PSEG Public Service Electric and Gas Company

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Robert L. Mittl General Manager
Nuclear Assurance and Regulation

September 3, 1985

Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20814

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

Gentlemen:

REVISED RESPONSE TO OUTSTANDING ISSUE-7
HOPE CREEK GENERATING STATION
DOCKET NO. 50-354

During the NRC-NRR Power Systems Branch audit of Hope Creek held on August 7 and 8, 1985 the NRC-NRR reviewer indicated that PSE&G should revise their August 5, 1985 response to Outstanding Issue-7 to be more representative of actual fault current values. As such, Attachment 1 provides for your review a revised summary description and evaluation of test currents vs Hope Creek Generating Station fault current testing.

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

Very truly yours,

R. L. Mittl / BA Preston

Attachments

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C D.H. Wagner
USNRC Licensing Project Manager

A.R. Blough
USNRC Senior Resident Inspector

ATTACHMENT 1

A. Test Currents vs. 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 calculated fault currents on the corresponding Hope Creek representative 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 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 derived to provide comparison. The derivation of the design values is based on representative cable installations with the fault current available reduced by impedances in the circuits (cables and/or transformers) and on the operating times of the primary overcurrent protective devices for clearing the fault currents to determine I^2t values.

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 overcurrent 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.

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: Fault Current, Amperes	Design Values: Time Seconds	Design Values: I^2t	Basis for 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	1026	.10	$.105 \times 10^6$	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 circuirt breaker in distribution panel DB18 for primary overcurrent protection. Backup protection is pro[illegible]led by an upstream 225A switchgear circuit breaker. The fault current available at the cable location inside the CSR is shown.
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	13369	.2	35.8×10^6	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. The fault current available for the enclosed cable is shown. Primary overcurrent protection is provided by a 600A load center breaker and a 1200A upstream switchgear circuit breaker provides backup protection.

Comparison of Wyle Test Configurations with HCGS Design

Wyle Test Configuration

HCGS Design

Test Configuration Number	Faulted Cable Size	Test Values			Design Values			Basis for Fault Current and Duration
		Current Amperes	Time, Seconds	I^2t	Fault Current, Amperes	Time, Seconds	I^2t	
5, 6, 7 and 8	3/C No. 2/O	600 900 1050 1350 1700 2000 2500 6000	900 900 960 1860 2220 1020 480 60	324×10^6 729×10^6 1058.4×10^6 3389.9×10^6 6415.8×10^6 4080×10^6 3000×10^6 2160×10^6 Total = 21157.1×10^6 Note 3	8349	.02	1.39×10^6	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. Primary overcurrent protection is provided by a 150A circuit breaker in the MCC. Backup protection is provided by an upstream 600A load center breaker. The fault current available downstream of the MCC bus is shown.

TABLE A

Comparison of Wyle Test Configurations with HCGS Design

Wyle Test Configuration

HCGS Design

Test Configuration Number	Faulted Cable Size	Test Values			Design Values			Basis for Fault Current and Duration
		Current Amperes	Time, Seconds	I^2t	Fault Current, Amperes	Time, Seconds	I^2t	
11 and 12 125A MCC 600A LC	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	4302	.02	$.37 \times 10^6$	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. Primary overcurrent proetction is provided by a 150A circuit breaker in the MCC. Backup protection is provided by an upstream 600A load center breaker.
13 and 14	4/C No. 10AWG-AC	160 220 260 340 450 600	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 Total = 712.2×10^6 Note 5	1048	.02	$.022 \times 10^6$	The test configurations represent armor-clad cable separation from cable tray. Typically the cable is a lighting branch feeder circuit to lighting fixtures. Primary overcurrent protection is provided by a 20A circuit breaker in the lighting distribution panel. Backup protection is provided by another 70A circuit breaker located upstream.

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: Fault Current, Amperes	Design Values: Time, Seconds	Design Values: I^2t	Basis for FaDlt Current and Duration
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 panel 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.