actions Taken and the Results Achieved:

   On August 7, 1989, as part of an Environmental Qualification inspection in response to NRC Information Notice 89-57, six improperly insulated AMP butt splices were identified in an electrical box on a vendor-supplied instrument rack. The splices are associated with a pressure switch, PS-1925B. On August 10, 1989 the six unwrapped AMP butt splices were properly insulated in accordance with the Duane Arnold Energy Center environmental qualification taping procedure.

2. Corrective Actions to be Taken:

   A comprehensive reinspection/walkdown of condulets, field option boxes, junction boxes, etc. associated with environmentally-qualified equipment (in both high radiation and high energy line break areas) was conducted. The scope and results of these inspections are described in Attachment 2 to the letter which transmits this Response. In addition, a discussion of the root cause of the failure of prior efforts to resolve this issue and the corrective actions to prevent their recurrence is included in Attachment 10.

3. Date When Full Compliance Will Be Achieved:

   Full compliance was achieved prior to restart from the Fall 1989 Maintenance Outage on October 20, 1989.

Issue Title: Reverification of Environmental Qualification of AMP and Thomas & Betts (STAKON) Splices

Issue

During performance of corrective maintenance on September 19, 1989, two untaped AMP splices were found by Iowa Electric Instrument Technicians in an electrical circuit for an Environmentally-Qualified (EQ) component. This equipment is located in the Drywell, which is an EQ-harsh environment (i.e., either a High Energy Line Break (HELB) area or a high-radiation-only area). This discovery raised questions about the reliability of earlier inspections which were intended to identify all such splices.

Actions Taken

A reverification program was developed and implemented to ensure that all electrical splices in EQ circuits are properly insulated in accordance with the DAEC EQ program. Written instructions for the re-inspection included a list of the equipment to be inspected; the composition of the inspection teams; the method of inspection to be used (hand-over-hand); the training instructions for the inspection teams; and the requirements for documenting the results of the inspections. This re-inspection effort was nearly complete when an NRC inspector found errors in the re-inspection documentation during an inspection on September 29, 1989. The NRC inspector also raised other EQ-related questions. As a result of these inspection findings, we re-evaluated our inspection program and made further improvements to increase our level of confidence in the program's effectiveness. These improvements were formalized into a Project Quality Plan (PQP). The following significant improvements were made: formation of a dedicated project organization composed of personnel from various departments (Maintenance, Quality Control, Design Engineering, Systems Engineering, EQ Engineering, Quality Assurance, Licensing and Technical Support); imposition of additional administrative controls for the identification, performance and documentation of the work items; augmentation of inspection teams (two engineers were added to each team to assist in documenting the results of the inspections, and to resolve discrepancies in the field); and, conduct of a second re-inspection, which utilized a "double-blind" method, similar to that used to verify system valve line-ups during plant startup. In our version of the double-blind method, one engineer with each team had the results of the first re-inspection, while the other team members were "blind" to these results. If the results of the first and second re-inspections differed, the engineer attempted to resolve the discrepancy in the field and documented that resolution on the inspection documents. If the discrepancy could not be resolved in the field or a deficiency was found, then the item was brought back to the project organization for further evaluation and final resolution. Each such item was logged and tracked to completion. In addition, after the inspections were completed, the inspection documentation was independently reviewed by a Quality Control Engineer and an EQ Engineer to ensure that the results of the re-inspections were properly documented; all discrepancies between the first and second re-inspections were satisfactorily resolved; all deficiencies were identified and appropriate follow-up actions taken, e.g., corrective maintenance and/or engineering evaluation.

Results

The first re-inspection found twelve untaped splices in addition to the two originally found during maintenance (i.e., a total of fourteen were discovered). Of these fourteen splices, nine were of the Thomas & Betts (STAKON) type and the remaining five were AMP butt splices. With the exception of the splices initially discovered in the Drywell, all splices were found in areas designated EQ-harsh for radiation only. The second re-inspection found no additional untaped splices in EQ circuits. (Note: other deficiencies were found during the second re-inspection and are discussed in other attachments.)

All the improperly-insulated splices have been corrected in accordance with the DAEC EQ Program.

Safety Significance

The following EQ components were found to have AMP splices that lacked the qualified insulation material.

Plant ID	Description	No. Splices
ZS-4306	Containment Purge Inlet Valve Position Switch	3
SV-4639	Recirculation System Sample Line Isolation Valve	2*

* - Splices discovered during maintenance on September 19, 1989.

ZS-4306

The containment purge inlet valve position switch (ZS-4306) is located in the RHR Valve Room. Its post-accident function is to provide indication of valve position, as required by Regulatory Guide (RG) 1.97. The purge valve is normally closed and, therefore, the normal indication for the position switch will be the closed position. Following an accident the operators need to verify that the purge valve is in the closed position to assure that containment isolation function has been completed.

The position switch is required to be operable for one hour following a Loss of Coolant Accident (LOCA) in the Drywell. The only postulated harsh parameter is a radiation dose of 1.3E06 Rads. The one hour operating time is conservative because operators will verify containment isolation following a LOCA within a few minutes. (Note: The DAEC EQ program assumes a standardized operating time of one hour for all components with actual operating times of less than one hour.) In addition, there is a redundant inboard purge inlet isolation valve that was operable. Only one of the valves is necessary to accomplish the post-LOCA containment isolation.

Our evaluation of the AMP splices associated with ZS-4306 concludes that they are qualified for their radiation-only environment. Either of two types of AMP splices could have been installed under the DAEC EQ Program: AMP nylon-insulated splices or PVDF-insulated (KYNAR) splices. The qualification of the AMP PVDF splices for aging and radiation was documented in the DAEC qualification files (QUAL-A602-00). The qualification of the nylon-insulated splices to the required (thermal aging and radiation) parameters was established by engineering analysis. In addition, the qualification test report contained in the 3M Tape Qualification Report documented qualification of the nylon-insulated splices for aging and radiation. Following the taping of butt splices performed in 1986 and 1987, the AMP documents were considered no longer necessary and were sent to archives as historical records.

The maximum room temperature in the RHR valve room is 140°F and the normal 40-year dose plus accident dose is 1.3E06 Rads. These splices can be qualified to these parameters and there is, therefore, no reason to suspect that they would not perform their post-accident function.

There is no mechanistic failure postulated for these splices under the limited harsh parameters to which they will be exposed. However, if total failure of the splice insulation is assumed, the result will be a loss of indication. The valve associated with this position switch is normally closed and fails closed. There is no postulated failure mode for the position switch that would cause the associated purge valve to open. Therefore, there is minimal safety significance to a postulated loss of indication.

<u>SV-4639</u>

SV-4639 is associated with the inboard containment isolation valve (CV-4639) on the recirculation system sample line. While this line does permit sampling of the reactor coolant, the line and its associated valves are not part of the Post-Accident Sampling System (PASS). The function of CV-4639 is to perform post-accident containment isolation. This valve is normally open/energized. These valves are redundant to SV-4640 and CV-4640, which perform the outboard isolation function on the sample line. The valves were originally included in the EQ Program because of the potential for the valve to be in the open position when a LOCA occurs. This position was taken because it is the most conservative. The operating time was specified as one hour (the shortest specified for any EQ component) although the valve will perform its post-accident function within seconds following an accident. Once the valve closes, it has performed its required function and there is no requirement to reopen the valve during any accident scenario.

The solenoid valve (SV-4639) receives various isolation signals when accident conditions are detected. The solenoid deenergizes and spring pressure changes the valve position, thereby isolating air to the control valve (CV-4639) and venting the air supply line to the control valve. The control valve, having its air supply line isolated and vented, closes under spring pressure isolating the sample line and thereby performing its containment isolation function. Thus, this valve fails safe upon loss of electrical power.

The recent inspection identified untaped butt splices on the solenoid coil lead wires. There are no electrical failure mechanisms associated with the splices on the lead wires that would prevent the valve from closing. Once the valve is deenergized, there is no electrical failure mechanism that could reenergize the valve as a result of the failure of the butt splices on the lead wires. Therefore, the post-accident function of SV-4639 does not depend on the qualified status of the butt splices on the lead wires. Based upon the above analysis, we have concluded that the electrical components for SV-4639 could be eliminated from the DAEC EQ Program.

The following components were found to have with T&B (STAKON) splices which lacked the qualified insulation material.

Plant ID	Description	No. of Splices
SV-4334A& ZS-4334A	Containment Isolation Valve and Position Switch for the Torus Spray Header N_2 Supply	5
SV-8110B	Containment Isolation Valve for the Drywell Radiation Monitoring and Torus Atmosphere Sample Return Line	2
ZS-5825A	Standby Gas Treatment System Air Intake Valve Position Indication	1
ZS-5825B	Standby Gas Treatment System Air Intake Valve Position Indication	1

SV and ZS-4334A

SV and ZS-4334A are a Target Rock solenoid valve and a position-indicating switch respectively. These components have been included in the EQ program because they perform, and provide indication of, a containment isolation function and are required to remain functional for thirty days following a LOCA in the Drywell. The components are associated with the Torus spray header nitrogen supply isolation valve and are located in the Torus Room.

The harsh parameters for which the components are required to be qualified are thermal aging and radiation exposure during normal and accident conditions. The maximum post-accident temperature is specified as 140°F. The normal plus accident radiation dose is specified as 1.2E07 Rads.

T&B STAKON splices are nylon-insulated crimp connectors that are used in control wiring applications at the DAEC. The nylon insulation can be qualified for the parameters identified above. An engineering analysis was performed to document this following the identification of the use of these splices in 1986. In addition, the nylon material is similar to material successfully tested by Commonwealth Edison and documented in the test report contained in the 3M Tape Splice Qualification file. Following the splice taping efforts performed in 1986 and 1987, these documents were considered no longer necessary and were sent to archives as historical records.

The effect of radiation on these splices is a decrease in the mechanical properties of the insulation material. However, the electrical properties of the material are not adversely affected at the doses expected in this application (1.2E07 Rads) because the splices do not require continued mechanical strength to perform the required function of electrical insulation during post-accident conditions. The only failure mechanism exhibited during the Commonwealth Edison testing of nylon-insulated splices involved moisture and high temperature following thermal and radiation aging which caused a breakdown of the insulating properties of the splice insulation. At DAEC these splices are exposed to thermal aging and radiation only and can be qualified for these parameters. Therefore, there is no mechanistic failure mode and no reason to suspect that the splices would not perform their post-accident function. However, if a non-mechanistic or random type failure is assumed, the result would have been the loss of function of SV-4334A and the loss of position indication for the valve through the loss of ZS-4334A. If this type of failure is assumed, the solenoid would be disabled in the closed position or would have changed to the closed position when deenergized (i.e., the valve fails safe). Once disabled, the valve would not reenergize due to a failure of the splices. Therefore, the containment isolation function would have been performed even if a non-mechanistic or random failure of the splices was assumed.

The position switch (ZS-4334A) is required as a post-accident (RG 1.97) indication of solenoid valve (SV-4334A) position. The position switch performs no active safety function and need not be operable for the solenoid valve to perform its isolation function. The valve is redundant to SV-4334B which is fully qualified and is in series on the same nitrogen line.

Following the initial accident event and postulated loss of SV-4334A, it may be necessary to re-inert the torus air space. This solenoid valve would normally be reenergized and opened to provide a path for nitrogen injection through the torus spray header. If this valve is disabled in the closed position, this path will not be available. A redundant path is provided by a separate, independent supply line with two qualified solenoid valves in series (SV-4333A and B). Therefore, the safety significance of the potential failure of these five splices is minimal.

SV-8110B

Solenoid valve SV-8110B is a containment isolation valve for the Drywell radiation monitoring and torus atmosphere sample return line. The valve is a Target Rock solenoid valve located in the Torus Room. Two untaped splices were found on the solenoid coil lead wires in the condulet located at the solenoid housing.

The post-accident function of SV-8110B is to provide containment isolation following a design basis LOCA inside the Drywell. The valve is in the air sample return line to the torus and is in series with SV-8109B. A redundant air sample return path is provided by the air sample return line to the Drywell. The valve is a normally-energized, normally-open valve that fails closed when the solenoid coil is deenergized (i.e., the valve fails safe). The valve receives isolation signals to provide containment isolation and will perform this function within seconds following an accident.

The DAEC EQ program specifies a thirty day post-accident operating time for this valve in order to provide the containment air sample monitoring function of the Post Accident Sampling System (PASS). The harsh parameters that the valve and associated splices are required to be qualified for are thermal aging and radiation exposure during normal and accident conditions. The maximum post-accident temperature is specified as 140°F and the normal plus accident radiation dose is specified as 1.2E07 Rads.

If these splices are assumed to experience a non-mechanistic or random type failure, the result would have been the loss of function of SV-8110B. If the splices had failed, the solenoid coil would be deenergized. A failure of these splices would not prevent the coil from deenergizing or cause the coil to reenergize. Therefore, the containment isolation function would be performed even if a non-mechanistic or random-type failure of the splices was assumed.

The post-accident monitoring function that the valve provides would also be lost if the splices are assumed to fail. The ability to open the valve to provide a return path to the Torus for air samples would also have been disabled. However, a redundant path for air sample return is provided by an air sample return line to the Drywell. Alternatively, grab samples can be taken, in which case no return line is needed. The loss of function of this valve does not affect the ability to obtain samples from either the Drywell or the Torus, only the ability to return air to the Torus. Therefore, the safety significance of the postulated failure of these two splices is minimal.

ZS-5825A and B

Position switches ZS-5825A and B provide position indication for SV-5825A and B. SV-5825A and B are environmentally-qualified solenoid valves for air intake dampers in the Standby Gas Treatment System (SGTS). They are micro-switch position switches and are located in the Standby Gas Treatment Room. One untaped nylon-insulated splice was identified in the circuit for each switch (ZS-5825A and B).

The position switches (ZS-5825A and B) are required to be qualified because they perform a post-accident (RG 1.97) monitoring function. The switches perform no active safety function and have no impact of the operability of the SGTS intake valves for which they monitor position.

The harsh parameters for which the switches and the associated splices are required to be qualified are thermal aging and radiation exposure during normal and accident conditions. The maximum post-accident temperature is 104°F and the specified normal plus accident radiation dose is 2.1E06 Rads. The conditions to which the splices are exposed in this application are bounded by those presented in the earlier discussions regarding material properties and accident conditions.

If the splices are assumed to experience a non-mechanistic or random type failure, the result would be a loss of position indication for the SGTS air intake valves. The failure of the splices would not affect the ability of the air intake valves to perform their safety function. The position switches provide no active safety function and therefore the safety significance of the postulated failure of these two splices is minimal.

Issue Title: Potential Submergence of Electrical Components Located Above the Flood Level

Issue

A potential exists for electrical components, which are located within enclosures that do not have proper drainage, to become submerged. Such components are not environmentally qualified for that condition. For example, under the DAEC EQ program, taped splices are not qualified for submerged conditions. Therefore, it is necessary to identify all such potentially affected components and to ensure that proper drainage exists or is provided in the enclosure containing these components.

Actions Taken

In the most-recent inspection program, previously described, the teams to were instructed ensure that electrical enclosures (junction boxes, field option boxes, pull boxes, and condulets) located in EQ harsh areas had proper drainage paths. The engineering members of the inspection teams evaluated the installation geometry and determined whether the enclosure would allow moisture accumulation, i.e., some configurations had a natural drainage path, such as condulets with bottom exit points. If the enclosure was susceptible to internal flooding and had no drainage point (weephole), the team provided one. In addition, weepholes were added to enclosures in areas designated EQ harsh for radiation only. We decided to add weepholes to enclosures in both HELB and radiation-only areas even though, in many cases, an engineering evaluation of the installed geometry could have demonstrated that submergence of the components within the enclosure was not possible and, therefore, a weephole would not be needed.

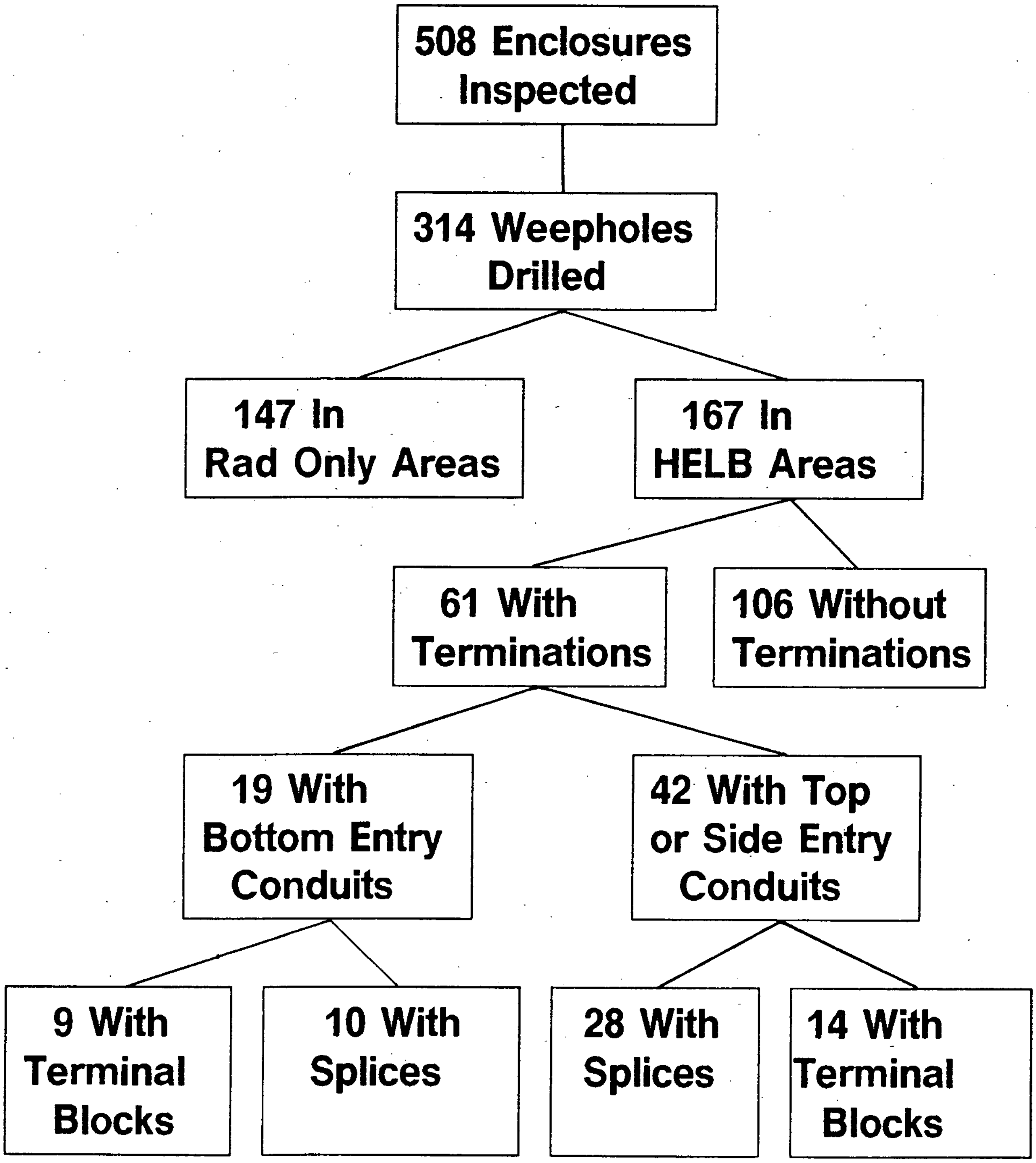
During an NRC inspection at the Clinton Power Station, a concern was raised regarding the possible submergence of end-use equipment, which was not qualified for this environment (reference NRC Information Notice 89-63). The most-recent inspection program at the DAEC documented the installed configuration of the end-use equipment for further engineering evaluation.

Results

The results of our inspection program described above identified sixty-one enclosures (condulets, field option boxes or junction boxes) that required weepholes be added in accordance with the DAEC EQ program. All such enclosures were drilled during this inspection. Of these sixty-one enclosures, thirty-eight contained EQ-insulated splices and the remaining twenty-three contained EQ terminal blocks. Twenty-eight of these enclosures were located in the Drywell and thirty-three were located in other High Energy Line Break areas. The results of this effort are shown in Figure 1.

Figure 1

Summary of Weepholes Drilled



Also, one electrical enclosure containing EQ circuits was found which had been encased in fire retardant materials in accordance with 10 CFR Part 50, Appendix R, requirements. Installation of a weephole in this enclosure would compromise the Appendix R qualification. An evaluation determined that a weephole was not required because the enclosure contains only electrical cable and no electrical splices or terminal boards. It is our position that electrical cable that has been tested in accordance with IEEE-383-74 has the capability to be submerged without any detrimental effects. We recognize that the subject of cable qualification under submerged conditions is an issue being addressed by the NRC and the Nuclear Utility Group on Equipment Qualification (NUGEQ). We are a member of NUGEQ and will be following this issue closely. We will consider further actions when a final resolution is reached.

The concern regarding moisture intrusion and possible submergence of electrical circuits in end-use equipment was addressed for instruments located in EQ harsh areas for radiation only. (Instruments that are located in EQ HELB areas are not of concern as they are: qualified for that environment (100% humidity) and are installed in the tested configuration; or, perform their safety function before the accumulation of enough moisture to affect the equipment's operability; or, have sealed enclosures to protect them against moisture intrusion.) As noted earlier, the installed configuration for the end-use equipment was documented during the most-recent inspection program. This information was subsequently reviewed for those end-use components that were not sealed against moisture intrusion. The general configuration consists of the end-use equipment connected to a field option box by a short length of flexible conduit. The wiring exits the field option box through rigid conduit. The field option box contains a weephole and any moisture entering the field option box via the rigid conduit will drain out through the weephole. Therefore, the only credible source of moisture intrusion into the flexible conduit is by condensation. Given the short lengths of flexible conduit used (approximately four to six feet), we concluded that negligible amounts of moisture can accumulate through normal condensation. Consequently, submergence of this end-use equipment is not credible at the DAEC.

Safety Significance

As discussed above, electrical enclosures containing terminal blocks or splices for EQ equipment were found to have no weephole, contrary to the DAEC EQ Program.

The specific equipment affected by these discrepancies is shown in Table 1.

The purpose of the weephole in an electrical enclosure is:

1. To prevent moisture accumulation in electrical enclosures during a pipe-break-induced harsh environment. The requirement for weepholes results from the EQ tested configuration for terminal blocks and splices. The vendors and test laboratories elected to exclude the possibility of submergence by providing a weephole in the tested enclosures.

2. To prevent the possibility of long-term accumulation of moisture within the electrical enclosure during normal operation (reference IN 89-63). Such

Table 1		
List of Affected Equipment		
Equipment ID	Function	Location
SV-4412 A, B, C	MSIV Pilot Solenoid Valves	Drywell
SV-4415 A, B, C	MSIV Pilot Solenoid Valves	Drywell
SV-4418 A, B, C	MSIV Pilot Solenoid Valves	Drywell
SV-4420 A, B, C	MSIV Pilot Solenoid Valves	Drywell
SV-4413 A, B, C	MSIV Pilot Solenoid Valves	Steam Tunnel
SV-4416 A, B, C	MSIV Pilot Solenoid Valves	Steam Tunnel
SV-4419 A, B, C	MSIV Pilot Solenoid Valves	Steam Tunnel
SV-4421 A, B, C	MSIV Pilot Solenoid Valves	Steam Tunnel
ZS-4412 A, B, C	MSIV Position Switches	Drywell
ZS-4415 A, B, C	MSIV Position Switches	Drywell
ZS-4418 A, B, C	MSIV Position Switches	Drywell
SV-4400	ADS S/RV Pilot Solenoid Valve	Drywell
SV-4401	LLS S/RV Pilot Solenoid Valve	Drywell
SV-4402	ADS S/RV Pilot Solenoid Valve	Drywell
SV-4405	ADS S/RV Pilot Solenoid Valve	Drywell
SV-4406	ADS S/RV Pilot Solenoid Valve	Drywell
SV-4407	LLS S/RV Pilot Solenoid Valve	Drywell
TE-4386 L	Drywell Average Temperature Element	Drywell
PS-4401 A, B, C	S/RV Tailpipe Pressure Switches	Drywell
MO-2238	HPCI Steam Supply Inboard Isolation Valve	Drywell
MO-1908	RHR Shutdown Cooling Inboard Isolation Valve	Drywell

Table 1 (Continued)		
List of Affected Equipment		
Equipment ID	Function	Location
SV-7605 A, B	SGTS Damper Pilot Solenoid Valves	HPCI Room
TE-2274 F	RWCU Steam Leak Detection Temperature Element	RWCU Heat Exchanger Room
TE-2263 B	HPCI Steam Leak Detection Temperature Element	HPCI Room
MO-2401	RCIC Steam Line Outboard Isolation Valve	Steam Tunnel
TE-4443 A. B, C, D	Steam Tunnel Steam Leak Detection Temperature Elements	Steam Tunnel
TE-4444 A. B, C, D	Steam Tunnel Steam Leak Detection Temperature Elements	Steam Tunnel
TE-4445 A. B, C, D	Steam Tunnel Steam Leak Detection Temperature Elements	Steam Tunnel
TE-4446 A. B, C, D	Steam Tunnel Steam Leak Detection Temperature Elements	Steam Tunnel
TE-4477 A, B	Main Steam Line Steam Leak Detection Temperature Elements	Turbine Building Heater Bay
TE-4478 A, B	Main Steam Line Steam Leak Detection Temperature Elements	Turbine Building Heater Bay
TE-4479 A, B	Main Steam Line Steam Leak Detection Temperature Elements	Turbine Building Heater Bay
TE-4480 A, B	Main Steam Line Steam Leak Detection Temperature Elements	Turbine Building Heater Bay
TE-4324	Torus Water Temperature Element	Torus Room
TE-4325	Torus Water Temperature Element	Torus Room

accumulation could result from either the condensation of moisture in the atmosphere during periods of high humidity followed by an abrupt temperature decrease or from localized system leakages (e.g., valve packing leaks).

During the most-recent inspections we found no moisture accumulation in any EQ enclosure from the source described in item 2 above. Therefore, in order to address the safety significance of an enclosure lacking a required weephole, we need only evaluate the affected equipment's operability post-accident. Specifically, only that equipment which is required to operate after exposure to high energy line break (moisture-laden steam environment) effects and having a long-term (more than a few minutes) post-accident operating time has been evaluated.

Equipment serviced by terminal blocks and/or splices within enclosures without weepholes are described below by type and function. For each equipment type, the effect of a lack of weephole on the equipment's post-accident operability (and thereby the safety significance) is evaluated.

<u>MSIV Pilot Solenoid Valves (see Table 1 for Equipment ID):</u> These solenoid valves are used to operate the MSIVs. Each of the eight MSIVs uses a set of three pilot solenoid valves (two for control and one for test purposes). Four sets are located in the Drywell and four sets are located in the Steam Tunnel. These solenoid valves are mounted on a gasket-sealed, cast aluminum electrical box which contains a terminal block for the electrical connections. No weephole was provided in these boxes. Previous evaluations had not required a weephole because the intrusion of moisture is unlikely and an earlier design configuration which utilized a low side entry conduit connection which allowed drainage. The two control solenoid valves, which keep each MSIV open, are normally energized and deenergize to close each MSIV. They are required to operate in less than ten seconds following initiation of an accident.

The EQ Program demonstrates that aging followed by exposure to a harsh environment will not prevent the solenoid valves from deenergizing, i.e. from performing their safety function. This safety function is fail safe electrically and requires EQ qualification of the mechanical components, e.g., elastomer materials, only. There are no submergence or moisture-induced failure effects at the terminal block that can prevent deenergization of the pilot solenoid valves. Therefore, these solenoid valves would have performed their safety function without weepholes in their junction box. Weepholes were, however, added as a conservative measure and for consistency (standardization) among junction boxes during the October 1989 Maintenance Outage.

<u>MSIV position switches (see Table 1 for Equipment ID)</u>: These switches are used to monitor the position of the MSIVs, four of which are in the Drywell and four of which are in the Steam Tunnel. Each of the eight MSIVs has a set of three position switches for indication, control, and testing purposes. Although only the open and closed indications are required to be EQ evaluated (i.e., RG 1.97 post-accident monitoring), all three position switches have been included in the EQ program for simplification and standardization purposes and as a conservative measure. (NOTE: The third position switch provides input to the Reactor Protection System; however, no credit for these signals is taken in any design basis events). The EQ-qualified safety function is to provide indication that the MSIVs have closed, which is a short post-accident operating time requirement. This function applies to a main steam line break accident and a design basis LOCA.

The MSIVs close in less than ten seconds and the plant control room operators confirm this indication within a few minutes following an accident. Electrical connection enclosures for three MSIV position switches did not have weepholes and additional evaluation of the operability of these enclosures is provided below.

Based on the inspection results, there was no submergence concern associated with the outboard MSIV position switches located in the Steam Tunnel and the position switches (ZS-4420 A, B, and C) for one of the four MSIVs in the Drywell. That is, all electrical enclosures supplying power to these five sets of position switches were found to have a weephole in the enclosures containing either splices or a terminal block. Therefore, all five of these position switch sets are concluded to have been operable without further evaluation.

Position switches ZS-4415A, B, C in the Drywell were found to have one electrical enclosure with two splices and no weephole. However, this box also has a bottom exiting conduit which would prevent moisture accumulation affecting the splices. This configuration is equivalent to the tested configuration and these position switches are concluded to have been operable without the enclosure weephole. A weephole was, however, added to this box for standardization.

Position switches ZS-4418A, B, and C had two electrical connection boxes without weepholes. One of the boxes has one bottom exiting conduit. The enclosed splices are considered operable because this configuration allows drainage. The other box contains two terminal blocks and three side entry conduits. However, this box is located in the Reactor Water Cleanup (RWCU) Pump Room which is a radiation-only harsh environment for a LOCA or other pipe break events in the Drywell or Steam Tunnel. The only possible HELB in the RWCU Pump Room is a RWCU line break. While MSIV position indication is not needed for this event, it has been included in the discussion for completeness. This box is mounted horizontally with the cover facing down and the terminal blocks are mounted on the back (top) of the box above the side conduit exit point. Therefore, submergence is not possible and a false or faulty MSIV position signal (although irrelevant to the RWCU HELB accident) is unlikely to result. In conclusion, based on the conduit configuration of the first enclosure and the radiation-only harsh requirement of the second enclosure, ZS-4418A, B, C were operable and consistent with the EQ file requirements.

The remaining position switch set (ZS-4412A, B, and C) had five electrical connection enclosures without weepholes. Three of these enclosures utilize a bottom-exiting conduit configuration and, therefore, submergence of the enclosed splices or terminal blocks is not a concern. The remaining two boxes contain splices and are mounted horizontally with the covers facing downward. Both of these boxes have two side-entry conduits, one of which is routed downward to a common box which did have a weephole. The remaining two side-exiting conduits are connected to entirely-enclosed raceways which will limit or prevent ingress of moisture. The only significant source of moisture intrusion is bypass around the cover gaskets, but, because the enclosures face downward, there is no credible way to accumulate any appreciable amount of moisture.

In summary, seven of the eight MSIV position switch sets are concluded to have been operable, either based on having acceptable drainage provisions or a radiation-only harsh environment. The remaining position switch set (ZS-4412A, B, and C) was likely to have functioned properly based on short operating time requirements, enclosed raceway connections, and covers facing downward. If this indication were to fail, either qualified indications of the containment isolation function are provided via position switches on the Steam Tunnel outboard isolation valves and from indication of the MSIV-Leakage Control System in operation.

These position switches also provide a signal to the Reactor Protection System (RPS) such that if predetermined combinations of MSIVs indicate closed (see UFSAR Figure 7.2-9), a reactor scram signal is generated. If a high energy line break event were to occur in the Drywell and eventually cause shorting within the junction box from accumulated moisture, the worst case effect would be a false scram signal late in the accident. Such a signal would occur after a scram had already occurred for reasons more directly related to the accident, e.g., Drywell pressure.

Reactor Steam Relief and Automatic Depressurization System (ADS) Pilot Solenoid Valves (SV-4400, -4401, -4402, -4405, -4406, and -4407). These solenoid valves are used to either manually or automatically actuate the steam relief valves to lower pressure or to depressurize the reactor vessel. SV4400, 4402, 4405, and 4406 are part of the Automatic Depressurization System (ADS) and SV-4401 and SV-4407 are part of the Low-Low-Set (LLS) function of the Nuclear Boiler system. The ADS function is required only for unisolable small break LOCAs and HPCI system failure, where it is necessary to reduce reactor system pressure so that low pressure ECCSs can be used for core cooling. It is conservatively assumed for purposes of this evaluation that during a postulated small break LOCA, the ADS function (or the decision to depressurize manually) would occur within a few hours of the accident's initiation. The LLS function is used during increasing pressure (intact pressure boundary) transients to relieve pressure to the Torus in order to balance or minimize loads on the Torus. While the LLS function is not required for pipebreak events, SV-4401 and SV-4407 were conservatively included in the EQ Program for consistency and completeness, as a backup manual capability for depressurization, and for additional reliability of the LLS function.

The following discussion describes operability of the above solenoid valves while considering the effect of the lack of weepholes in enclosures containing either a terminal block or splices.

SV-4402, SV-4405, and SV-4407 were not a concern because all electrical enclosures containing a terminal block or splices also have a bottom drainage path as a result of a bottom exit conduit configuration. This configuration satisfies the EQ moisture drainage requirement and is equivalent to the tested configuration for terminal blocks and splices. Therefore, SV-4402, SV-4405, and SV-4407 were operable for the harsh environment-effects in the Drywell.

SV-4400 has one junction box with a terminal block and one condulet with taped butt splices. The junction box has a bottom exit conduit which will prevent the accumulation of moisture. The condulet is mounted horizontally and has a side-entry conduit that will not allow a significant amount of water to accumulate. This amount of water will not submerge the taped splices or cause any degraded effects beyond what was experienced in the EQ LOCA tests for the taped splices. SV-4400 was, therefore, operable with these electrical enclosures without weepholes.

SV-4401 has one junction box with a terminal block and one condulet with splices. The junction box is vertically mounted with the terminal block inside mounted horizontally such that the box would have to be filled at least one third full before the terminal block would be affected. The junction box has both a top-entry conduit and an upper-side-entry conduit. The conduit system is entirely enclosed (i.e., it does not open up into any cable trays). The side-entry conduit rises approximately two feet before goosenecking down into the condulet mounted on the solenoid valve. The top-entry conduit has two 90° bends which route it immediately in a downward direction. Therefore, there is no source of water except through the cover gasket on the cover of the junction box. However, leakage past the gasket would permit only small amounts of water or steam to leak in, as the cover is mounted vertically on the box. Therefore the amount of moisture, if any, that would accumulate over the required operating period during a LOCA is minimal and not enough to affect operability of the terminal block. The condulet with splices is connected vertically to the solenoid valve with its cover also vertical. As discussed before, the connecting conduit system is totally enclosed. Therefore, one can reasonably assume that the taped splices would have remained acceptable over the period that ADS is required to be operable.

SV-4406 has one junction box with a terminal block and one condulet with splices. The junction box has a bottom-exit conduit which provides a path for moisture removal and is, therefore, not a concern. The condulet is vertically connected to the solenoid valve with a totally-enclosed conduit raceway system. The top entry conduit is a short gooseneck up and then a loop seal down (i.e., an "S-type" configuration) before entering a junction box. Therefore, the potential for moisture accumulation in the condulet is minimal and the solenoid valve was likely to have been operable for its assumed post-accident operating time.

In conclusion, the safety significance of not having weepholes in the enclosures for these valves is minimal for one of the following reasons: 1) the valve performs only a back-up function in a harsh environment; 2) a drainage path, such as a bottom-entry conduit, previously existed; 3) the enclosed raceway and enclosure cover gasket orientation limits or prevents the possibility of significant moisture accumulation over the required time period. Therefore, at least three of the four ADS solenoid valves were operable and a fourth (SV-4406) had a high likelihood of functioning properly.

Of the two backup, manual (and LLS) valves, one (SV-4407) was operable and the second (SV-4401) had a high likelihood of functioning properly based on its totally-enclosed raceway and short operating time.

<u>Drywell Temperature Elements (TE-4386L):</u> Eight temperature elements are used to monitor Drywell post-accident temperature. Of these eight, only one (TE-4386L) had a junction box with a terminal block or splice and no weephole. This junction box is mounted vertically and contains a vertically-mounted terminal block. The junction box also has two rear-exiting conduits which are lower than the terminal block. Both conduits have short horizontal runs and then are routed down into cable trays. It is not possible for accumulated moisture to rise to the level of the terminal block. Therefore, while the lack of a weephole would not have affected the operability of this Drywell temperature element, it was not considered to have been operable due to other EQ deficiencies (see Attachment 5).

Reactor Vessel Safety-Relief Valve Tailpipe Pressure Switch (PS-4401A, B, and C): Indication of reactor safety-relief valve position is a post-accident monitoring function, (RG 1.97) that was originally required by NUREG-0737, Supplement 1. The downstream discharge pressure of each of the eight relief valves is monitored by three pressure switches which electrically share a common terminal block and junction box. The box utilized by PS-4401A, B, and C is located in the Drywell and did not have a weephole. The other seven sets of pressure switches utilized junction boxes with weepholes.

The primary purpose of this set of instruments is to detect a stuck-open relief valve; it was included in the EQ Program for this reason. A secondary purpose of these pressure switches is to verify operation of the relief valves when they are used to reduce plant pressure.

A stuck-open relief valve will not produce a moisture-laden environment in the Drywell, as the discharge from the relief valves is piped directly to the Torus. Therefore, this event is not of concern here.

An unisolable small break LOCA would produce a moisture-laden environment which would have affected the operability of this set of pressure switches. However, alternate indications of the open relief valve, (such as Torus water temperature, reactor pressure and relief valve tailpipe temperature) are available.

Therefore, it is concluded that the lack of weephole would, by itself, not affect operability of the pressure switch for the function of detection of a stuck-open relief valve. The safety significance of this lack of a weephole for verifying relief valve operation during a small break LOCA is minimal.

HPCI Steam Supply Inboard Isolation Valve (MO-2238): This normally-open isolation valve is located in the Drywell. Its safety function during a LOCA is to close, providing containment isolation when the HPCI system is no longer able to run, i.e., after reactor depressurization. For a HPCI steam line break outside the Drywell, this valve is required to close, but for this accident and the remaining non-pipe break design basis accidents, the environment in the area of MO-2238 and its junction box is mild (i.e., no harsh parameters) and no weephole would be required.

The junction box connected to MO-2238 contains two terminal blocks and had no weephole. It has two side-entry conduits and is vertically mounted. Both conduits are entirely enclosed. As a result, there is no source of significant moisture to the junction box and, since the terminal blocks are not mounted on the bottom of the box, it is unlikely that the water level in the box would ever reach the point of affecting the terminal blocks' operability. Also, the containment isolation function would most likely occur prior to the time of any possible submergence of the terminal blocks.

If for some reason, this valve failed to close when required, there is a redundant outboard isolation valve (MO-2239) in the Steam Tunnel which would close independently and complete this safety function. Therefore, the safety significance of the lack of a weephole is minimal.

RHR Shutdown Cooling Suction Inboard Isolation Valve (MO-1908): This valve is one of two isolation valves in series in the shutdown cooling suction line between the recirculation system and the RHR pump suction line. MO-1908 is a normally-closed valve located in the Drywell. Its safety function is to remain closed during a design basis LOCA. There are no possible electrical failures in the Drywell that would cause this valve to inadvertently change position.

In the highly unlikely event that the LOCA were to occur while this valve was open, i.e, during shutdown cooling, the resulting accident conditions would be milder than the design basis LOCA, as shutdown cooling can only be initiated when reactor pressure is less than 135 psig. Hence, the driving pressure for moisture intrusion into the junction box would be lower and consequently the valve would operate prior to the accumulation of significant moisture in the junction box. In addition its redundant counterpart (MO-1909) is located outside the Drywell and would isolate the line as required.

This valve is in the primary flowpath for long-term decay heat removal. However, the decay heat removal function at the DAEC is not designed to be single failure proof and alternate flowpaths for decay heat removal are available.

The junction box connected to MO-1908 contains two terminal blocks and had no weephole. Two conduits entered the top of the junction box. This junction box is mounted vertically. The terminal blocks are mounted vertically on the back of the junction box above the bottom of the box. One of the two top-entry conduits is totally enclosed for the approximate twenty foot run to MO-1908 (vertically approximately eight feet and horizontally for the remaining twelve feet of the run). The other conduit is routed horizontally a short distance from the top of the junction box and then is routed downward into a cable tray. The only source of water following a LOCA would be condensed steam driven by the pressure generated by the accident through the open end of this conduit and into the top of the junction box. This flow would stop when the pressure in the junction box equalled the peak accident pressure (approximately ten seconds per UFSAR Figure 6.2-45). The amount of moisture which could enter in this short period of time is not likely to affect operability of the terminal blocks.

The safety significance of the lack of a weephole and the two top-entry conduits is minimal because, even in the unlikely event that this valve were required to be operated, the moisture accumulation within this junction box would have been minimal because of its relatively large size and the limited sources and driving force for moisture entry; and, due to the terminal blocks being mounted above the bottom of the box, this limited accumulation of moisture would not have affected either the power or control circuits for this valve.

However, even if the valve's operability were compromised by the EQ deficiencies, the safety significance is minimal because of the availability of an operable, redundant component (MO-1909) and the existence of alternate flowpaths for long-term decay heat removal.

<u>Offgas Retention Building Vent To Standby Gas Treatment System (SGTS) Isolation Damper Pilot Solenoid Valves</u> (SV-7605A and B): These solenoid valves control two dampers in series in the vent line between the Offgas Retention Building and the SGTS. Both pilot solenoids are in the HPCI Room and subject to the environment resulting from a possible HPCI steam line break. Both solenoid valves were found to have condulets containing splices and no weepholes.

The safety function of these solenoid valves is to change position and allow the air-operated dampers to close. This function is required on a Group III isolation, and is required for a design basis LOCA or for other accidents which require operation of the SGTS.

We conclude that the valves would have been operable during a HPCI steam line break because the safety function is not electrical in nature (i.e., they fail safe). There are no possible moisture-induced failures associated with the splices that would prevent the valve from deenergizing and changing position, allowing the dampers to isolate on loss of air.

<u>RWCU Heat Exchanger Room Steam Leak Detection Temperature Element</u> (TE-2744F): This temperature element is one of three detectors monitoring the RWCU Heat Exchanger Room outlet air temperature for RWCU steam leak detection. It was the only one of the three temperature elements which had a terminal block or splices within an enclosure without a weephole. This enclosure, however, has a bottom-entry conduit routed downward to an open cable tray. This pathway is equivalent to the tested configuration which had a weephole. Therefore, this temperature element is concluded to have been operable without a weephole in the enclosure. If this temperature detector were to fail, the safety significance would be minimal because of the two operable, alternate temperature detectors which perform the same function.

<u>HPCI Room Steam Leak Detection Temperature Element</u> (TE-2263B): This temperature element is one of seven elements which monitor HPCI Room temperature to detect a HPCI steam line leak. One of the junction boxes for TE-2263B was found to contain both a terminal block and a splice and the box had no weephole. This is a short duration safety function such that the temperature detector will detect heat and trip the valve isolation circuitry before the terminal block and splice experience any submergence effects from an accident.

The enclosure has two side-entry conduits and one top-entry conduit. The top-entry conduit is routed directly out of the area through a sealed penetration. Therefore, the effects of the postulated line break in the HPCI Room will not result in moisture entering the box via the top-entry conduit.

One side-entry conduit runs horizontally to a cable tray. The other side-entry conduit is routed downward to a pull box. These configurations will prevent moisture from dripping directly onto the terminal block. In addition, the wires are routed upward to the block such that moisture will not travel along the wire and onto the terminal block.

If this temperature detector were to fail, additional redundancy from the other six temperature elements, which were operable, would ensure system isolation, if required. Therefore, the safety significance of the lack of a weephole was minimal.

<u>RCIC Steam Line Outboard Isolation Valve</u> (MO-2401): This steam line isolation valve is located in the Steam Tunnel and is normally open. The safety function of MO-2401 is to isolate the RCIC system during a RCIC steam line break.

The circuitry for MO-2401 had two electrical connection boxes without weepholes. The first enclosure contains a terminal block and has two side-entry conduits. During a RCIC steam line break, system isolation occurs within seconds, well before submergence could affect the terminal block associated with the valve. The conduit raceway system connected to the junction box is entirely enclosed. Therefore, moisture ingress would be very limited and would not fill the junction box to the point of affecting the terminal block connections. If the terminal block connection were to fail, the redundant inboard isolation valve, MO-2400, would remain operable and isolate the RCIC system when required.

The second electrical enclosure contains five butt splices insulated with Raychem heat-shrink tubing. While the enclosure has a bottom-exiting conduit, which is equivalent to a weephole for drainage, Raychem-insulated splices in this box are concluded to have been operable.

In conclusion, the safety significance of the lack of weepholes on operability of MO-2401 was minimal based on a pre-existing drainage path in one of the boxes, and the short term operability requirements and limited potential for moisture ingress into the second. A redundant operable valve also exists in the Drywell.

Steam Leak Detection Temperature Monitoring System (TE-4443 A thru D; TE-4444 A thru D; TE-4445 A thru D; TE-4446 A thru D; TE-4477 A,B; TE-4478 A,B; TE-4479 A,B; and TE-4480 A, B): These temperature detectors are located in the Steam Tunnel and Turbine Building Heater Bay. They are used to detect a main steam line break. Each of these RTD temperature detectors supplies its signal through an electrical connection box containing three Raychem-insulated splices. These boxes did not have weepholes.

The concern regarding possible submergence does not apply to Raychem-insulated splices. Raychem tested its splices for 32 days while submerged. All of the applicable insulation resistance values were above 2E08 ohms. The 2E08 ohm value is acceptable for this application. This submergence test is documented in Raychem Report EDR 5011, dated February 25, 1980.

Additional assurance of operability is provided by the short-term nature of the leak detection safety function. System isolation occurs approximately ten seconds after an accident, which is well before the harsh environment would reach the splices contained within the electrical connection box.

In conclusion, we have concluded on the basis of documented testing that the main steam line break leak detection system was operable without a weephole in each of the enclosures containing Raychem-insulated splices. Therefore, there was no safety significance to the lack of weepholes in these enclosures.

Torus Water Temperature Detectors (TE-4324 and TE-4325) These two temperature detectors are used to monitor Torus water temperature and are required by RG 1.97 for post-accident monitoring. The elements are immersed in Torus water through the Torus vessel wall but the electrical connections are located in the Torus Room. Each of these temperature elements has an electrical connection box containing Raychem-insulated splices. These enclosures had no weepholes.

As discussed earlier, the Raychem-insulated splices are qualified for submergence by existing type testing. Therefore, there is no safety significance of the lack of weepholes and these temperature detectors are concluded to have been operable.

Issue Title: Qualification of Terminal Blocks in Junction Boxes with Top-Entry Conduit

Issue

During their inspection on September 29, 1989, the NRC inspectors raised a concern regarding the environmental qualification of terminal blocks in junction boxes with top-entry conduits. Specifically, during LOCA testing, some terminal blocks have exhibited leakage currents, which could affect the circuit's safety function, when moisture was sprayed onto the blocks. Although a junction box protects the terminal block from direct spray, a top-entry conduit could allow moisture that had accumulated upstream of the junction box to spray onto the terminal block, resulting in unacceptable leakage currents. During the NRC inspection, junction boxes with top-entry conduit which had not been evaluated in the DAEC EQ files were found in HELB areas.

Actions Taken

We reviewed our equipment database to establish a list of terminal blocks in EQ circuits. This list was verified against the results of the then-current inspection to identify all EQ terminal blocks in junction boxes with top-entry conduit which are located within HELB areas. The boxes in non-HELB areas, i.e. radiation only, are not subject to this concern as it is not possible to accumulate enough moisture under either normal or post-accident conditions to result in spraying water onto the terminal blocks, the conditions which caused the excessive leakage currents seen during the LOCA tests. In addition, drainage paths have been provided in electrical enclosures in both HELB and radiation-only areas, further reducing the potential for significant moisture accumulation.

Results

While the inspection results and subsequent evaluation did find terminal blocks in junction boxes with top-entry conduit in HELB areas, all but two were in configurations that had previously been evaluated and found acceptable. Of these two boxes, one was evaluated and found to be acceptable because the terminal block was offset within the junction box and direct spray onto the terminal block via the top-entry conduit was not possible. The second box has been modified so its top-entry conduit enters the side of the junction box, thereby eliminating the concern.

During the re-inspection, thirteen terminal blocks in EQ circuits were found that had not been included in our equipment database (see attached Table). Of the thirteen terminal blocks identified: eight were qualified Amerace NQB terminal blocks; one was a qualified Buchanan 524 terminal block; and four were GE terminal blocks. The GE terminal blocks were replaced with qualified terminal blocks.

TERMINAL BLOCKS

Junction Box ID	Supported Equipment	Location	Manufacture & Model
2J2038	SV/ZS-4331A	RHR Valve Room	Amerace NQB
2J2037	SV/ZS-4331B	RHR Valve Room	Amerace NQB
2J2036	SV/ZS-4333A	Torus Room	Amerace NQB
2J2035	SV/ZS-4333B	Torus Room	Amerace NQB
1J1791	SV/ZS-4334A	Torus Room	Amerace NQB
1J1790	SV/ZS-4334B	Torus Room	Amerace NQB
1J1793	SV/ZS-4332A	Reactor Building	Amerace NQB
1J1792	SV/ZS-4332B	Reactor Building	Amerace NQB
1J1638	TE-2263B	HPCI Room	Buchanan 524
1J0786	SV-8107A,8A,9A,10A	Torus Room	GE
2J1654	ZS-8773A	NW Corner Room	GE
2J1652	ZS-8773B	NW Corner Room	GE
FO-Box	TE-2744F	RWCU Room	GE

Safety Significance

As noted above, two enclosures were identified in the Drywell which had top-entry conduits above terminal blocks. One was associated with MO-1908 and the second was in a junction box associated with relief valve tailpipe pressure switches PS-4407A, B, and C.

The safety significance of the top-entry conduit associated with MO-1908 is provided in Attachment 3 of this letter.

The top-entry conduit associated with the enclosure for PS-4407A, B and C makes an immediate 90° turn and runs horizontally into the next box and therefore, the effects of a postulated break will not result in moisture entering the box via this conduit. Therefore, the safety significance of this top-entry conduit was minimal.

Three of the four GE terminal blocks were located in either the Torus Room or the Northwest Corner Room. The post-accident environment in these areas is limited to high-radiation only. These blocks are qualifiable for this post-accident environment using test data and analysis for the materials of construction. Therefore, there is no safety significance associated with past operation with these blocks in control circuits.

The fourth GE terminal block was located in an instrument circuit for a steam leak detection temperature element (TE-2744F). The temperature element is located in the RWCU Heat Exchanger Room, which is subject to HELB conditions. It is one of six temperature elements that measure high ambient temperature in that area. Given the combination of redundant temperature indication/leak detection instruments and their short post-accident operating time, there is minimal safety significance to the past operation with the GE terminal block in this temperature element circuit.

Issue Title: Qualification of Taped Splices in Instrument Circuits

Issue

During the qualification testing of taped splices, leakage currents were observed which were capable of adversely affecting the accuracy of certain types of instrument circuits. The leakage currents were caused by the accumulation of moisture. If the accuracy of the instrument could be degraded to the point that it can no longer perform its safety function, then other EQ qualified insulation methods, which exhibit acceptably low leakage currents, are required.

Actions Taken

The EQ Master Equipment List and the qualification file for the tape used to insulate splices (QUAL-M345-00) were reviewed to identify those instruments that could be subject to this concern. This list of instruments was then reviewed against the information gathered during the most-recent inspection program to identify instruments with taped splices located within HELB areas. The non-HELB areas are not subject to this concern because neither sufficient moisture to degrade the taped splices can be accumulated since the enclosures have a drainage path, nor can water spray onto the splices via top-entry conduit. These are the conditions necessary to cause the excessive leakage currents seen during the testing.

Results

The screening process narrowed the equipment of concern to switches and temperature elements within HELB areas. Switches were subsequently excluded because leakage currents of the magnitude seen during qualification testing would not prevent them from performing their safety function. An engineering evaluation was then performed for the remaining temperature elements. Assuming the worst-case insulation resistance observed during the test (26.4 K-ohms), the evaluation determined that the leakage currents for these temperature elements would not inhibit operation of the circuit. Consequently, our existing qualification file for taped splices in these circuits is acceptable.

It should be noted that, during the review of maintenance records in preparation for the most-recent inspection of these circuits, we determined that commercial-grade, heat-shrink tubing had been specified as an acceptable alternative to the environmentally-qualified Raychem sleeves normally used in such circuits. The most-recent inspections confirmed that commercial-grade, heat-shrink tubing had been used on eight temperature element circuits. Each circuit had three splices, for a total of twenty-four splices with the commercial-grade, heat-shrink tubing. These temperature elements (RTDs) are used to sense Drywell temperature and are discussed later in this attachment.

In addition, one dual-element thermocouple, associated with the Steam Leak Detection System (SLDS) in the Reactor Water Cleanup System Pump Room, was found on which the wires had been insulated with the commercial-grade, heat-shrink tubing. These splices have been evaluated for their effect on the circuit and are discussed below.

All of the above identified deficiencies (i.e., the twenty-eight splices with commercial-grade, heat-shrink tubing) were repaired with environmentally-qualified Raychem insulation.

Safety Significance

The Drywell RTDs, TE-4386E, F, G, H, J, K, L and M, in the EQ Program provide Drywell temperature indication only and provide no active safety function. The RTDs are required to be qualified based on their function as RG 1.97 post-accident monitoring instruments. Redundant Drywell temperature indication is obtainable from Drywell pressure, the transmitters for which are located outside the Drywell. These instruments provide a qualified, redundant means of monitoring post-accident temperature.

Since the RTDs provide indication only (post-accident monitoring) and do not perform any active safety function, we have concluded, based upon our evaluation described in Attachment 9 to this letter, that there was minimal safety significance to the past operation with the commercial-grade, heat-shrink tubing installed in these circuits.

One RWCU leak detection temperature element (TE-2744A) was identified on which commercial-grade, heat-shrink tubing had been used for insulating the four splices in the circuit. TE-2744A is one of two temperature elements that measure high ambient temperature in the RWCU Pump Room. The redundant temperature element was operable. In addition, there are three pairs of differential temperature elements that provide isolation signals to the same valves as the two high ambient temperature elements.

Given the combination of redundant temperature indication/leak detection instruments and the short post-accident operating time of this temperature element, we have concluded that there was minimal safety significance to past operation with the commercial-grade, heat-shrink insulated splices in this temperature element circuit.

Issue Title: Equipment Qualification for Motor-Operated Valves (MOVs)

Issue

During the NRC EQ inspection on September 29, 1989, the inspectors requested that we re-evaluate all EQ issues which we had previously identified and were scheduled to be resolved during the next refuel outage, to determine if they required resolution prior to startup from the then-current outage. Three issues were identified relating to the qualification of Limitorque motor-operated valves (MOV).

One such issue was a 10 CFR Part 21 notification from the Limitorque Co. regarding a potential failure of torque switches manufactured from a melamine material in their Model SMB-00 and SMB-000 motor-operators. We had previously written a Justification for Continued Operation (JCO) to support our decision to defer corrective action on valves with these model motor-operators until the next refuel outage. These valves were reassessed prior to startup.

A second issue was identified due to a revision of the DAEC EQ file for Amerace/Buchanan terminal blocks as a result of recently-issued industry information on these blocks. Our review of this information resulted in restrictions being applied on the use of these terminal blocks in power circuits for MOVs.

Third, the Nuclear Utility Group on Environmental Qualification (NUGEQ) recently published its final report on Limitorque MOVs. This report identified the potential for unqualified, vendor-supplied splices to be found on the internal motor leads within dual-voltage motors supplied with valve motor-operators. We, therefore, decided to initiate inspection of all MOVs in the EQ program to identify and inspect any dual-voltage motors for improperly-insulated internal splices. (Inspections for splices found externally to the motor-operator switch compartments were being performed as part of the re-inspections described in Attachment 2 to this letter.)

Actions Taken

Our earlier review of the Limitorque Part 21 notification had concluded that there were forty-six valves in the EQ program which had model SMB-00 and SMB-000 motor-operators. Of these forty-six MOVs, we had previously identified nineteen as not containing torque switches made of the melamine material. Of the remaining twenty-seven MOVs, twenty had been evaluated and we had concluded that their safety function would not be impaired by the failure of the melamine torque switches. Each of the torque switches in the remaining seven MOVs had been replaced with a non-melamine torque switch before the most-recent EQ inspections. Therefore, no actions were required as a result of this inspection.

Another inspection program for MOVs was developed which was composed of three phases. The first phase was an external inspection of all eighty-one MOVs in the EQ program. The primary purpose of this inspection was to identify those MOVs with dual-voltage motors to inspect for internal, unqualified splices. Sixty-two MOVs with dual-voltage motors were identified. The phase two inspections found one dual-voltage motor with three internal, untaped Thomas & Betts (STAKON) splices. These splices were determined to be vendor-supplied.

The third phase of the MOV inspections was conducted to determine if inappropriate terminal blocks were used in power circuits. This inspection found six MOVs which contained terminal blocks that were not rated for the maximum-applied voltage. The power leads for these six MOVs were removed from the terminal blocks and spliced using DAEC-qualified methods.

Results

After re-evaluation of our JCO for the MOVs with melamine torque switches, we have concluded that all MOVs in the EQ program, whose safety function could have been impaired by the torque switch failure, had been repaired prior to the Fall 1989 Maintenance Outage. Therefore, replacement of the remaining torque switches will be done to improve MOV reliability at the next refueling outage (as per the JCO).

Six MOVs were identified with Buchanan 0524 terminal blocks in their limit switch compartments. The terminal blocks were used for motor power lead connections, which is a 460V application. The terminal blocks are rated by Underwriters Laboratories (UL) for 300 Volt applications although they have been tested under severe environmental conditions at much higher voltages for the purpose of qualification as discussed below.

MOV	Location	Qual Criteria*	Actual Peak Temp.	Qualification Data
MO-1933	Torus Room	DOR	277°F	484V @320°F
MO-1936	Torus Room	DOR	277°F	484V @320°F
MO-2006	Torus Room	DOR	277°F	484V @320°F
MO-2009	Torus Room	DOR	277°F	484V @320°F
MO-2290A	Torus Room	DOR	277°F	484V @320°F
MO-2290B	Torus Room	DOR	277°F	484V @320°F

*DOR = DOR Guidelines

The Buchanan 0524 terminal blocks are qualified for use during LOCA conditions up to 475 VAC at 340°F based on their use as a motor lead terminal block in Limitorque Test Report Project 600376A (File Sect. 4.5). This use was investigated and confirmed by the Nuclear Utility Group on Equipment Qualification as documented in their memorandum dated April 7, 1989 (File Section 8.5). The Limitorque test report (Franklin Test Results FC3441, Table 1(a), pages 3-7) documents that the motor was energized at voltages as high as 484 VAC. At the second peak of the temperature transient (340°F), the voltage was 475 VAC. Therefore, these terminal blocks are qualified by test for voltages up to 475 VAC at a temperature of 340°F and up to at least 484 VAC at a temperature of 320°F.

Therefore, these terminal blocks are qualified to the DOR guidelines by the existing Limitorque qualification test as documented in the DAEC qualification file. These MOVs were supplied by Limitorque with the terminal blocks installed and certified to the appropriate test report.

The one dual-voltage motor which was found with three unqualified internal splices is associated with MO-1943B, the cross-tie valve between the Residual Heat Removal (RHR) system and the RHR Service Water system. The function of this valve is to allow the primary containment to be flooded, if necessary, in certain post-accident conditions. Although this capability is described in the DAEC Updated FSAR (Section 5.4.7.2.1), it is a manually-initiated function and no credit is taken for its use in any existing accident analyses. We have therefore determined that this MOV, and its redundant counterpart, MO-1943A, are not required to be included in our EQ program.

Safety Significance

The six MOVs which had underrated terminal blocks were located outside the Drywell, where the post-accident conditions and accident duration are less severe. In addition, the maximum-allowable voltage based on the EQ test results for these blocks is not likely to be exceeded in this application. Therefore, we have concluded that these MOVs were operable and qualified with these terminal blocks in power circuits.

Issue Title: Environmental Qualification of Tailpipe Pressure Switches

Issue

During the inspection described in Attachment 2, questions were raised internally regarding environmental qualification of the tailpipe pressure switches mounted on the discharge piping of the Safety/Relief Valves (S/RV) and the Spring Safety Valves (SSV), (PS-4400A, B & C through PS-4407A, B & C). Specifically, the installed configuration permitted moisture to accumulate in the conduit leading to these switches and no drainage path was provided. The EQ test report for these switches did not enable one to determine whether or not the tested configuration had allowed moisture to collect on the switch connections and wiring supplied with the switches. These switches were required to be installed by NUREG-0737, Item II.D.3, and are a RG 1.97 variable.

Actions Taken

After further engineering review, we concluded that these pressure switches were most-likely not qualified in their as-installed configuration and to take action to preclude moisture from coming in contact with the switch wiring and external connections. Because installation of a drainage path, i.e. a weephole, was not practical, a design change was initiated to seal the entrance to the conduit leading to these pressure switches and thereby prevent moisture intrusion. An electrical connector sealed assembly (ECSA), was installed in the conduit entrance. These ECSAs are qualified in accordance with the DAEC EQ program.

Results

The installation of the ECSAs ensure that the as-installed configurations of these pressure switches conform to the tested configuration and, therefore, complies with the DAEC EQ program.

Safety Significance

While these switches are RG 1.97 post-accident monitoring instruments, other qualified instruments are available to assist the operator in determining the position of S/RV.

The functions performed by these components and the impact of the qualification deficiencies on the ability of the components to perform their required functions are discussed in Attachments 3 and 5 of this letter. Based upon those discussions, we conclude that the as-found configuration of these pressure switches had minimal safety significance for the safe operation of the DAEC.

Issue Title: Environmental Qualification of Victoreen Radiation Monitors

Issue

During an internal review of the DAEC EQ files conducted in August 1989, a question was raised as to whether the as-built configuration of the two Drywell high-range radiation monitors (RE-9184A & B) conformed with the qualified configuration. At that time a recommendation was made to inspect the installed configuration at the next refuel outage. However, we decided to inspect these radiation monitors as part of the most-recent EQ inspection program. This inspection established that the installed configuration was not in conformance with the qualified configuration because the electrical enclosures leading to these instruments were not sealed to prevent moisture intrusion. The test report states that any moisture accumulation on the instrument's external connections during accident conditions causes instrument failure. These instruments were installed to meet NUREG-0737, item II.F.1.3, and RG 1.97, requirements and must be environmentally qualified for HELB conditions.

Actions Taken

A design change was made and ECSAs, similar to those installed in the S/RV tailpipe pressure switches, were installed at the entrance to the conduit leading to the radiation detectors (see Attachment 7). These ECSAs will prevent moisture from entering the conduit.

Results

Because the newly-installed ECSAs are qualified for HELB conditions, these radiation monitors conform to the tested configuration and are, therefore, qualified.

Safety Significance

These instruments are required to meet NUREG-0737 and RG 1.97 post-accident monitoring requirements. However, they provide indication only and do not perform an active safety function. Alternate indications of high radiation levels within the primary containment, including other RG 1.97 instruments, are available to assist the operator in evaluating post-accident conditions and were operable. Therefore, the safety significance of the failure of these instruments was minimal.

Cumulative Effect of EQ Deficiencies

The safety significance of each potential failure of the components caused by the EQ deficiencies has been discussed in Attachments 2 through 8. In addition, we have evaluated the cumulative effect of these potential failures to determine, for several postulated accident scenarios, whether the failures would have significantly impaired the operators' ability to classify correctly the Emergency Action Level (EAL) of these events and to mitigate them using the Emergency Operating Procedures (EOPs). Two evaluation techniques were used. We believe that each method confirmed that the guidance provided in the DAEC procedures would enable operators to cope with the postulated failures.

The first method was a table-top review of the EOPs and Emergency Plan Implementing Procedures (EPIPs) using an "A" Shift Supervisor who holds an active Senior Reactor Operator (SRO) license and has more than ten years of Control Room experience. This review systematically evaluated the impact of loss of the EQ-deficient components on the ability of DAEC operators to follow the EOPs and EPIPs. The second method modelled the deficiencies on the DAEC Simulator and ran the accident sequences in real time using a Control Room crew in routine requalification training. This crew had no advanced briefing as to the purpose or nature of the scenarios being simulated.

In both methods, the assumptions were made that the EQ deficiencies resulted in the complete failure of the affected components and that the failures occurred at the instant when the harsh environmental conditions necessary to cause the particular failure arose. For example, if the deficiency was a junction box in the Drywell without a weephole, the affected component was assumed to fail after sufficient moisture accumulated to submerge the components in the junction box, either by the accident-induced environment or through the initiation of Drywell spray. In addition, we evaluated only accidents within the DAEC design basis, i.e., no severe accidents were evaluated. These assumptions were made to simplify the evaluation and represent our "best estimate" of the failure modes associated with the EQ deficiencies.

Based on our review of the list of affected components, the functions they perform, their location in the plant, and the postulated failure modes caused by the EQ deficiencies, we concluded that Loss-of-Coolant Accidents (LOCA) within the Drywell are the worst accident scenarios for this evaluation. We evaluated two such scenarios: the Design Basis LOCA and a Small Break LOCA.

Design Basis LOCA

For the DAEC, the Design Basis LOCA is the double-ended guillotine break of the reactor recirculation suction piping with a concurrent loss of offsite power and the single failure of Division II of 125 VDC power. This LOCA was chosen because it represents the greatest challenge to the Engineered Safety Features and it produces the most harsh environment in the Drywell. In addition to the equipment failures normally associated with the accident, the components listed in the following table are also assumed to fail as a result of the EQ deficiencies:

Equipment ID	Equipment
MO-2238	Containment Isolation Valve for HPCI Steam Supply
SV-4412	MSIV Pilot Solenoid Valve
SV-4415	MSIV Pilot Solenoid Valve
SV-4418	MSIV Pilot Solenoid Valve
SV-4420	MSIV Pilot Solenoid Valve
SV-4639	Containment Isolation for Recirculation Sample Line
ZS-4412	MSIV Position Switch (RG 1.97)
ZS-4415	MSIV Position Switch (RG 1.97)
ZS-4418	MSIV Position Switch (RG 1.97)
RE-9184A	Drywell Radiation Monitor (RG 1.97)
RE-9184B	Drywell Radiation Monitor (RG 1.97)
TE-4386 E, F, G, H	Drywell Temperature Monitoring (RG 1.97)
TE-4386 J, K, L, M	Drywell Temperature Monitoring (RG 1.97)
MO-1908	RHR Shutdown Cooling Suction Line Isolation Valve
SV-4400	Safety Relief Valve (ADS)
SV-4401	Safety Relief Valve (Low-Low Set)
SV-4406	Safety Relief Valve (ADS)
PS-4400 thru 07 A, B, C	Relief Valve Tail Pipe Pressure Switches (RG 1.97)

The failure of the listed components will result in loss of the following DBA LOCA functions:

- Drywell Temperature Indication
- HPCI Steam Supply Inboard Isolation (Containment Isolation)
- Drywell Radiation Monitoring (Accident Range Indication)
- MSIV Position Indication (three-out-of-four of the MSIVs located in the Drywell)

The results of both the table-top review and the simulator evaluation indicate that the operators' ability to classify EALs correctly in this event and to mitigate it by the use of the EOPs would not be significantly impaired by the above failures. Guidance is provided which would enable operators to use alternate and/or redundant means to perform the functions which would be lost as a result of the EQ deficiencies.

Small Break LOCA

For the Small Break LOCA, we evaluated a partial break of the RCIC steamline within the Drywell with a concurrent loss of offsite power and the single failure of Division II of 125 VDC power. This break size and location were chosen for two reasons: it disables the RCIC system and challenges the ADS valves, in addition to the equipment which fails as a result of the loss of offsite power and Division II of 125 VDC; and, a small steamline break is a slower developing event than the DBA LOCA and provides for a better assessment of the ability of the operators to cope with the EQ deficiencies. In addition to the equipment failures resulting directly from the accident, we assumed the same EQ-related failures as were assumed for the DBA LOCA, as listed in the Table above.

The failure of the components listed in the above Table will result in the loss of the following Small Break LOCA functions:

- Drywell Temperature Indication
- HPCI Steam Supply Inboard Isolation (Containment Isolation)
- Drywell Radiation Monitoring (Accident Range Indication)
- MSIV Position Indication (three-out-of-four of the MSIVs located in the Drywell)
- Shutdown Cooling Mode of RHR
- Automatic and Manual Reactor Depressurization (Three-out-of-six S/RV's)
- S/RV Position Indication (Primary Indication)

The results of both the table-top review and the simulator evaluation indicate that the operators' ability to classify EALs correctly in this event and to mitigate it by the use of the EOPs would not be significantly impaired by the above failures. Guidance is provided which would enable operators to use alternate and/or redundant means to perform the functions which would be lost as a result of the EQ deficiencies.

In conclusion, our evaluations demonstrated that, taken both individually and collectively, the EQ deficiencies recently identified at the DAEC have minimal safety significance.

Root Causes and Corrective Actions to Prevent Recurrence

After reviewing the deficiencies described in the earlier Attachments, we have concluded that they can be divided into two general classes. One class consists of the improperly-insulated AMP and Thomas and Betts (STAKON) splices which the inspections conducted in 1986 and 1987 had failed to identify and correct. The other class contains all other deficiencies discussed in the preceding Attachments. There were two root causes for these deficiencies: inadequate inspections to identify and correct the improperly-insulated AMP and Thomas and Betts (STAKON) splices prior to the most-recent program; and, weaknesses in the implementation of the DAEC EQ Program, which resulted in the other deficiencies.

As described in Attachment 2 to this letter, our most-recent inspection program improved upon the prior attempts to ensure that all splices in EQ circuits were identified and properly insulated. We are now highly confident that all such splices have been identified and properly insulated and we have a sound, documented basis for that confidence. Therefore, no further corrective actions are required.

The weaknesses identified in the implementation of our EQ Program can be attributed to two causes:

The first cause is characterized as organizational. Administrative control procedures did not clearly define and assign specific, working-level responsibilities for implementing the EQ Program. Interfaces between different departments (particularly Design Engineering and Maintenance) of the IE organization were not well defined--which led to poor communication among persons in these departments. The theory and practice of EQ were perceived to be the responsibility of a limited few within the IE organization. Others, working in "the field", did not sufficiently understand all EQ requirements and therefore could not have been expected to properly implement the instructions they received. Moreover, the engineers who developed the instructions sometimes had incomplete knowledge of the as-built configuration of DAEC and their performance was further hampered by the problems with communication between organizational units.

A second and related root cause for the deficiencies also played an important role. That cause was the information concerning the as-built plant which was available. While our design documents are consistent with typical industry practice, we have now concluded that the level of detail is often not sufficient for EQ purposes. Some DAEC design documents which were available to IE engineers lacked the detail which could assure that in every case qualified component configuration could be readily achieved and maintained in the field. For example, DAEC design documents did not specify equipment orientation or the location of cable splices or enclosure weepholes.

To eliminate the first root cause described above, i.e., the organizational problem, and avoid any further deficiencies in continuing implementation of the EQ Program at DAEC, we are reviewing the organizational structure through which the Program is carried out. This review will be conducted as part of an examination of the Design Engineering Department which we have undertaken in response to NRC Inspection Report 88-023. We expect to define and clearly assign departmental and individual responsibilities for EQ and to define the interface between Design Engineering and the DAEC Plant Staff for implementing the EQ Program. This review is now scheduled to be completed by February 16, 1990.

The second basic deficiency referred to above is the paucity of information which has been available. That is also being addressed. The recent inspection efforts (described in other Attachments) have developed most of the detailed information previously lacking. This information is being incorporated into our existing design document system. It will be readily accessible to the personnel who need it to maintain qualified configurations for equipment within the EQ Program. Although we will begin incorporating this information into our design documents in the near future we recognize that we may need to reverify some of the as-built equipment configurations and may need to augment this information such that it will be more useful. This may require inspections in plant areas which are not accessible during normal operations. Such inspections will be done at the next scheduled refueling outage and incorporation of this information into the design document system will be completed within ninety days after that outage.

We are confident that the corrective actions described above will complete effective integration of the DAEC EQ Program into IE's organization and facilitate improvements in implementation of EQ requirements in the field.