PSE&G Public Service Electric and Gas Company

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Robert L. Mittl General Manager
Nuclear Assurance and Regulation

August 5, 1985

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20814

Attention: Mr. Walter Butler, Chief
Licensing Branch 2
Division of Licensing

Gentlemen:

SAFETY EVALUATION REPORT OPEN ISSUE 7
HOPE CREEK GENERATING STATION
DOCKET NO. 50-354

Pursuant to the May 28, 1985, telecon on SER Open Issue 7, the following information is attached for your review:

- o Data for test current versus the maximum short circuit condition in each test case.
- o a statement regarding the test performance of the metal clad cable compared to the rigid steel conduit.

Should you have any questions in this regard, please contact us.

Very truly yours,

R L Mittl

Attachment

C D. H. Wagner
USNRC Licensing Project Manager

A. R. Blough
USNRC Senior Resident Inspector

ATTACHMENT 1

Safety Evaluation Report-Open Item 7 and Confirmatory Item 29

On May 28, 1985 a telephone conference call was held to discuss the information submitted by PSE&G letter to NRC dated April 4, 1985, R. L. Mittl to A. Schwencer. The letter submitted for staff review a copy of Wyle Test Report 17730-01, "Cable and Raceway Physical Separation Verification Testing" dated March 1985. Mr. Wagner and Mr. Rhow of the NRC staff requested additional information from PSE&G in order to complete the review of the subject items. The following provides the requested additional information:

A. Test Currents vs. Maximum HCGS Fault Currents

The test was designed to address a concern expressed by the NRC staff reviewer with regard to cable and raceway separation. In the discussions with the staff, PSE&G and BPC offered to test using maximum short circuit currents; however, the staff reviewer was concerned that the I^2t value for the maximum short circuit current would not be as destructive as that of an overload current that could persist for a longer time. This, in fact, is the case. Thus, a comparison of the heating effects on the faulted test cables represented by a summation of I^2t values imposed by the fault currents with those of the maximum calculated fault currents on the corresponding Hope Creek cables is provided in the attached tabulation.

Table I of the Wyle test report tabulates the various sizes of cables that were tested together with the test currents used to cause the faulted cable condition (open circuit with or without ignition of the cable). Attached Table A has been prepared to correlate selected information from the Wyle Table I with the corresponding Hope Creek design configuration in order to compare the test currents with maximum fault currents expected in the actual design. The tabulation is arranged to show the maximum I^2t values imposed on each of the test cable sizes until the test cable reached a faulted condition, i.e., the same test cable size is used in more than one test configuration and only the maximum I^2t values calculated for each test configuration is shown. Corresponding to the test values are the design values which have been conservatively derived to provide comparison. The derivation of the design values is based on conservative assumptions that the fault current available is not reduced by impedances in the circuits (cables and transformers) and that the maximum operating times of the primary overcurrent protective devices are used.

As shown by the tabulation the test values significantly exceed the HCGS design values with respect to heating effects caused by faulted cables. It is concluded that the Hope Creek design will prevent faulted cables in the same or similar configuration as tested from affecting the redundant cables because an over-current device, primary or upstream backup if the primary device fails, in each circuit will clear fault currents such that temperature obtained in the testing are not reached in the design. Also, the Hope Creek design does not permit circuits to be loaded to rated ampacity of a cable since derating factors are used to account for ambient temperatures and installation in raceways.

B. Metal-Clad Cable and Rigid Steel Conduit

The metal cladding of the metal-clad cable performs the same function as the rigid steel conduit in providing protection to the enclosed cable from external hazards of a limited nature. A discussion of testing on the metal-clad cable is provided in FSAR Section 1.8.1.75.

TABLE A

Comparison of Wyle Test Configurations with HCGS Design

Wyle Test Configuration HCGS Design

Test Configuration Number	Faulted Cable Size	Test Values: Current, Amperes	Test Values: Time, Seconds	Test Values: I^2t	Design Values: Maximum Fault Current, Amperes	Design Values: Time, Seconds	Design Values: I^2t	Basis for Maximum Fault Current and Duration
1 and 2	2/C No. 2 AWG	210 550 700 900 1200	900 1500 3150 1830 300	39.7×10^6 453.8×10^6 1543.5×10^6 1482.3×10^6 432×10^6 Total = 3951.3×10^6 Note 1	8430	.011	$.781 \times 10^6$	The test configurations represent Cable Spreading Room tray installations. The largest cable in this area is 2/C No. 2AWG which is used to supply 125V dc power to relay panels (C654 series). The cable has a 50A circuit breaker in distribution panel D318 for overcurrent protection. To provide conservative design values, the fault current available at the distribution panel is assumed to be the same as at its upstream switchgear and the duration is based on the 50A circuit breaker's operating time.
3 and 4	1/C 500 MCM	477 1000 1400 1750 1900 2077 2200	900 2760 840 4080 2580 1860 540	204.8×10^6 2760×10^6 1646.4×10^6 12495×10^6 9313.8×10^6 8023.9×10^6 2613.6×10^6 Total = 37057.5×10^6 Note 2	30000	.2	180×10^6	The test configurations represent a 480V ac power cable enclosed and separated by 1" from an open cable tray. This power cable is typically a motor control center feeder cable with 500 MCM as the largest cable. To provide conservative design values, the fault current available at an unit substation bus is shown and the duration is based on the operating time of an unit substation circuit breaker.

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Wyle Test Configuration HCGS Design

Test Configuration Number	Faulted Cable Size	Test Values: Current, Amperes	Test Values: Time, Seconds	Test Values: I^2t	Design Values: Maximum Fault Current, Amperes	Design Values: Time, Seconds	Design Values: I^2t	Basis for Maximum Fault Current and Duration
5, 6, 7 and 8	3/C No. 2/0	600	900	324×10^6				The test configurations represent 480V ac power cables dropping out of cable trays or enclosed in rigid steel conduits with a separation distance of 1/2" or 1", as defined in the tests, from a conduit or free air cables. Typically the power cables are for motor control center loads of motors, battery chargers and heaters. Overcurrent protection is provided by a circuit breaker in the MCC. To provide conservative design values the fault current available at the MCC bus is shown and the duration is based on the operating time of a MCC circuit breaker.
		900	900	729×10^6				
		1050	960	1058.4×10^6				
		1350	1860	3389.9×10^6				
		1700	2220	6415.8×10^6				
		2000	1020	4080×10^6				
		2500	480	3000×10^6				
		6000	60	2160×10^6				
				Total = 21157.1×10^6 Note 3	25000	.02	12.5×10^6	

Comparison of Wyle Test Configurations with HCGS Design

Wyle Test Configuration HCGS Design

Test Configuration Number	Faulted Cable Size	Test Values: Current, Amperes	Test Values: Time, Seconds	Test Values: I^2t	Design Values: Maximum Fault Current, Amperes	Design Values: Time, Seconds	Design Values: I^2t	Basis for Maximum Fault Current and Duration
11 and 12	4/C No. 2AWG-MC	492 692 1000 1500	900 180 3540 2640	217.9×10^6 86.2×10^6 3540×10^6 5940×10^6 Total = 9784.1×10^6 Note 4	25000	.02	12.5×10^6	The test configurations represent metal-clad cable separation from cable tray. Typically the cable is a 480/277V ac power cable from a motor control center to a lighting distribution panel. Overcurrent protection is provided by a circuit breaker in the MCC. The design values shown are the same as shown for Test Configuration Nos. 5, 6, 7 and 8 to provide conservatism.
13 and 14	4/C No. 10AWG-AC	160 220 280 340 450 600	900 1620 2400 1300 960 210	23×10^6 78.4×10^6 188.2×10^6 152.7×10^6 194.4×10^6 75.6×10^6 Total = 712.2×10^6 Note 5	25000	.02	12.5×10^6	The test configurations represent armor-clad cable separation from cable tray. Typically the cable is a lighting branch feeder circuit to lighting fixtures. Overcurrent protection is provided in the lighting distribution panel. Even though the fault current and duration available at the lighting distribution panel will be significantly less than that available at its upstream MCC bus,

Comparison of Wyle Test Configurations with HCGS Design

Wyle Test Configuration — HCGS Design

Test Configuration Number	Faulted Cable Size	Test Values: Current, Amperes	Test Values: Time, Seconds	Test Values: I^2t	Design Values: Maximum Fault Current, Amperes	Design Values: Time, Seconds	Design Values: I^2t	Basis for Maximum Fault Current and Duration
13 and 14 (Cont'd)	4/C No. 10AWG-AC							the same design values for Test Configuration Nos. 5, 6, 7 and 8 are shown here for conservatism.
13 and 14	Heliax-coaxial	100 200 300 400 500 600	780 720 1620 1020 1020 20	7.8×10^6 28.8×10^6 145.8×10^6 163.2×10^6 255×10^6 7.2×10^6 Total = 607.8×10^6 Note 6	250	.011	$.0006875 \times 10^6$	The test configurations represent UHF radio antenna cable separation from cable tray. The cable carries low power signals. Primary overcurrent protection is provided in the radio cabinet with backup protection provided by a 20A fuse in the 120V ac distribution panle 1BJ484. The fault current available is from the upstream inverter which has a limited output.

NOTES

1. Test Values shown are based on Test Configuration No. 1 results.
2. Test Values shown are based on Test Configuration No. 3 results.
3. Test Values shown are based on Test Configuration No. 6 results.
4. Test Values shown are based on Test Configuration No. 12 results.
5. Test Values shown are based on Test Configuration No. 13, Test 1 results.
6. Test Values shown are based on Test Configuration No. 14, Test 2 results.