November 13, 1979

Mr. James P. O'Reilly, Director
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Serial No. 888A
PSE&C/JMD:adw:mc

Docket No. 50-339

Dear Mr. O'Reilly:

Pursuant to the provisions of 10CFR50.55(e) and 10CFR21, you were notified on October 24, 1979, and by letter (Serial No. 888) dated October 29, 1979, concerning discovery of a defect in the insulation of one conductor of a twelve (12) conductor #14 AWG Class IE cable.

North Anna Unit 1 was installing a twelve (12) conductor #14 AWG, Firewall III Class IE cable furnished by Cerro Wire and Cable Company, a type cable used in many Class IE areas of both North Anna Units 1 and 2, and during the termination process discovered a small area of bare conductor on one of the twelve conductors after stripping the jacket back.

The defective section of cable was removed and returned to vendor for determination of cause and probability of any further defects in procured and installed cable.

The defect was determined by the vendor to be the result of a undercured insulation repair made during the manufacturing of single conductors. The undercured repair was severely distorted during subsequent curing of the overall neoprene jacket covering the twelve conductors.

Vepco returned the remaining three (3) reels of 12 conductor #14 AWG Firewall III cable on site to the vendor for inspection and evaluation of any defects. The cable was disassembled, inspected and tested for any defects. One repair was located and shown to be good. All testing proved no defects existed in the returned cable.

The vendor further sampled and tested insulation repairs in his existing cable inventory to statiscally show further defects do not exist. The attached test report from the cable vendor details his inspections, tests and conclusions.

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We agree that the conductor defect discovered at North Anna was a random and highly improbable occurrence and not indicative of other defects existing in the installed cables.

This is our final report on this item. Should you require further information please advise.

Very truly yours,

Sam C. Brown, Jr.
Senior Vice President
Power Station Engineering
and Construction

Attachments

cc: Mr. Victor Stello, Director
Office of Inspection & Enforcement

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation

THE ROCKBESTOS COMPANY
NEW HAVEN, CONNECTICUT 06504 USA TELEPHONE (203) 772-2250 TELEX 710 465-2149

October 26, 1979

Mr. Arthur J. Fitzpatrick
Stone & Webster Engineering Corp.
245 Summer Street
Boston, Mass. 02107

Dear Mr. Fitzpatrick:

In accordance with the test plan submitted to you, dated October 17, 1979, we have performed testing and analysis outlined in the attached report.

Please contact J. R. Marth or me if you have further questions.

Very truly yours,

THE ROCKBESTOS COMPANY

G. G. Littlehales
Manager, Quality Assurance

ebn
att.

cc: E. S. Reed
F. R. Postma
J. R. Marth
A. H. Lybeck
E. J. D'Aquanno
A. J. Rausch
W. J. Patterson

TEST REPORT

SUBJECT: Defective insulation repair
Stone & Webster P.O. NA 3187
12/C 14 Firewall III
Vendor Reel 3187-153
Stone & Webster Reel 3-692

Objective: To determine the degree of probability that Rockbestos Firewall III cables may contain further defective insulation repairs, similar to the example reported.

Analysis:

1. Defective Repair

A defective molded insulation repair was taken from one conductor of reel No. 3-692, 12/C 14 AWG Firewall III cable, at the North Anna site. This repair was severely distorted and contained openings exposing the copper conductor.

Upon examination, the repair was found to be extremely undercured, causing it to become distorted during subsequent curing of the overall neoprene cable jacket.

The repair had received a minimal mold cure causing the pre-cured taped configuration to flow and become homogeneous, but not to become cured. The absence of a significant degree of curing was confirmed by a solvent extraction test per ASTM D2765. The uncured, or undercured repair showed extraction of essentially 100%, whereas the adjacent cured insulation showed extraction of 19.4% which is normal for properly cured XLPE.

2. Heat Distortion Testing

Thirteen repairs were taken at random from reels of Firewall III single conductor control cables presently in the New Haven plant. We identified 150 reels containing repairs out of an approximate total inventory of 600 reels, and used these reels for our sampling.

This sampling, in accordance with MIL-STD-105D, indicates that with no rejections, statistically the lot contains fewer than 1.0% defectives.

Heat distortion testing was performed on the thirteen specimens per IPCEA S-66-524, except that preheating was conducted at 100°C. which is equivalent to the cable jacket curing temperature of 210°F., and is 10°C. in excess of the temperature rating of the cable.

The following results were obtained:

(see page 2)

Specimen No.	% Distortion (requirement 30% Max.)
1	13.0
2	18.0
3	24.0
4	20.0
5	15.0
6	17.0
7	18.0
8	24.0
9	26.0
10	20.0
11	19.0
12	17.0
13	25.0

All of the above specimens were adequately cured and would sufficiently resist significant deformation during jacket curing.

3. Curing Cycle Tolerance

Repairs were produced in Firewall III single conductor control cables using cure times of 1 minute, 5 minutes, and 10 minutes at 150 PSI steam pressure. A heat distortion test was then performed on each repair per IPCEA S-66-524 at 100°C.

The following results were obtained:

Cure Time	Specimen No.	% Distortion (requirement 30% Max.)
10 minutes	1	17.1
	2	20.0
*5 minutes	3	48.0
	4	43.0
1 minute	5	56.0
	6	60.0

A curve derived from these data establishes eight minutes cure time as the point at which the maximum permissible deformation of 30% occurs. Therefore, there is a 20% margin of safety built into the standard ten minute cure cycle.

*Cures of less than 5 minutes show visual evidence of insufficient cure as the insulation tape overlaps are still visible.

4. Comparison of Properly and Improperly Cured Repairs

From the data in Item 3 above, it can be demonstrated that a properly cured repair (specimens 1 and 2) will not deform during exposure to the 210°F. heat of jacket curing. On the other hand, an improperly cured repair (specimens 5 and 6) will deform excessively at these temperatures.

5. Examination of 12/C 14 AWG Firewall III Cable from North Anna Site

The following three reels of 12/C 14 Firewall III cable were returned to New Haven for evaluation on October 19, 1979.

Reel No.	Length
3187-150	2550'
3187-151	2550'
3187-153	2562' (2030' on reel when received)

Overall jackets and underlying binder tapes were completely removed from these lengths and they were visually inspected on an inch by inch basis for presence of insulation repairs and general condition of single conductors.

One repair was located in the orange/black conductor of reel 3187-153. This repair showed no distortion whatsoever, and was completely serviceable. It was cut out and subjected to a dielectric breakdown test, showing no breakdown up to 22 KVAC which is five times greater than the IPCEA requirement, at which point arcing occurred. There was no distortion, sticking, or other abnormality in any of the conductors in the three lengths examined.

COMMENTS:

Each length of single conductor in P.O. NA 3187 cables successfully passed AC voltage testing after immersion in water for six hours.

This testing provides a safeguard against further processing of single conductors which are electrically unsound at that stage of production.

In addition, each length of completed cable successfully met or exceeded IPCEA requirements for AC voltage testing, insulation resistance, and conductor resistance testing.

CONCLUSION:

Undercuring of the repair is established as the cause of the defective condition. This led to distortion during curing of the overall jacket, and physical damage to the repair which may have been caused during stripping of the jacket. This damage would not have occurred if the repair had been properly cured.

The undercuring was caused either by an extreme reduction of the molded repair curing cycle, or by a momentary loss of steam pressure which caused the curing mold to fail to heat properly. Neither of these possible causes is an event with a significant possibility of recurrence. We have no history of intermittent loss of steam other than during a major steam line breakdown. Steam pressure is pre-set, and is not controllable by operators. In addition, repair operators are trained in correct operating procedures, including the duration of the curing cycle.

Therefore, after careful review of all pertinent facts, it is our opinion that this defect was a highly unusual occurrence, and not indicative of a condition to be found elsewhere in Rockbestos Firewall III cables.

G. G. Littlehales
Manager, Quality Assurance

The Rockbestos Company
285 Nicoll St.
New Haven, Ct. 06511

October 29, 1979