



LONG ISLAND LIGHTING COMPANY

SHOREHAM NUCLEAR POWER STATION

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Direct Dial Number

May 25, 1983

SNRC-895

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

Environmental Qualification
Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

Reference: Letter dated March 24, 1983, A. Schwencer (NRC) to
M. S. Pollock (LILCO) re; Environmental Qualification
of GE switches, Type CR 2940

Dear Mr. Denton:

The above referenced letter concerns the identification by Philadelphia Electric Co. of the failure of GE type CR 2940 switches under design basis LOCA radiation conditions. The test failure, as described by Philadelphia Electric Co., was attributed to radiation embrittlement of the non-metallic switch cam after exposure to 2.7×10^7 rads. These switches are used in various applications at Shoreham.

Although a similar failure was identified by Wyle Labs during generic environmental qualification testing conducted for LILCO, the failure was not considered a reportable deficiency and NRC was not notified because the failure occurred under conditions not representative of those for Shoreham equipment (i.e. the intent was to qualify these switches for all possible future applications as well as the presently defined harsh environment applications). A summary of the Shoreham test is presented in Attachment 1 to this letter.

These switches are installed in control circuits which are sufficiently isolated from the class 1E power system such that cam failure would not adversely affect other safety related equipment. The harsh environment application of these switches (both Class 1E and non-Class 1E) is listed in Attachment 2. Justification for exclusion of the non-Class 1E applications of these switches from further consideration within this qualification review is also provided in this attachment.

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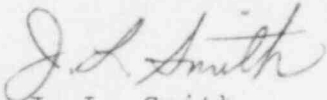
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A summary of the failure analyses and justification for continued use of those switches used in Class 1E control circuits exposed to the postulated harsh environment is given in Attachment 3.

In conclusion, the Philadelphia Electric Co. test failure was due to a radiation dose higher than that applicable to Shoreham equipment. Failure of GE CR 2940 switches under Shoreham design basis LOCA radiation levels would not adversely affect any other safety related equipment or impact plant safe shutdown capability.

Should you have any further questions regarding this matter, please feel free to contact this office.

Very truly yours,



J. L. Smith
Manager, Special Projects
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DWD:bc

Attachment

cc: J. Higgins
All Parties Listed in Enclosure 1
J. Etzweiler

ATTACHMENT 1

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ATTACHMENT 1

SHOREHAM CR 2940 TESTING SUMMARY

The GE CR 2940 series switches were recently tested by Wyle Laboratories as part of the Shoreham Environmental Qualification Program. In order to determine the appropriate test requirements, a detailed survey of CR 2940 switches used in harsh environments at Shoreham was performed. This included field walkdowns, a review of electrical design tabulations of local selector switches used in cable and conduit scheduling, and a review of vendor-supplied equipment located in the secondary containment. This review resulted in identification of the bounding service condition and the formation of a test plan which included testing of two CR 2940 switches.

One switch specimen was irradiated to 1.43×10^8 rads to envelop all secondary containment radiation zones in order to generically qualify this switch for any future applications at Shoreham. The cam of this specimen was embrittled during irradiation and broke during shipment to Wyle from the radiation test facility. Since this test failure occurred under conditions not representative of those for Shoreham equipment, it was not considered a reportable deficiency and NRC was not notified.

The second switch specimen was irradiated to 6.33×10^6 rads to envelop the Shoreham required service conditions. This switch specimen successfully passed the postulated accident radiation test and subsequent 40-year equivalent thermal aging test without incident. The next sequence of testing required by the Wyle labs test program was cycle aging and during this phase, the cam failed due to embrittlement. This sequence of testing was not appropriate for Shoreham equipment however, and a more detailed discussion is presented in Attachment 3.

ATTACHMENT 2

GENERAL ELECTRIC CR2940 CONTROL SWITCHES
LOCATED IN POTENTIALLY HARSH ENVIRONMENT

<u>Switch Location</u>	<u>Function</u>	<u>Power Supply</u>	<u>QA Category</u>	<u>Remarks</u>
1P41*HS102A,B	Sample to Rad. Monitor valve 1P41*MOV102A,B	1R24*MCC1111,1124	I	Addressed in Wyle Test Report 17606-1
1T48*HS851A,B	H ₂ Analyzer Function	1R35*PNL-B2,R2	I	Qualified by Comsip-Delphi Test Report No. 1035-1.
1C41*PB024A,B	1C41*P024A,B Test Push Buttons (local)	1R24*MCC1113,1123	I	Addressed in Wyle Test Report 17606-1
1C61*PNL-RSP	RCIC Turbine Trip	1R42*MCC0A2	I	Remote Shutdown Panel is normally de-energized and is not required for LOCA or PBOC mitigation.
1G11-HSSS035A,B, C,D	Control Switch for 1G11-P035A,B,C,D	1R24-MCC11D1,12D1	II	Nonsafety-related power; the Category II MCC power supply feeding RB sump pumps is tripped on LOCA signal by 1R24*MST11D1,12D1
1G11-HSS214A,B	Control Switch for 1G11P21A,B	1R24-MCC11D1,12D1	II	Nonsafety-related power; the Category II MCC power supply feeding RB sump pumps is tripped on LOCA signal by 1R24*MST11D1, 12D1
1G11-HSS224A,B	Control Switch 1G11-P224A,B	1R24-MCC11D1,12D1	II	Nonsafety-related power; the Category II MCC power supply feeding RB sump pumps is tripped on LOCA signal by 1R24*MST11D1,12D1.

ATTACHMENT 2 (continued)

<u>Switch Location</u>	<u>Function</u>	<u>Power Supply</u>	<u>QA Category</u>	<u>Remarks</u>
1H21-PNL-011	Standby Liquid Control Storage Tank Heaters	1R24-MCC111C	II	Nonsafety-related power. The Cat II MCC power supply for these heaters is tripped on a LOCA signal.
1H21-PNL-011	Standby Liquid Control Tank Startup Heaters	1R24-MCC112C	II	Nonsafety-related power. The Cat II MCC power supply for these heaters is tripped on a LOCA signal.
1P11-HS010A,B	Control Switch 1P11-P010A,B	1R24-MCC11D3,12D1	II	Nonsafety-related power; located in environment with maximum radiation dose of 5.08×10^4 rads. Also, cam failure shows pumps would stop if cam broke. Pump operation does not affect other safety-related equipment.
1P11-HS011	Control Switch 1P11-P011	1R22-SWG-12	II	Nonsafety-related power; located in environment with maximum radiation dose of 5.08×10^4 rads. Also, cam failure breaker analysis shows pump circuit breaker would trip if cam broke. Pump operation does not affect other safety-related equipment.
Reactor Building Vehicle Access Lock Control Panel	Operate access doors	1R24-MCC11D1	II	Nonsafety-related power; cam failure in push button will not change state of circuit.

ATTACHMENT 2 (continued)

<u>Switch Location</u>	<u>Function</u>	<u>Power Supply</u>	<u>QA Category</u>	<u>Remarks</u>
Drywell Personnel AirLock Hatch Control Panel 1T28-JB01	Operate drywell access hatch	1R42-PNL-C2	II	Nonsafety-related power; cam failure push button will not change state of circuit.
1P33-PNL-049	Test button for Reactor Building Sample Panel	1R35-PNL-N6	II	Nonsafety-related power; cam failure in push button will not change state of circuit.
1G33-PNL-028	RWCU Local Control Panel	1R35-PNL-N6	II	Nonsafety-related power. Cam failure will not affect system safety function.
1G33-RK-012	RWCU Local Inst. Panel	1R35-PNL-N6	II	Nonsafety-related power. Cam failure will not affect system safety function.

ATTACHMENT 3

CR 2940 FAILURE ANALYSIS

The failure of these switches during environmental qualification testing for Shoreham is described in Attachment 1. As discussed therein, when tested to Shoreham specific, service condition, the switches were found to be acceptable until the final phase of testing, cycle aging. However, the requirement to cycle these switches after exposure to the accident environment is not applicable to Shoreham.

These switches are designated operability code B; they are not required to operate during or after a LOCA and cannot fail in any manner which would prevent other safety-related equipment from accomplishing its required safety function. This operability code has been assigned on the basis that these switches are local control switches and only utilized for local system testing. LILCO considers these switches qualified for their current applications on the basis that there is no requirement that they be operated after a LOCA.

Although these switches are qualified for their current Shoreham applications, a failure analysis has been performed for each of the 1E control circuits which contain locally mounted GE type CR 2940 switches. The analysis determined of what, if any, consequence to the circuit a catastrophic switch actuator cam failure would be. It is postulated, although considered highly unlikely, that high radiation levels during and after an accident could cause the nonmetallic cam to weaken to the point where the contact spring force could cause the cam to break. As a result, the switch contacts would revert to their normal state.

A total of four locally mounted Class 1E switch applications located in the postulated harsh environment of the reactor building secondary containment have been identified. A summary of the failure analysis and justification for continued use of these switches is provided on the following pages.

1) EQUIPMENT NAME

Hydrogen and Oxygen Analyzer Panels 1T48*PNL 068A&B and
1T48*PNL 069A&B (Local Control Stations)

LOCA RADIATION DOSE

5.93×10^5 rads

FAILURE ANALYSIS

None required

JUSTIFICATION STATEMENT

These switches are used for local control applications.
The vendor, Comsip-Delphi, has qualified these switches as
part of the panel assembly to a radiation dose of 10^6 rads.

2) EQUIPMENT NAME

Standby Liquid Control Pumps, local motor control devices
(1C41*PO24A&B)

LOCA RADIATION DOSE

5.75×10^6 rads

FAILURE ANALYSIS

These are locally mounted momentary contact, spring return, push-button type switches which are used for testing the SLC pumps. When the push-button is not depressed (i.e. during normal operation) the cam is disengaged and its failure would not actively effect the control circuit. Cam failure would only prevent local testing of the pumps.

JUSTIFICATION STATEMENT

These pumps are not required to operate during or after a LOCA. Failure of these switches will not degrade the safety function of any other Class 1E equipment.

3) EQUIPMENT NAME

Service Water System sample valves 1P41*MOV102A&B, Local control devices.

LOCA RADIATION DOSE

5.75×10^6 rads

FAILURE ANALYSIS

These are locally mounted 3 position rotary switches; "close" "open" "center", spring return to center. In the "center" position (normal plant operation), all contacts are held open by the cam. Failure of the cam would result in a signal to close these sample valves. These MOV's isolate the sample lines between the service water system and the QA Category II service water radiation monitoring panels 1D11-PNL023A&B.

Valves 1P41*MOV102A&B are also interlocked with the RHR heat exchanger outlet valves (service water side; 1P41*MOV034A&B) such that 1P41*MOV102A&B will open whenever 1P41*MOV034A&B open. Valves 1P41*MOV034A&B receive signals to close for a LOCA. However, at some time after the LOCA, the RHR heat exchangers would be placed back in service and valves 1P41*MOV102A&B would open due to the interlock circuitry. Once these valves are fully open and the "open" signal clears, the "close" signal (from the local control station) is once again present (failure of CR 2940 switch seals this in) and the valve again closes. When the valve is fully closed and the "close" signal clears, the "open" signal is again received due to the interlock. This cycle repeats itself for a maximum period of 200 seconds because of a timer relay in the interlock circuit. After the timing relay clears, the valve will remain closed. The cycling of these sample valves would not degrade the function of any other safety system.

Torque and limit switches are provided in the closing and opening circuits to prevent electrical fault should the valve already be fully closed or open and the local control switch fail to the "closed" position.

JUSTIFICATION STATEMENT

The Cat II radiation monitor is not required for LOCA mitigation. Local operation of these valves is not required to mitigate the consequences of a LOCA. Failure of the local control switches would not degrade the function of any other safety related system.

4) EQUIPMENT NAME

Remote Shutdown Panel. RCIC turbine trip

LOCA RADIATION DOSE

4.62×10^5 rads

FAILURE ANALYSIS

This is a pushbutton type switch which allows remote tripping of the RCIC turbine from the remote shutdown panel (RSP). The RSP is normally deenergized. Failure of this switch at the RSP would not affect the operation of RCIC during a LOCA.

JUSTIFICATION STATEMENT

The RSP is not required to operate for LOCA mitigation. Failure of these switches would not degrade the function of any other safety related equipment.