NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Callaway Plant Unit 1	0 5 0 0 0 4 8 3	1 OF 1 7

TITLE (4) Instrument & Control Termination Splices Fail To Meet Environmental Qualification Requirements Due To Superceded Guidance and Installation Errors From Ineffective Training

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
										0 5 0 0 0
1 0	2 9	8 8	8 8	— 0 1 3	— 0 2	0 4	1 0	8 9		0 5 0 0 0

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
1	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10) 1 0 0	20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
	20.405(a)(1)(ii)	50.36(c)(2)	X 50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
	20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
	20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
J. A. McGraw - Superintendent, Design Control	AREA CODE 3 1 4 6 7 6 - 8 1 5 3

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
D	S J	C O N	R C 9 8	N		B	A B	C O N	R 0 9 8	N	
B	S J	C O N	R 0 9 8	N		B	C B	C O N	R 0 9 8	N	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (16)

On 10/29/88, it was discovered that the Raychem heatshrink terminations for 'C' steam generator (S/G) feedwater level transmitter, AE-LT-0539, were not installed in an EQ configuration. On 12/5/88 at 1120 CST it was determined that Environmentally Qualified (EQ) terminations on EQ instrumentation circuits in multiple systems and redundant safety trains were not installed in accordance with the design, vendor recommendations, or the EQ program requirements. These conditions have existed during plant operation from Mode 6 - Refueling up through Mode 1, 100% Reactor Power. Some conditions were discovered in Mode 1 - Power Operations, with the majority discovered in Mode 3 - Hot Standby.

The root causes of these conditions are attributed to: less than complete installation procedures by contract construction and utility personnel; and inadequate training of planners, installation personnel, and inspectors.

Approximately 260 EQ instrumentation and control circuit termination splices were reworked following a comprehensive field inspection.

There has been additional training of personnel involved with the installation of Raychem heatshrink and a revision of termination procedures. Also, a detailed procedure checklist or specific design instructions will be used each time Raychem heatshrink tubing is installed.

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Basis For Reportability

On 10/29/88, it was discovered that the Raychem heatshrink terminations for 'C' steam generator (1) (S/G) narrow range feedwater level transmitter (2), AE-LT-0539, were not installed in a configuration that would ensure post accident operability. This inoperability is a condition prohibited by Technical Specification (T/S) 3.3.1 Table 3.3-1.13 Action 6 and T/S 3.3.2 Action (c) Table 3.3-3.6.d Action 9. This event was reported on 11/28/88 pursuant to 10CFR50.73(a)(2)(i)(B) as a condition prohibited by the plant's T/S. As a follow-up to this event, further sample inspections of Raychem terminations were initiated.

On December 5, 1988 at 1120 CST it was determined that Environmentally Qualified (EQ) terminations on EQ instrumentation and control circuits in multiple systems and redundant safety trains had not been installed in accordance with the design, vendor recommendations, or the EQ program requirements.

These conditions were prohibited by T/S 3.3.1, 3.3.2, 3.3.3.5, and 3.3.3.6. These T/S require certain reactor trip system instrumentation to be operable in Mode 1, Power Operation, and Mode 2, Startup, in addition to certain Engineered Safety Features Actuation Systems, remote shutdown monitoring instrumentation, and accident monitoring instrumentation to be operable in Mode 1, Mode 2, and Mode 3, Hot Standby. This event is reported in accordance with 10CFR50.73(a)(2)(v) and 10CFR 50.73(a)(2)(vii) as a condition that alone could have prevented the fulfillment of the safety function of systems that are needed to shutdown the reactor and maintain it in a safe shutdown condition and to mitigate the consequences of an accident.

These conditions have existed during plant operation from Mode 6 - Refueling up through Mode 1, 100% Reactor Power. Some conditions were discovered in Mode 1. The majority of the conditions were discovered in Mode 3.

Description of Event

In response to Information Notice 86-53 and Raychem heatshrink problems identified at a similar plant in December 1987, an action plan was developed between January and April 1988. As part of this action plan, equipment lists for potential EQ splice concerns were developed between April and August 1988. Field inspections commenced in late August. In early September 1988, a work history review commenced for Raychem heatshrink documentation. As a result of this review, a potential concern with S/G level transmitter AE-LT-0539 was identified on 10/28/88 by utility engineers. On 10/29/88, a containment entry confirmed improperly installed Raychem heatshrink terminations on the transmitter lead wires. This condition had existed since initial installation.

The Raychem heatshrink tubing was installed in a four-inch by four-inch conduit box with one conduit entering from the top and one conduit entering from the bottom. The installed Raychem heatshrink kit was a style NPKV-2-14 which was tested for use on wires with an outside diameter of between 0.1 inch and 0.2 inch. The field cable and transmitter leads had a 0.14 inch and a 0.072 inch outer diameter, respectively. Because of this, the contract construction personnel installed a one-inch piece of WSCF-70-N heatshrink tubing as a shim, to increase the effective outer diameter of the 0.072 inch lead. The resulting outer diameter was not calculated and was oversized at 0.25 inches. Thus, this configuration was outside of the tested use range for the NPKV-2-14 kit.

The one-inch piece of WSCF-70-N heatshrink tubing installed as a shim was assembled such that an environmental seal length of approximately one-fourth inch existed between it and the NPKV-2-14 kit heatshrink tubing. The NPKV-2-14 kit heat shrink tubing was found to move easily on the shimmed transmitter lead wire which indicated an apparent lack of a complete environmental seal. The tubing apparently had moved following heat application to the kit. The apparent lack of a complete environmental seal was also supported by the lack of visual deformation of the NPKV-2-14 kit heatshrink tubing where the shim should have been. This condition created the possibility of moisture intrusion into the assembly during post accident conditions.

The short seal length and apparent lack of a complete environmental seal are not enveloped by Raychem test reports. Raychem test reports indicate that seal lengths less than 1/2-inch result in excessive leakage currents and are not qualified for use on instrument circuits.

The possibility of moisture intrusion into the assembly, with high subsequent leakage current flow, could potentially render instrumentation inoperable during post accident conditions. This condition was corrected and the documentation review and sample inspection continued.

On 12/1/88, utility EQ engineers discovered that previously installed Raychem heatshrink splice kit shims were missing from terminations (see Figure 1) on the four Reactor Coolant System[3] (RCS) pressurizer pressure transmitters[4] (PT). This discovery was coincidental to the ongoing inspection plan. The four pressurizer PT splice kits had been replaced with butt splices prior to 12/1/88.

On 12/2/88, following a documentation review and subsequent visual inspections, it was discovered that shims were missing for two S/G wide range feedwater level transmitter[5], AE-LT-0501/0502, instrument terminations. These were replaced on 12/2/88.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

On 12/5/88, at 1120 an evaluation of tested EQ configurations for the conditions discovered on 12/1/88 and 12/2/88 determined the instruments to have been previously inoperable. Based on the discovery of these conditions, the ongoing inspection plan was modified to include a visual inspection, in addition to the documentation review for all Raychem heatshrink splice kits located within the containment and accessible during Power Operations.

On 12/8/88 at 0900, it was discovered that pressurizer(6) level transmitter, BB-LT-0459, had a termination without the required heatshrink kit shim. The appropriate T/S action statements were entered for this instrument, T/S 3.3.1 and 3.3.2. BB-LT-0459 was repaired and the T/S action statements were exited.

On 12/8/88 at 1100, a termination for pressurizer level transmitter, BB-LT-0460, was discovered to have no Raychem heatshrink applied. A construction period Temporary Alteration tag was found hanging on the termination. The appropriate T/S actions were entered for this instrument. At 1315, T/S 3.0.3 was entered as a precaution when it was assumed that a third pressurizer level transmitter, BB-LT-0461, was also inoperable. Documentation for BB-LT-0461 indicated a kit was installed but did not show a shim to be installed. However, later visual inspection revealed that a kit was not installed but an alternate qualified Raychem application was installed at the termination. While the documentation was apparently incorrect, BB-LT-0461 was actually operable and T/S 3.0.3 was therefore exited at 1356. Further work documentation review of BB-LT-0461 revealed that the Raychem kit had been replaced with a qualified bolted in-line connection (see Figure 2) under an authorized rework in March, 1984.

Later on 12/8/88, a decision was made that contingent upon discovery of any further Raychem kit discrepancies, the plant would be shutdown to Mode 3. As a precaution, the inspection plan was modified to include a sample of terminations which were indicated to be correctly installed per documentation.

On 12/9/88, the documentation for S/G wide range level transmitter, AE-LT-0503, indicated a bolted in-line connection had been installed. Visual inspection revealed AE-LT-0503's termination to be made with a Raychem kit. The kit's shim was missing.

Because of the discrepancy between the documentation and the actual field installation for AE-LT-0503, a plant shutdown was commenced at 1800 on 12/9/88. Mode 3 was achieved on 12/10/88 at 0354. An inspection of Raychem termination splices (NUREG 0588 and Regulatory Guide 1.97 EQ Category 'A' and 'B' instrumentation and controls) both inside and outside of containment commenced.

As the result of this inspection, other types of concerns were discovered in addition to the missing heatshrink kit shims. These included: the minimum bend radius (MBR) of splices less than allowable; the application of tubing with a seal length less than required; the application of tubing with a use range diameter less than required; and the lack of proper tubing shrinkage.

On 12/15/88 at 0620, Mode 4 - Hot Shutdown was entered in order to work several connections to the same system simultaneously.

On 12/17/88 at 0315, Mode 1 - Power Operations was resumed after completion of the inspections and required rework.

Root Cause

A. Root Cause for the Incorrectly Installed Shim on AE-LT-539

The original Raychem installation procedures utilized a Raychem application guide as the source for the installation criteria. At the time of installation, the Raychem application guide had been superceded. The criteria was superceded in 1983, by the issuance of Raychem's revised application guide. The Raychem revised criteria clarified the heatshrink application requirements for accident and non-accident heatshrink sizing requirements. The use of superceded information is assumed to have caused the improper installation of the shim and NPKV-2-14 kit. When the transmitter lead wire was shimmed, the contract construction planning personnel apparently did not correctly calculate or inadvertently omitted the process of calculating the resulting outer diameter. This condition caused the installed NPKV-2-14 kit to be in a configuration outside of the Raychem tested use range.

B. Root Cause for the Missing Heatshrink Splice Kit Shims

The contract construction and utility planning agencies and installation personnel were apparently not familiar enough with the Raychem application guide. The vendor lead and field side conductor diameters need to be determined in order to select the kit that best suits the application and the appropriate shim size. Inadequate training of personnel resulted in no shims being installed when kits were utilized during construction and post construction activities. The installation procedure, MTT-ZZ-I0004, required the installers to make complex sizing calculations.

C. Root Cause for No Heatshrink Installed on BB-LT-460

A construction period Temporary Alteration (TA) tag was found in the splice box for BB-LT-0460 and the vendor field splice was made with the use of wire nuts. The TA tag was inside the splice box and not visible to personnel. A review of the TA log indicated the tag had been removed and verified. The two contract construction personnel, who removed and verified the tag removed, either checked the piece of equipment for the tag vice the splice box or looked for the tag on the splice box and didn't find one. The as-found configuration had no Raychem heatshrink applied.

D. Root Cause for the MBR of Splices Less Than Allowable

The field inspections found that the Raychem recommended MBR of five times the diameter had been violated in numerous installations. The MBR violations were predominantly found in four-inch x four-inch splice boxes with more than two splices in the splice box. The MBR violations were restricted to in-line splice applications. The original Raychem application guide did not provide MBR requirements. Revision One of the application guide was issued in August 1983, which included the MBR requirement. The construction vendor never identified the need to include the changed application guide criteria into the construction work procedure (CWP-304). The utility installation procedure developed in 1986 from CWP-304 also did not include the Raychem MBR requirement.

E. Root Cause for Heatshrink Tubing Sizing Problem

1. Length Too Short

Three termination splices had an overall tubing splice length of approximately four inches which can only be attributed to craftsmanship and inadequate knowledge of splice length requirements.

2. Diameter Too Small

The underlying reason for the misapplication of heatshrink tubing is lack of familiarity with the Raychem application guide. During construction, standardized bolting hardware was specified for in-line bolted splices. The detailed manufacturer's instructions for the bolted in-line connections require that the effective diameter of the bolted connection be determined. Using the effective diameter of the bolted connection, the correct heatshrink tubing diameter can be identified by referring to a vendor supplied data

table. However, the overall bolt length didn't include the bolt head when determining the effective diameter of the bolted splice. Unless required to do otherwise, the installer will normally utilize the minimum size of heatshrink tubing available. This is due to the small space available inside the termination splice box. This mistake resulted in WCSF-200-N sleeving being utilized vice WCSF-300-N sleeving for the hardware utilized. In addition, the bolt lengths varied, which added to the overstressed condition at the bolted splice. The same mistakes were made during post construction activities because of inadequate training in the area of Raychem application.

In addition, the failure to maintain both the construction and the utility's terminating procedures in compliance with Raychem's most current application guide resulted in the misapplication of Raychem heatshrink. The revised vendor application guide was not incorporated into the original utility Raychem installation procedure. The utility procedure was written using the vendor construction work procedure (CWP-304).

F. Root Cause for Lack of Proper Tubing Shrinkage

Some terminations had incomplete shrinkage which are attributed to ineffective training. The installers and QC inspectors apparently were not effectively trained in what is considered properly shrunk Raychem.

Corrective Action

An engineering evaluation of the MBR violations concluded they were qualified but for a shorter life span (i.e. 8.22 years for control circuits and 35 years for instrumentation circuits). Rework of all other installation problems for EQ instrumentation and control circuit termination splices was completed. This rework brought them into compliance with the design requirements. The QC inspectors and engineers involved in this rework were instructed on the installation of these EQ termination splices with emphasis placed on the criteria and method of determining the correct size of heatshrink tubing. Detailed written instructions were utilized for this rework.

A thorough field inspection of EQ equipment categorized as "A" or "B" for a Loss of Coolant Accident (LOCA), High Energy Line Break (HELB), or Main Steam Line Break (MSLB) was performed to ensure the Raychem application was in compliance with approved test reports. A comprehensive field inspection was performed inside and outside containment.

Some terminations were not inspected because:

(a) Design documents did not require Raychem heatshrink.

(b) Plant personnel had inspected and reworked the equipment recently and documented conformance.

(c) An engineering evaluation was performed in order to eliminate the need to open and inspect certain splices.

(d) The Raychem splice was located in an environment which provided a seal against moisture intrusion.

(e) An inspection was not performed if moisture intrusion was not a concern (i.e. in only a radiation environment located outside of the containment).

(f) The power circuit was qualified for open atmosphere.

(g) Engineering evaluations have been performed for terminations not previously identified in the original inspection scope.

(h) The few inspections previously missed will be performed during the plant's third refueling in the Spring of 1989.

A review of the Temporary Alteration Log was made and a list of equipment generated. This list was based on the two individuals who missed the Temporary Alteration on BB-LT-0460. A field inspection found no further discrepancies.

Planned Program Improvements

In order to prevent recurrence, the following actions will be taken to improve our heatshrink installation practices and procedures.

(1) Formal retraining has been provided to appropriate utility and contract personnel involved with the installation of Raychem heatshrink tubing prior to the next refueling outage.

(2) "Termination Procedure for Cables 600 Volts or Less", MTT-ZZ-I0004, was revised to clearly establish who is responsible for any required calculations. These calculations will be required to be documented on the work document which authorizes the activity.

(3) The Operating Quality Control Manual has been revised to clarify cable terminal inspection requirements and to clearly identify the sign-off points.

(4) A detailed procedure checklist or specific design instructions will be used each time Raychem heatshrink tubing is installed.

(5) Vendor application guide changes are now reviewed for procedure incorporation and any impact on previous installations.

Safety Significance

The EQ heatshrink conditions found, as described above, were widespread, affecting multiple safety systems, and redundant safety trains. These conditions were not in accordance with required installation guidelines on EQ termination splices.

Environmental qualification consists of a simulation of actual physical conditions on a prototype or an actual component type testing, analyses, or a combination of type testing and analysis, as applicable. The testing period is sufficient to ensure the capability to function during and for the required interval after a Design Basis Accident. For the EQ termination splices, environmental qualification was established based on type testing.

Environmental qualification testing of heatshrink tubing shows unacceptably high leakage currents for use in instrumentation circuits during the high humidity and high temperature (harsh environment) condition following a high energy line break, if the heatshrink assembly is too small in diameter or it is susceptible to moisture intrusion. If moisture had entered the assembly, excessive leakage currents could have resulted with a subsequent loss of transmitter accuracy. Since excessive moisture concurrent with a differential pressure is required for moisture intrusion to take place, only accidents which produce this effect are required to be analyzed, specifically a LOCA, HELB, or a MSLB.

The various misapplications of Raychem heatshrink have been analyzed for the impact on plant component and system operability. Raychem test reports performed by industry utilities belonging to the Nuclear Utilities Group on Environmental Qualification (NUGEQ) which encompass Callaway's projected accident profile were utilized to demonstrate environmental qualification (EQ) and the safety significance of the as-found configurations.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

The following is a summary of the industry performed evaluations. The evaluations addressed each root cause generically, except where the test reports would not support the as-found configuration. Specific evaluations were performed by Callaway Engineers for those components not encompassed by the test reports.

The term holdout, as used below, is defined as the ratio of the splice connection diameter to the minimum diameter of the heatshrink material achieved due to heating.

A. Incorrectly Installed Shim on Steam Generator (S/G) Level Transmitter, AE-LT-0539

The as-found Raychem splice kit configuration resulted in seal length of 1/4-inch with a holdout of 2.6, where the WCSF-70-N shim was located; in series with a 1/4-inch seal length, with a holdout of 0.74, where the shim was missing. The Callaway installation had two 1/4-inch seals in series and, therefore, potentially had a better seal than just one 1/4-inch seal. No industry test reports support this configuration. Moisture intrusion into the splice could result in the loss of instrument accuracy or the total instrument failure.

The Final Safety Analysis Report (FSAR) for a main feedwater line break accident shows a first-out reactor trip on S/G low-low level in the faulted S/G. The analysis assumes that the water level in all S/Gs decreases equally until the low-low level trip setpoint is reached. The potential loss of AE-LT-0539 is mitigated because a trip should be produced simultaneously in all four S/Gs.

AE-LT-0539 produces a signal which is supplied to a two out of four coincidence circuit. The loss of AE-LT-0539 would produce an equivalent logic of two out of three, assuming an indeterminate failure. In addition, if AE-LT-0539 were to fail, an annunciator would be received in the Control Room and the licensed operators would take appropriate action.

The continuous operability of the other three narrow range level instrument loops on 'C' S/G has been confirmed. In addition, a work history review for AE-LT-0539 confirmed it has been operable for the environment to which it has been subjected.

Therefore, there was no unreviewed safety questions raised by the misapplication of the Raychem splice kit on AE-LT-0539.

B. Misapplied Raychem Splice Kits

Raychem NPKV type splice kits were found not to be installed at Callaway in strict compliance with the Raychem application guide. The installation deviations were grouped into three categories.

A) Kits with incomplete shrinkage.

B) Kits installed with the correct electrical parameters but which were mishandled mechanically.

C) Use of kits slightly outside the Raychem recommended use range (0.074 to 0.25 inches instead of 0.10 to 0.20 inches).

For Category A, the rapid rise in temperature during an accident would cause a re-shrink of the Raychem prior to moisture intrusion. Moisture intrusion is further minimized by the fact that the splices are enclosed in the conduit/raceway system and are not exposed to a direct moisture path.

Category B splice kits which had been mechanically mishandled did not exhibit tears or holes. The appropriate sealing areas were visibly sealed and a second heating would preserve the seal.

The Category C as-found kit problems were qualified by utilizing tested configurations provided in the utility test reports. The reports qualified holdouts from 0.67 to 3.6. These reports also qualified in-line butt splices. The similarity between the Raychem NPKV splice kits and the tested butt splice samples was evaluated. Both the WCSF-N heatshrink tubing for butt splices and the material used in NPKV kits are flame retardant, radiation cross-linked polyolefins. The comparison was based on total seal length, electrical leakage path length, and the holdout value. The effective seal lengths and holdouts were similar. In addition, the kit has an electrical leakage path length almost four times as long as the butt splice which enhances the kit's ability to withstand holdouts greater than the Raychem tested configuration. The as-found splices were qualified for use on both instrumentation and control circuits.

C. Missing Raychem Heatshrink on Pressurizer Level Transmitter, BB-LT-0460

The assumed failure of BB-LT-0460 would have no adverse impact. Work history, surveillances, and channel checks have demonstrated that the transmitter was functional and that the device provided accurate controlling signals. A failure of BB-LT-0460 would result in an artificially high level, which is a failure to the safe condition.

The continuous operability of the other two pressurizer level transmitters BB-LT-0459 and BB-LT-0461 was confirmed.

D. Minimum Bend Radius Deviations

The Raychem guide requires that the splices should not be bent to a radius tighter than five times the outside diameter of the splice. Various industry test reports had severe bend radii (some less than 1.0D) and the IR values were found to support the Callaway as-found conditions. A qualified life for MBR violations was established. Work Requests have been initiated to re-work the appropriate splices before the EQ qualified life has been exceeded.

E. Less Than the Minimum Required Splice Seal Length

An industry test report and the Raychem kit design adequately justify that splices with 1/2 to 2 inch seal lengths were qualified. The test specimens experienced zero leakage current during qualification and enveloped the voltages/currents expected in instrument and control circuits at Callaway. The deviations from the Raychem application guide have no adverse impact on the operability of affected equipment in a post-accident environment.

F. Holdouts of 2.0 to 2.7

In several cases, Raychem sleeving had been applied over bolted connections where the resulting holdout was between 2.0 and 2.7. The Raychem guide stresses that the holdout should be between 1.0 and 2.0. The potentially over-stressed condition occurs over the bolted area only. An industry test report qualified holdouts up to approximately 3.6. The test samples did experience lowered IR valves but the report conclusions indicate the low IR readings were due to the interconnect cable and not to the Raychem splice. Therefore, the applications with holdouts between 2.0 to 2.7 were qualified for use on both instrumentation and control circuits and the as-found conditions had no impact on operability of affected components.

G. Hold outs of 0.7 to 1.0

Raychem heatshrink tubing had been used at Callaway in applications where the lowest holdout was 0.7. An industry test report was referenced to qualify the splices found at Callaway with holdouts as low as 0.67. All the test samples experienced zero leakage current and the results enveloped Callaway's findings. Therefore, the operability of affected components in a post-accident environment was not degraded by these conditions.

H. Braid under Raychem Splice Sleeves

Non-impregnated braid was found to extend under the Raychem sleeve on six valves located outside the containment. These are control circuit valves. Four of the six valves are in a LOCA category 'A' area, which is a radiation area only. The two remaining solenoid valves are series ASCO Valves, AB-HY-0018 A/B. The main steam isolation bypass valve, AB-HV-0018, is closed during normal operations and both solenoid valves must be energized and remain in that state to open AB-HV-0018. If leakage currents became too high and one solenoid were to fail, the solenoid would close causing AB-HV-0018 to close. The solenoid valves are on separate 125V DC vital buses and in order for AB-HV-0018 to open due to unexpected grounds, four separate and independent failures would have to occur. In addition, the positioner controller, AB-HIK-0015, would have to be in a position other than its normal position. Therefore, service air would not be supplied to open AB-HV-0018. In conclusion, the as-found condition did not affect component operability.

I. Bolt Protrusions/Abrasions of Heatshrink Splice Material

SJ-HV-0018 and BM-HV-0021 were the only two components where bolt protrusion/abrasions occurred at the Raychem splice. An abrasion condition on BM-HV-0021 was only present on the common lead. Therefore, valve operation and valve indication would not be affected. If BM-HV-0021 failed closed to its safe position, post-accident S/G sampling is still possible from a lower sampling point on 'C' S/G. In addition, outer containment isolation is provided by the downstream valve, BM-HV-0067.

SJ-HV-0018 is a normally closed valve and is designed to fail closed. Excessive leakage current from the solenoid hot lead would exceed 30 amps and blow the 3 amp fuse, thus closing the valve. In addition, the outer containment isolation valve provides redundant containment isolation. Therefore, the failure of the valve presents no new failure mode and no unreviewed safety questions exist.

Previous Occurrences

None

Footnotes

The system and component codes below are from the IEEE Standards 805-1983 and 803A-1983, respectively.

(1) System - SB; Component - SG
(2) System - JC, JE; Component - LIT
(3) System - AB
(4) Component - PT
(5) System - JC, JE; Component - LIT
(6) Component - PZR

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

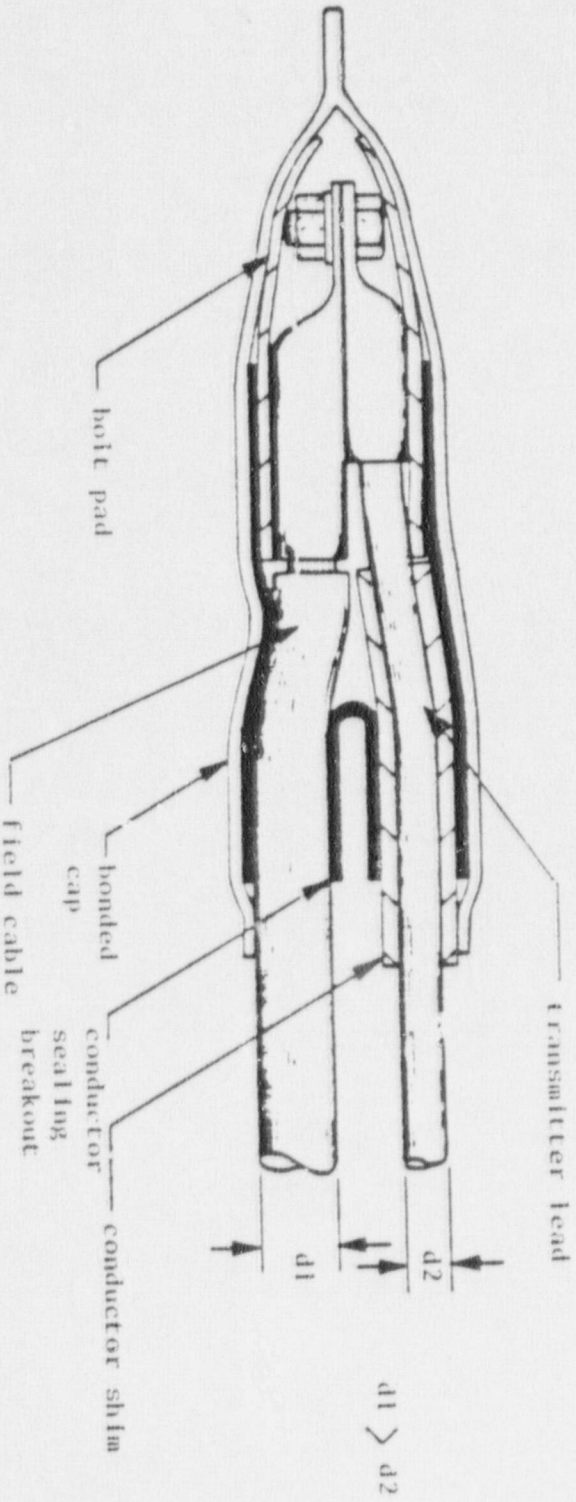
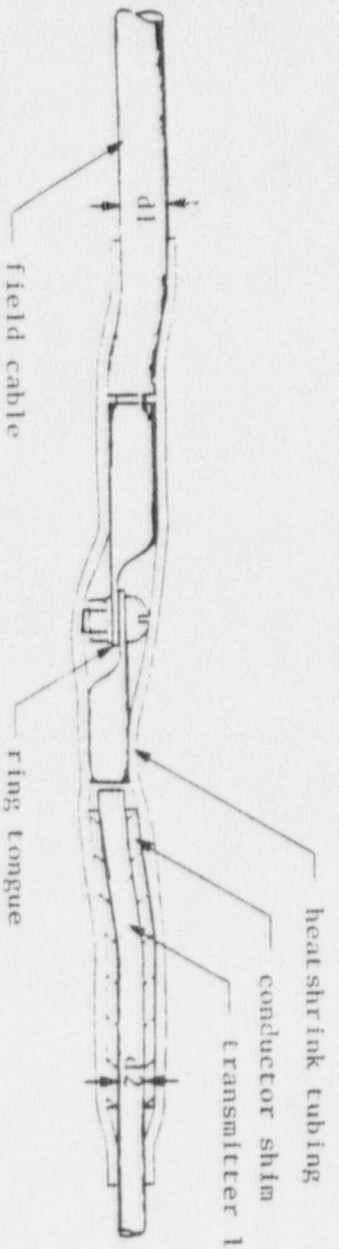


FIGURE 1 TYPE "V" - STUB CONNECTION



d1 < d2

FIGURE 2 BOLTED IN-LINE CONNECTION

NRC Form 366B
(9-83)

LICENSEE EVENT REPORT (LER) FAILURE CONTINUATION

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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
B	W I	C O N	R 0 9 8	N							
B	B P	C O N	R 0 9 8	N							
B	J E	C O N	R 0 9 8	N							
B	B B	C O N	R 0 9 8	N							
B	I G	C O N	R 0 9 8	N							
B	K N	C O N	R 0 9 8	N							

UNION ELECTRIC

Callaway Plant

April 10, 1989

U. S. Nuclear Regulatory Commission
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Washington, DC 20555

ULNRC-1969

Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 88-013-02
INSTRUMENT & CONTROL TERMINATION SPLICES FAIL
TO MEET ENVIRONMENTAL QUALIFICATION REQUIREMENTS DUE TO
SUPERCEDED GUIDANCE AND INSTALLATION ERRORS FROM INEFFECTIVE TRAINING

The enclosed Licensee Event Report is submitted pursuant to 10 CFR 50.73 concerning improper installation of Raychem heatshrink terminations. This second supplement expands on the Safety Significance portion of the report.

J. D. Blosser
Manager, Callaway Plant

TPS
TPS:jlh

Enclosure

cc: Distribution attached

IE22
1/1

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