10 CFR 50.73

Boston Edison

Pilgrim Nuclear Power Station
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E. T. Boulette, PhD
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January 22, 1997
BECo Letter 2.97.005

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

Docket No. 50-293
License No. DPR-35

The enclosed supplemental Licensee Event Report (LER) 96-004-01, "Low Voltage Power Primary Containment Electrical Penetrations with Degraded Electrical Protection," is submitted in accordance with 10 CFR 50.73.

The commitments identified in this letter are the same as those identified in the reply to a notice of violation that was submitted on November 20, 1996 (BECo Letter 2.96.101). Therefore, this letter contains no new commitments.

Please do not hesitate to contact me if there are any questions regarding this report.

E T Boulette

E. T. Boulette, PhD

DWE/dmc/9600401

cc: Mr. Hubert J. Miller
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NRC Form 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB NO.3150-0104 EXPIRES 5/31/95
LICENSEE EVENT REPORT (LER) (See reverse for number of digits/characters for each block)	ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE(3)
PILGRIM NUCLEAR POWER STATION	05000-293	1 of 13

TITLE (4)
Low Voltage Power Primary Containment Electrical Penetrations with Degraded Electrical Protection

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 NAME N/A	DOCKET NUMBER 05000
04	09	96	96	004	01	1	22	97	FACILITY NAME N/A	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (Check one or more) (11)							
POWER LEVEL (10)	100		20.402(b)		20.45(c)		50.73(a)(2)(iv)		73.71(b)
			20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)))		73.71(c)
			20.405(a)(1)(ii)		50.36(c)(2)	x	50.73(a)(2)(vii) C		OTHER
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(specify in Abstract
			20.405(a)(1)(iv)	x	50.73(a)(2)(ii) B		50.73(a)(2)(viii)(B)		below and in Text,
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		NRC Form 366A)

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Douglas W. Ellis - Principal Regulatory Affairs Engineer	508-830-8160

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
X	EC	CNTR	W120	Y						

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 15 single-spaced typewritten lines) (16)

On April 9, 1996, at 1720 hours, primary containment was declared inoperable and a 24 hour technical specification limiting condition for operation (LCO) was entered. This action was taken because the trip settings of magnetic-trip-only circuit breakers associated with certain 480V ac containment electrical penetrations were set too high to ensure containment integrity. Immediate corrective action taken consisted of decreasing the trip settings to the low/minimum setting. The LCO was terminated at 2109 hours on April 9, 1996. The integrity of the related containment electrical penetrations was verified with satisfactory results.

The primary root cause for the improper trip settings was a general unawareness of the coordination requirements for circuit protection components within 480 volt motor control centers. The coordination requirement was implied by reference to the National Electric Code in an electrical engineering calculation performed in 1992.

Additional corrective actions taken included the subsequent replacement of the subject circuit breakers with circuit breakers having a thermal magnetic trip design, review of other engineering calculations, revision of the procedures for engineering calculations and the long term plan, and engineering personnel training. Corrective actions planned include modifications by the end of the 1997 refueling outage and training.

The condition was identified while at 100 percent reactor power with the reactor mode selector switch in the RUN position. The reactor vessel pressure was approximately 1027 psig with the reactor water at the saturation temperature for the reactor vessel pressure.

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

REASON FOR THE SUPPLEMENT

This supplement is submitted to meet our commitment to supplement the initial report after completing the root cause analysis. The root cause analysis had not been completed when the initial report was submitted.

BACKGROUND

The safety objective of the primary containment system (PCS) is to provide the capability, in conjunction with other safeguards features, to limit the releases of fission products in the event of a postulated design basis accident so that offsite doses will not exceed the guidelines set forth in 10 CFR Part 100. The PCS design employs a low leakage pressure suppression containment system that houses the reactor vessel, the reactor recirculation system loops, and other branch connections of the reactor primary system.

The PCS consists of a drywell, a pressure suppression chamber (torus) that stores a large volume of water, a connecting vent system between the drywell and suppression chamber, isolation valves, vacuum relief system, containment cooling systems, and other service equipment.

In the event of a process piping failure within the drywell, reactor water and steam would be released to the drywell atmosphere. The resulting increased drywell atmosphere pressure would force a mixture of gas, steam, and water through the vent system into the suppression pool. The steam would condense rapidly in the suppression pool and result in a rapid drywell pressure reduction. Non-condensable gas transferred during the blowdown would pressurize the torus atmosphere. The resulting torus atmosphere pressure would subsequently vent to the drywell through the vacuum relief system as the drywell pressure decreases to less than the torus atmosphere pressure.

The drywell cooling system consists of eight cooling units located and distributed within the drywell. The units are manually controlled via control switches. Each cooling unit consists of two cooling coils and two motor driven fans. One or both cooling coils may be used for drywell atmosphere temperature control. The drywell cooling system cooling units are non-safety-related. The cooling coils are supplied with water for cooling by the safety-related reactor building closed cooling water system. The motor of each motor driven fan is supplied with 480V ac power via circuitry that includes electrical power conductors and a combination circuit breaker/starter. The starters are located in the reactor building (secondary containment) within safety-related 480V MCCs B-17 and B-18.

In general, primary containment penetrations, both piping and electrical, are designed for the following characteristics:

- the same pressure and temperature conditions as the drywell and torus
- capability of withstanding the forces caused by impingement of the fluid from the rupture of the largest local pipe or connection without failure

- capability of accommodating the thermal and mechanical stresses which may be encountered during all modes of operation including environmental events without failure

- withstanding the maximum reaction of the pipe to which they are attached

The electrical penetrations are testable. The test taps are located such that the penetrations can be tested without entering or pressurizing the drywell or suppression chamber.

The electrical penetrations for low voltage electrical power (480V ac), control (120V ac and 125V dc) and instrument cables utilize either aluminum oxide (suppression chamber portion of primary containment) or an epoxy resin (drywell portion of primary containment) to maintain the leak tight integrity of the penetration. The electrical circuits associated with these penetrations are equipped with protective devices, typically combination circuit breakers/starters and fuses. A combination circuit breaker/starter consists of a circuit breaker, contactor, and overload relay. The circuit breaker is normally closed. The circuit breaker is controlled by its trip setting. The contactor is controlled by a control switch and overload relay. The overload relay is controlled by the size of its heater element. If closed, the contactor functions to open if the control switch is manually operated or if the overload relay trips due to a faulted condition. The circuits provide power to safety-related and non-safety-related components inside primary containment.

Circuit protection for primary containment electrical penetrations is accomplished through coordination of the circuit breaker, contactor, and overload relay. The 480 volt motor control center (MCC) magnetic-trip-only circuit breakers were manufactured by the Westinghouse Corporation. Relative to electrical protection, the Pilgrim Station updated final safety analysis report section 8.9.5 (Cable Protection and Process Instrumentation Location Criteria) states, "Overload protection is provided by the proper selection and settings of relays, circuit breakers, heaters, and fuses."

The original architect - engineer (Bechtel Corporation) calculations include calculation EI-3. This calculation includes coordination curves for a number of protective devices for 4160 volt switchgear, 480 volt load centers, and 480 volt MCCs. The calculation neither identifies the basis for trip settings nor the need for coordination of the circuit breakers and motor starters (contactors and overload relays). Calculation EI-3 and other electrical calculations were obtained from the architect - engineer in the December 1987 time frame.

The original MCC drawings by the MCCs' fabricator, Nelson Electric, did not identify or specify breaker trip settings. The drawings (E8 series) included the provision for motor data but did not indicate motor horsepower or overload relay size. The drawings did not include or identify test/acceptance criteria.

During initial installation (circa 1971), it appears the majority of magnetic-trip-only circuit breakers were tested at the breaker's minimum trip settings. After initial Pilgrim Station startup in 1972, the settings were recorded on visi-records maintained by electrical maintenance. Discussions were conducted with knowledgeable electrical maintenance personnel in the late April - May 1996 time frame to determine the settings of the magnetic-trip-only circuit breakers since initial startup. The results of these discussions indicate the magnetic-trip-only circuit breakers were "usually" set at the breaker's maximum setting to prevent a spurious trip during the start of a motor, potentially at a critical time. The maintenance and settings of electrical components including circuit breakers and overload relays are currently controlled in accordance with approved drawings, including the E8 series drawings, and procedures, including procedure 8.Q.3-3, "480V AC Motor Control Center Testing and Maintenance."

In November 1986, engineering provided test and setting criteria for circuit breakers installed in 480 volt MCCs. The circuit breaker settings were based on electrical coordination studies that were completed in 1986. These studies evaluated coordination between circuit breakers/overload relays in 480 volt MCCs and circuit breakers in 480 volt load centers. These studies used existing trip settings from the visi-records. The trip settings of some of the magnetic-trip-only circuit breakers were decreased subsequently to coordinate with the trip settings of the related 480 volt load center breakers. The studies did not address circuit protection of the circuits powered from the 480 volt MCCs.

In the 1987 - 1988 time frame, as part of a circuit breaker overhaul project, the 480V ac MCC molded case circuit breakers were replaced. These molded case circuit breakers were type HFA circuit breakers having either a thermal magnetic or magnetic-trip-only design. The circuit breakers were replaced with type HFB breakers because molded case type HFA breakers were no longer available. The type HFB circuit breakers also had either a thermal magnetic or magnetic-trip-only design.

On July 9, 1991, several corrective action program documents including potential condition adverse to quality (PCAQ) 91-152 were written as part of preparation activities for an NRC inspection of the electrical distribution system. PCAQ 91-152 findings included the need to revise a calculation (PS-74) because the calculation did not address all values of current for which electrical penetrations should be protected. This finding initiated an engineering evaluation relative to operability.

During the period July 22-26, 1991, the NRC electrical distribution system functional inspection (91-80) was conducted. During the inspection, questions were raised regarding electrical penetration protection.

In response to the questions, PCAQ 91-165 was written on July 29, 1991, and the engineering evaluation that was initiated before the inspection was completed on August 1, 1991. As part of the evaluation, time-current curves for selected worst case circuits were prepared based on existing protective equipment settings that had been previously established. The curves showed the electrical penetration assemblies were adequately protected for short-circuit fault conditions. Westinghouse time-current curves and overload relay tables were used to develop these curves. Westinghouse time-current curves and overload relay tables were used to develop these curves. Westinghouse documents specifying, by reference to the NEC, the required circuit breaker - motor starter coordination were not reviewed because the focus of the evaluation was on installed equipment, not the selection or sizing of new equipment. The evaluation reviewed the adequacy of the largest protective devices for low voltage power and medium voltage power circuits associated with primary containment electrical penetrations.

PCAQ 91-165 remained open pending revision of calculation PS-74 (rev. 0) to incorporate the results of the evaluation.

PCAQ 91-167 was written on August 5, 1991. This document involved the heat dissipation capability of each electrical penetration assembly during normal ambient drywell atmosphere temperature conditions and during a loss of coolant accident (LOCA). The document also addressed overload protection of the penetration conductors after the conductors were derated for normal ambient drywell atmosphere temperature, grouping and diversity. These findings did not impact the trip settings of the circuit breakers of concern. PCAQ 91-167 and PCAQ 91-152 were consolidated with PCAQ 91-165 and were closed on August 17, 1992.

On November 25, 1991, a letter was submitted to the NRC in response to inspection report 91-80. The letter included actions pertaining to the questions involving electrical penetration protection. The letter indicated the time-current curves for each penetration circuit were to be documented in calculation PS-74. Instead, a new calculation PS-119, was performed to develop the time-current curves. Moreover, the letter indicated PS-74 would be revised to evaluate the penetrations' circuits that are active during a LOCA. Instead, a new calculation, PS-124, was performed to evaluate the derating factors for the penetrations' circuits that are active during a LOCA.

Calculation PS-119 was performed in the December 1992 time frame. The calculation was performed to develop time-current curves for each electrical penetration circuit during normal ambient drywell atmosphere conditions. Calculation PS-124 was also performed in the December 1992 time frame and evaluated the penetrations circuits that are active during loss of coolant accident conditions. These calculations were performed as part of a design reconstitution effort for primary containment electrical penetration protection. This effort was undertaken to resolve an observation that design documentation for circuit protection was incomplete.

In late 1995, Boston Edison Company contracted the NSSS supplier (General Electric) to calculate the time dependent drywell atmosphere temperature response profile following a range of small steamline pipe breaks based on a service water (ultimate heat sink) temperature of 75 degrees Fahrenheit. In January 1996, preliminary results of the NSSS calculations indicated the drywell atmosphere temperature profile was higher than the August 1987 report. Problem Report 96.9028 was written to document questions raised by the preliminary results. The preliminary results initiated a Boston Edison Company nuclear engineering review to identify affected equipment. The review included primary containment electrical penetrations. During this review, errors in calculations PS-119 and PS-124 were discovered. The discovery was documented in a problem report (PR 96.9092) and prompted an electrical engineering evaluation regarding operability of the electrical penetrations. The engineering evaluation was performed on January 26, 1996, and concluded the penetrations were operable.

On February 7, 1996, a problem with a circuit breaker for one of the drywell ventilation area coolers, VAC-205E2, was discovered during a routine operator tour. The problem consisted of a trip of the 480V ac MCC-B18 circuit breaker 52-1834 that occurred during normal operation. An attempt to reset the breaker was made but the breaker tripped during the attempt. The breaker was tagged, and a maintenance request (MR 19600320) was written to correct the problem. A corrective action program document (PR 96.9048) was written to document the problem. On February 7-8, 1996, in situ troubleshooting of breaker 52-1834 was conducted. The troubleshooting included visual inspection of the combination breaker/starter, and an electrical test (meggar) of the power circuit and fan motor for VAC-205E2, located inside the drywell. The electrical test indicated a failure of the fan motor.

On or about April 4-5, 1996, during continued engineering review of the protection for the electrical penetrations, an additional problem was identified. The problem involved the short circuit protection evaluation for the electrical penetrations in calculations PS-119 and PS-124. A problem report (PR 96.9159) was written to document the problem, and an evaluation relative to operability was performed on April 5, 1996. The evaluation concluded the penetrations were operable. The February 7, 1996, problem with circuit breaker 52-1834 was not known to the engineers who performed and reviewed the evaluation; consequently, the problem was not considered as part of the April 5, 1996, evaluation.

Later on April 5, 1996, after learning of the problem with circuit breaker 52-1834, engineering personnel became concerned the problem might impact penetration protection. On April 8, 1996, engineering personnel inspected the breaker 52-1834 cubicle, in the electrical shop and found evidence of thermal damage. Of specific concern was the fusion of the contactor contacts. Such fusion could prevent the circuit from de-energizing (i.e., the opening of the contactor contacts due to the operation of the overload relay) during certain fault conditions. The combination breaker/starter associated with 52-1834 was a molded case magnetic-trip-only design circuit breaker, model HFB-3480ML, with a size 1 contactor, equipped with an H44 overload relay, all manufactured by the Westinghouse Corporation. Although no root cause had been determined at that time, engineering personnel began a review of the electrical co-ordination of protective devices used to protect the penetration circuits because of the implications resulting from the evidence of fusion of the contactor contacts.

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

On April 9, 1996, a possible unacceptable failure mode of 480V ac MCC circuits supplying power to equipment inside the drywell was identified. The circuits of concern were those supplied via magnetic-trip-only circuit breakers whose trip settings could be set too high to ensure proper protection of the associated starter. Evaluation of these circuits identified 12 size 1 starters that were unacceptable.

These 12 circuits were for the motors of 12 of the 16 drywell unit coolers fans. These 12 circuits had 10 horsepower motors with size 1 starters and had magnetic-trip-only design circuit breakers set to trip between 300 amperes and 400 amperes. The circuit conductors are size #10 AWG. Based on the manufacturer catalogue requirements, size 1 starters should have a breaker with a magnetic trip setting of 182 amperes or less to provide proper starter protection. The other four fan motors are 20 horsepower, were not affected, and are supplied via size 2 contactors.

Operating above 182 amperes and below the 300 to 400 ampere breaker trip setting could damage the starter contactor and prevent clearing a high impedance electrical fault on overload. This, in turn, could damage the breaker's magnetic trip coil which is only designed to carry 50 amperes continuously. A failure of the coil would prevent a trip of the circuit breaker. Under these conditions, the conductor temperature would approach excessively high levels during normal operation in approximately 4 to 8 seconds if the fault did not clear. Under the same conditions, the conductor temperature would approach excessively high levels during an accident in approximately 2 to 4 seconds if the fault did not clear. Note that this failure mechanism would be a problem only if a high impedance electrical fault caused currents in the susceptible range. The susceptible range was current greater than 182 amperes and less than 300 to 400 amperes, for a period of 2 to 8 seconds without the fault degrading to a point where the circuit breaker would trip. Based on this mechanism, there would not be sufficient assurance that penetration seal integrity and, consequently, primary containment integrity could be maintained.

Nuclear engineering management was notified and a problem report (PR 96.9169) to document the problem was written and processed.

EVENT DESCRIPTION

On April 9, 1996, at 1720 hours, the senior on-shift licensed operator declared primary containment inoperable, and a 24 hour Technical Specification 3.7.A.2.a limiting condition for operation (LCO) was entered. The LCO was entered due to the problem with the trip settings of 12 circuit breakers that are part of the protection for the related containment electrical penetrations.

The penetration number, circuit breaker number, overload heater type, and functional description of the related electrical components were as follows:

Penetration Number (elevation)	Breaker Number (all type HFB-3480ML)	Overload Heater Type	Functional Description	
• Q105 A: (el. 39'-6")				
	52-1716	H44	Drywell unit cooler	VAC-205F1
	52-1726	H44		VAC-205A1
	52-1731	H44		VAC-205B1
	52-1732	FH44		VAC-205C1
	52-1733	H44		VAC-205D1
	52-1734	H44		VAC-205E1
• Q105B: (el. 39'-6")				
	52-1816	H44	Drywell unit cooler	VAC-205F2
	52-1826	H44		VAC-205A2
	52-1831	H44		VAC-205B2
	52-1832	H44		VAC-205C2
	52-1833	H44		VAC-205D2
	52-1834	H44		VAC-205E2

The NRC operations center was notified of the condition in accordance with 10 CFR 50.72 at 1727 hours.

Meanwhile, an engineering modification document (FRN 96-02-22) was written to decrease the trip settings of applicable breakers to less than 182 amperes (the low/minimum trip setting). Maintenance Request 19600856 was written to implement the modification. The trip settings of 10 of the above 12 circuit breakers were decreased to the low/minimum trip setting, and the LCO was terminated at 2105 hours on April 9, 1996. The trip settings of the other two affected circuit breakers, 52-1732 and 52-1834, were not changed because those circuit breakers were not installed or not in service at that time.

The condition was identified while at 100 percent reactor power with the reactor mode selector switch in the RUN position. The reactor vessel pressure was approximately 1027 psig with the reactor water at the saturation temperature corresponding to the reactor vessel pressure.

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

CAUSE

The primary cause for the improper trip settings was a general unawareness that circuit protection components within 480 volt MCCs had to be coordinated. The coordination requirement was implied by reference to the National Electric Code (NEC) in Westinghouse component sizing documents.

The Westinghouse design for magnetic-trip-only circuit breakers that are used in conjunction with motor starters (contactors and overload relays) requires the breaker to be set in accordance with the NEC. The NEC requires magnetic-trip-only circuit breakers be set at seven times the motor's full load current. If necessary, the trip setting can be increased to a maximum of thirteen times the full load current to prevent a trip during the start of a motor. Therefore, relative to contactor size/motor rating, the circuit breaker trip setting should be no greater than 182 amperes. The magnetic-trip-only circuit breakers were set to trip between 300 - 400 amperes, instantaneously. For overall protection of the subject circuits, the magnetic-trip-only circuit breakers should have been set at the minimum trip setting (approximately 160 amperes).

Calculation PS-119 included numerous references. The references, however, did not include any Westinghouse documents that provide circuit breaker-starter coordination criteria. The time-current coordination curves developed as part of PS-119 showed the overload relay protection extending up to the trip setting of the circuit breaker. There was no indication the overload relay protection was only applicable up to thirteen times the motor full load current rating. A review of the curves would not indicate a coordination problem.

The summary section of calculation PS-119 noted the penetrations' rated short-time overload capacity, rated short-circuit current, and rated short-circuit thermal capacity were not exceeded. The summary also noted problems with the penetrations' rated continuous current for which required action was identified including the correction of the trip settings for some magnetic-trip-only circuit breakers. In contrast, within the body of the calculation, it was noted that some circuits were not adequately protected for short-circuit fault conditions because the settings of the magnetic-trip-only circuit breakers exceeded NEC limits. The calculation did not indicate that Westinghouse required coordination in accordance with the NEC.

An engineering document was prepared in May 1993 to initiate corrective actions identified within the body of PS-119. Later in May 1993, the document (CSJA 93-006) was approved and a long term program item (LTP-639) was created to track this project. Prompt corrective action, however, was not taken for this project because the project was misprioritized based on the understanding that the project was an enhancement to restore design margin. This mischaracterization was based on the August 1, 1991, operability evaluation and engineering judgment that: (1) it was unlikely an electrical fault would result in short-circuit currents within the unprotected range (> 182 amperes and < 300-400 amperes); and, (2) if such a fault were to occur, it was unlikely the overload protection/contactor would fail to function. The electrical engineers were not aware of the Westinghouse design requirement pertaining to the coordination requirements of the NEC at that time, and they did not envision that the contactor contacts could fuse under certain conditions.

The mischaracterization of the modifications as enhancements versus required corrective actions caused the project to have a lower priority than other nuclear electrical engineering work assignments. The mischaracterization was the primary root cause for not expediting the modifications. Causes contributing to untimely corrective action included: (1) design requirements that were not properly identified; (2) the summary of calculation PS-119 was not accurate; and, (3) procedure NOP 89A1, "Long Term Plan," was misunderstood.

CORRECTIVE ACTION

A 24 hour LCO was entered at 1720 hours on April 9, 1996. The trip settings of 10 of the 12 affected circuit breakers were decreased to the low/minimum trip setting. This action was taken in accordance with nuclear engineering modification document FRN 96-02-22 and implemented via MR19600856. The trip settings of the other 2 affected circuit breakers, 52-1732 and 52-1834, were not changed because those circuit breakers were not installed or not in service at that time. The LCO was terminated at 2105 hours on April 9, 1996.

The integrity of penetration Q105B that contains the conductors associated with circuit breaker 52-1834 was verified on April 12, 1996, with satisfactory results. This action was taken because of the potential for overheating of the conductor and, hence, the electrical penetration seals from the same event that damaged the contacts of the contactor related to circuit breaker 52-1834. The verification consisted of a visual inspection of the penetration test pressure gauge. This gauge, and other test pressure gauges, is used for leak rate testing of primary containment conducted while shut down. The pressure gauge was found pressurized at a pressure consistent with the last leak rate test pressure and temperature. Based on the satisfactory results of the inspection and ALARA considerations, no additional penetration Q105B inspections were performed. The integrity of penetration Q105A was also verified in a similar manner with satisfactory results.

Another engineering modification document (FRN 96-02-23) was issued on April 9, 1996, to replace the 12 affected magnetic-trip-only design circuit breakers including the 10 that had their trip settings decreased to the low/minimum setting earlier on April 9, 1996. The document was implemented via MR 19600862. The replacement breakers are Westinghouse model HFB-3020L thermal magnetic design circuit breakers that provide better electrical protection than the magnetic-trip-only design circuit breakers that were replaced. Thermal magnetic type circuit breakers provide better protection because the thermal element in a thermal magnetic breaker provides a backup to the circuit's overload relay. The trip settings of the new installed circuit breakers were tested in accordance with the testing/acceptance criteria specified on the respective drawings, E8-13-8 and E8-15-7, that were issued as part of FRN 96-02-23. The installation of the new circuit breakers was completed by April 23, 1996.

Calculations PS-119 (rev. 2) and PS-124 (rev. 1) were identified as impacted by FRN 96-02-23 because of the change from magnetic-trip-only circuit breakers to thermal magnetic trip design circuit breakers. The calculations will be revised as part of the modification close-out process.

The problems with calculations PS-119 and PS-124 were discussed during two nuclear electrical engineering department weekly meetings, one held in March 1996 and one held on April 17, 1996.

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

The primary containment electrical penetrations were evaluated for operability based on the proper conductor derating factors and the maximum drywell atmosphere accident temperature. The evaluation concluded the penetrations were operable. The evaluation was approved on May 6, 1996, and superseded the April 5, 1996, operability evaluation performed for PR 96.9159.

The nuclear electrical engineering design guide standards EB19 and EB20 were revised (to rev. E1) for improvement relative to design considerations for primary containment electrical penetration protection. This action was completed in October 1996.

Nuclear Engineering Services Group (NESG) calculations were reviewed in November 1996. The focus of the review was to determine if other similar conditions existed (improper summarizing of calculation results in the calculation summary). The reviews identified no other instances of a calculation having been improperly summarized in the calculation summary. The review consisted of at least ten calculations, in each of the five engineering disciplines, that had been approved from January 1, 1990, to October 30, 1996. The review was performed as a self-assessment.

The other modifications resulting from calculation PS-119 are being implemented with some scheduled for implementation during the 1997 refueling outage (RFO-11) that is scheduled to begin in February 1997. The modifications will be completed by the end of RFO-11.

NESG procedure 3.05 (rev. 19), "Design Calculations," was revised. The focus of the revision was to require verification that, if corrective action(s) is identified as a result of a calculation, the corrective action(s) is tracked. This action was completed on December 23, 1996.

Procedure NOP 89A1, "Long Term Plan," has been reviewed and revised (to rev. 2). The focus of the revision was to improve the procedure from a human factors perspective. This action was completed by the end of December 1996. Training on NOP 89A1 will be conducted. The training is expected to be completed in the first quarter 1997. Actions taken and planned regarding procedure use and quality (NOP 89A1) are described in the response to NRC Inspection Report 96-80. Those actions are being separately tracked.

Training on the proper summation of calculations was conducted. The focus of the training was to assure a calculation summary reflects the conclusions identified in the body of the calculation. This training was conducted as a special training activity in the engineering and support personnel (ESP) training program. The majority of engineering personnel received the training during the week of December 16, 1996. The training was completed during the week of January 5, 1997.

Training on the communication of potential issues having safety significance was also conducted. The focus of the training was to emphasize management expectations regarding timeliness of corrective action. This training was also conducted as a special training activity in the ESP training program. The majority of engineering personnel received the training during the week of December 16, 1996. The training was completed during the week of January 5, 1997.

The corrective actions taken and planned were included in the reply to a notice of violation (96-07-01) submitted to the NRC on November 20, 1996. The reply included a commitment to include the reply (letter 2.96.101) in the ESP training program. The purpose of this training is for broad awareness of the violation, the reasons for the violation, and the corrective actions taken and planned. This action is expected to be completed in the second quarter 1997.

The corrective actions taken and planned, including the reply to the notice of violation in the ESP training program, are being tracked as part of the reply to the notice of violation. This supplemental LER does not contain corrective actions in addition to those identified in the reply to the notice of violation. Therefore, this supplemental LER does not contain any new commitments.

SAFETY CONSEQUENCES

The most severe nuclear system effects and the greatest release of radioactive material to primary containment results from a complete circumferential break of one of the recirculation loop pipelines. The accident is described in UFSAR section 14.5.3 and was established as the design basis LOCA.

The circuit breakers installed in the 12 identified applications during original plant construction were type HFA circuit breakers. The trip settings while the type HFA magnetic-trip-only design circuit breakers were installed were "usually" set at the breaker's maximum setting to prevent a spurious trip during the start of a motor, potentially at a critical time. Therefore, the problem reported in this report potentially existed since initial startup of Pilgrim Station. Since initial startup, Pilgrim Station has conducted numerous reactor startups, has operated at various reactor power levels, and has conducted numerous reactor shutdowns. Based on operational experience, the risk of a design basis LOCA during the 1972-1996 period was conservatively estimated at approximately 3.3E-05/year. The postulated failure mechanism, a high impedance electrical fault that causes currents in the susceptible range without the fault degrading to a point where the circuit breaker would trip, although possible, is not likely. Therefore, it is reasonable to expect that the likelihood of a high impedance electrical fault causing currents in the susceptible range for penetration failure in conjunction with a LOCA would be much less than 3.3E-05/year. The integrity of penetration Q105B (related to breaker 52-1834) was verified with satisfactory results on April 12, 1996. The verification consisted of a visual inspection of the penetration test pressure gauge. This gauge and other test pressure gauges are used for primary containment leak rate testing. The integrity of penetration Q105A was also verified with satisfactory results.

This report is submitted in accordance with 10 CFR 50.73 (a)(2)(ii)(B) because the trip settings of the affected magnetic-trip-only circuit breakers in conjunction with a high impedance electrical fault without the fault degrading to a point where the circuit breaker would trip, could have resulted in the failure of at least one low voltage power primary containment electrical penetration during normal plant operation or in the event of a LOCA.

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

This report is submitted in accordance with 10 CFR 50.73 (a)(2)(vii)(C) because the problem potentially affected more than one primary containment electrical penetration (penetrations Q105A and Q105B).

SIMILARITY TO PREVIOUS EVENTS

A review was conducted of Pilgrim Station Licensee Event Reports (LERs) submitted since 1984. The review focused on LERs involving the primary containment pressure boundary. The review identified LERs 89-008-00, 89-037-01, 91-023-00, and 94-007-00. These LERs did not involve electrical penetrations or electrical systems.

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for this report are as follows:

COMPONENTS	CODES
Contactor (associated with breaker 52-1834)	CNTR
Penetration	PEN
Vessel (Primary Containment Vessel/Torus)	VSL

SYSTEMS	
Containment Leakage Control System	BD
Low-Voltage Power System (600V and less)	EC