Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

April 15, 1994

Mr. William Russell, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Document Control Desk

Subject: Braidwood Station Units 1 and 2
Additional Information on Environmental Qualification of Okonite Tape Splices at Braidwood Station
NRC Docket Nos. 50-456 and 50-457

Reference: Teleconference between Commonwealth Edison Company (CECo) and the Nuclear Regulatory Commission (NRC) dated March 3, 1994, Regarding Additional Information Concerning Okonite Tape Splices

As discussed during the reference teleconference between the Nuclear Regulatory Commission (NRC) and the Commonwealth Edison Company (CECo), CECo agreed to submit the attached information in response to the questions on splicing technique continuity at Braidwood Station.

Attachment 1, a letter from Okonite Company dated March 31, 1978, provides the basic splicing detail utilized at Braidwood Station. This detail is shown on Okonite drawing D-11547 which provides instructions for splicing 12/c#14 600V Okonite cable.

Commonwealth Edison's position in 1978 was to restrict the number of splices allowed during construction. This position is delineated in Sargent and Lundy letter dated December 11, 1978 (Attachment 2). In instances where control or instrumentation cables were "pulled short," the cables were terminated on terminal blocks and a new cable was installed from this terminal point to the end equipment. This position was reaffirmed, in a letter to the Braidwood site via Sargent and Lundy letter dated October 10, 1983 (see Attachment 3).

In August of 1983, note #76 was added to Sargent & Lundy drawing 6/20E-0-3390A Rev. AD (Attachment 4) and gave direction to tape butt splices similarily to Okonite instructions for taping pigtails splices on motor connections. Note #76 on drawing 6/20E-0-3390A Rev. AE (Attachment 5) was revised to give more specific details on splicing and included a referece to Okonite drawing D-11547 received in the March 1978 transmittal. This note has since appeared on drawings with only minor changes in content and a shift to a drawing series which was created to bring all notes which apply to a similar piece of equipment or installation activity (i.e., cable, conduit, etc.) to a common location. It now appears as note #10A on drawing 20E-0-3000N SH-2 Rev. H (Attachment 6) where it has resided since this drawing series was begun in 1985.

k:\nla\brdwd\okonite1

A001

Additionally, attached is a copy of Byron/Braidwood FSAR Question 040.3 dated May 1979 (Attachment 7). These questions were asked and responded to during the original NRC review of the pre-licensing Byron/Braidwood FSAR. The response provides the manufacturer's names and types of cable to be used for power, control and instrumentation circuits at Byron and Braidwood. As indicated, Okonite is the specific vendor for power and control cable. This information was incorporated into the first revision of the FSAR but was originally provided to the NRC for review under that question number.

If you have any questions concerning this response please contact me at (708) 663-6484.

Sincerely,

Denise M. Saccomando
Nuclear Licensing Administrator

Attachments

1) Okonite letter from J. D. Fess to T. B. Thorsell dated March 31, 1978
2) Sargent & Lundy letter from B. G. Treece to J.T. Westermeier dated December 11, 1978
3) Sargent & Lundy letter from F. G. Gogliotti to R. Cosaro dated October 10, 1983
4) Sargent & Lundy drawing 6/20E-0-3390A Rev AD
5) Sargent & Lundy drawing 6/20E-0-3390A Rev AE
6) Sargent & Lundy drawing 6/20E-0-3000N SH-2 Rev H
7) Byron/Braidwood FSAR Question 040-3

cc: R. Assa, Braidwood Project Manager - NRR
S. Dupont, Senior Resident Inspector - Braidwood
J. Martin, Regional Administrator - Region III
Office of Nuclear Facility Safety - IDNS

k:\nla\brdwd\okonite1

ATTACHMENT 1

THE OKONITE COMPANY

707 East 47th Street
LaGrange, Illinois 60525
312-352-7200

March 31, 1978

Mr. T. B. Thorsell
Sargent & Lundy
55 East Monroe
Chicago, Illinois 60603

Subject: Commonwealth Edison Company
Byron and Braidwood Stations
600 Volt Control Cables
Specification F/L 2823

Dear Mr. Thorsell:

At the request of Mr. J. Dennehy we are attaching a drawing and instructions for splicing of 12/C #14 control cable which will be used on the subject project.

Please review and submit this data to the field unless there are any further questions.

Very truly yours,

THE OKONITE COMPANY

John D. Fess
District Manager

JDF/cmj
Attach.

cc: Mr. J. J. Dennehy (attach.)

INSTRUCTIONS FOR A STRAIGHT SPLICE FOR MULTI-CONDUCTOR, RUBBER INSULATED, OKOLON JACKETED NUCLEAR STATION CONTROL CABLE

Drawing No. D-11547 Rev. A

1. Study the drawing and instructions for design and dimensions of the splice and the step by step procedure.

2. Determine the number of steps in the splice and the approximate number of conductors to be jointed at each step and the overall length (L) of the completed splice from the following table:

NUMBER OF CONDUCTORS IN CABLE	NUMBER OF STEPS	NUMBER OF JOINTS PER STEP	OVERALL LENGTH (L)
2 - 3	1	3	10
4 - 7	2	4	12
8 - 14	2	7	12
15 - 21	3	7	14
22 - 28	4	7	16
29 - 37	5	8	18

3. Form and rack the cables into their final position and cut the ends so that the cables overlap for the distance of (L) minus (4) inches.

4. Remove the cable jacket from both cables for a distance of (L) minus (4) inches.

5. Remove the insulation belt and fillers to within (1) inch of the cable jacket on both cables.

6. Match one of the center conductors from both cables. Cut off the excess length from one or both conductors as necessary to locate the joint at the proper step in the splice, cutting the conductors so that they butt together. Remove the insulation for a distance of (1/2) the connector length from each conductor. Place the conductors in the connector being sure that they butt together in the center of the connector and compress the connector onto the conductors using the correct tool in accordance with the connector manufacturer's instructions.

7. Buff the surface of the insulation on each side of the connector for a distance of (1/2) inch. Wipe the buffed insulation surface with a cloth moistened with chlorothene or other suitable non-toxic, fast drying solvent and allow to dry. Apply a thin layer of Okonite cement to the buffed surfaces and allow to dry until tacky.

8. When dry, apply one half-lapped layer of Okonite T-95 insulating tape over the connector lapping onto the insulation on either side of the connector for (1/2) inch.

9. Apply one half-lapped layer of Okonite No. 35 jacketing tape over the applied Okonite T-95 insulating tape.

. Repeat the above procedure on all the remaining conductors working from the center conductor outward and staggering the joints so as to keep the overall diameter of the splice as small as possible.

11. Buff the surface of the insulation belt with Aloxite cloth. Wipe the buffed surface with a cloth moistened with chlorothene or other suitable non-toxic, fast drying solvent and allow to dry.

12. When dry, apply a thin film of Okonite cement to the buffed insulation belt surface and allow to dry until tacky.

13. Apply one half-lapped layer of Okonite No. 35 jacketing tape, with minimum tension necessary so that it conforms to the contour of the splice. Apply the tape over the bundled conductor splices up to the edge of the cable jacket on each cable.

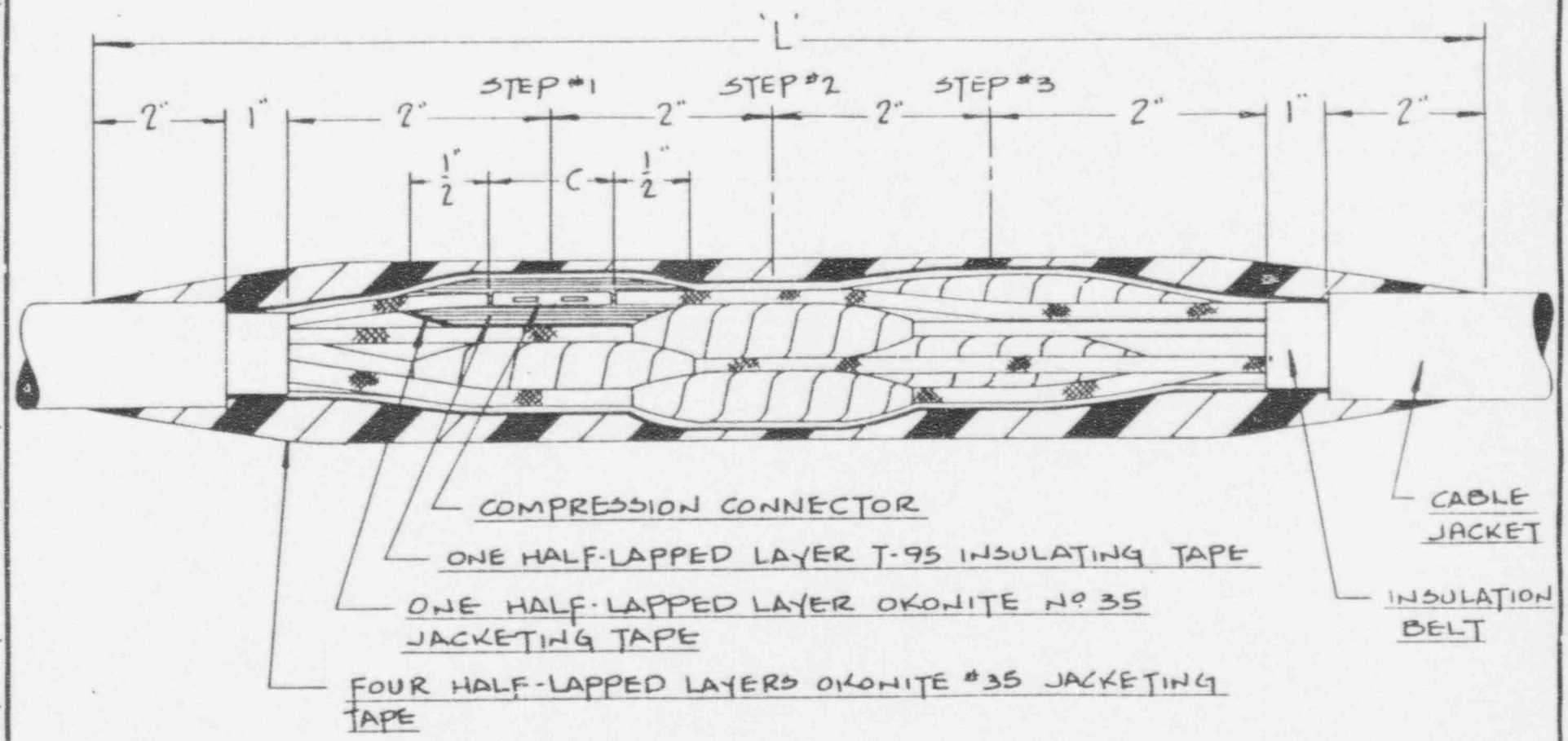
14. Buff the surface of the cable jacket for approximately (2) inches on each cable. Wipe the buffed cable jacket surfaces with a cloth moistened with chlorothene or other suitable non-toxic, fast drying solvent and allow to dry.

15. When dry, apply a thin film of Okonite cement to the buffed cable jacket surfaces and allow to dry until tacky.

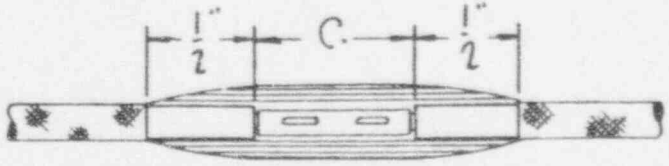
16. Apply a minimum of (2) half-lapped layers of Okonite No. 35 jacketing tape, with minimum tension necessary so that it conforms to the contour of the splice. Apply the tape over the complete splice area and lap onto the cable jacket for approximately (2) inches.

THE OKONITE COMPANY
Ramsey, New Jersey

Revised 12/09/77



Nº CONDR'S.	SIZE CONDR'S.	INSUL. THKNESS	NUMBER OF STEPS	CONDR. SPLICES PER STEP	OVERALL LENGTH 'L'
12	#14 AWG	.030"	2	6	12"



STRAIGHT SPLICE FOR MULTI-CONDR. RUBBER INSUL. OKOLON JKTD. NUCLEAR STATION CABLE

THE OKONITE COMPANY
RAMSEY, N.J., U.S.A.

DR. CH.
DATE 1-24-77
TR.
APP LD
SCALE NTS
REVISIONS A 12-9-77
DRAWING NO. D-11547

September 8, 1983
Revised - March 15, 1984

OKOLON CABLE JACKET REPAIR PROCEDURES

The attached drawings illustrate the recommended procedures for repairing Okolon cable jackets which have been damaged during or after installation. The correct procedure to follow is based on the severity of the damage. Examination of the damage is necessary to determine which procedure is applicable.

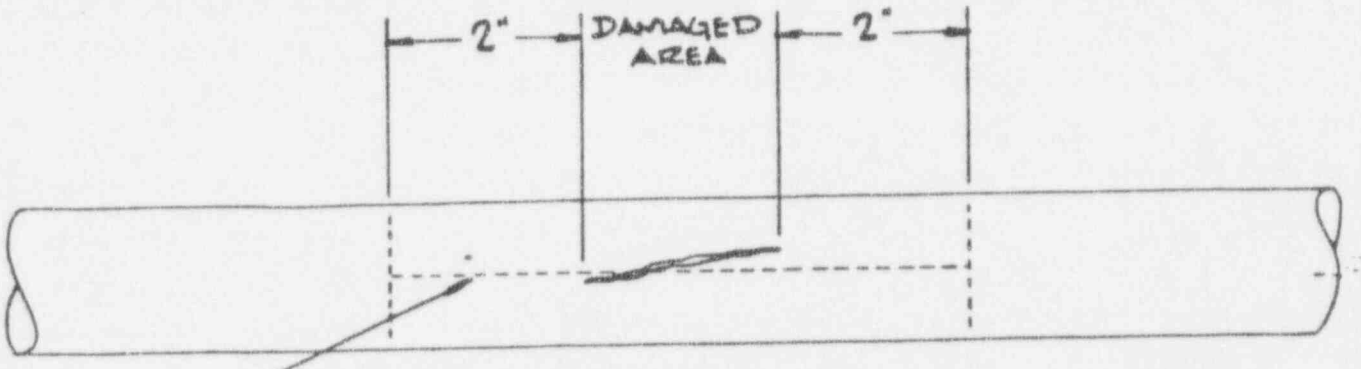
Description of Damage		Drawing
I. DURING INSTALLATION		
(1)	Abrasions, cuts, gouges or indentations not exceeding 30% of the cable jacket.	No Repair Required
(2)	Flattened cable in which the ratio of minimum diameter to maximum diameter is not less than 90%.	No Repair Required
(3)	Abrasions, cuts, gouges or indentations exceeding 30% but not greater than 50% of the jacket thickness.	D-5721
(4)	Abrasions, cuts, grouges or indentations exceeding 50%	D-5731
(5)	Jacket section(s) torn off the cable	D-5715
AFTER CABLES ARE COMPLETELY INSTALLED AND TRAINED		
(1)	Abrasisons, cuts, grouges or indentations that are not greater than 50% of the jacket thickness.	No Repair Required
(2)	Abrasions, cuts, gouges or indentations exceeding 50% of the jacket thickness	D-5731
(3)	Jacket section(s) torn off the cable	D-5715

The above procedures apply to 300V to 15kV cable except 1/C 5 and 8kV non-shielded cable.

If repairs are required on Class 1E nuclear generating station cable, materials must be ordered through the Ramsey office.

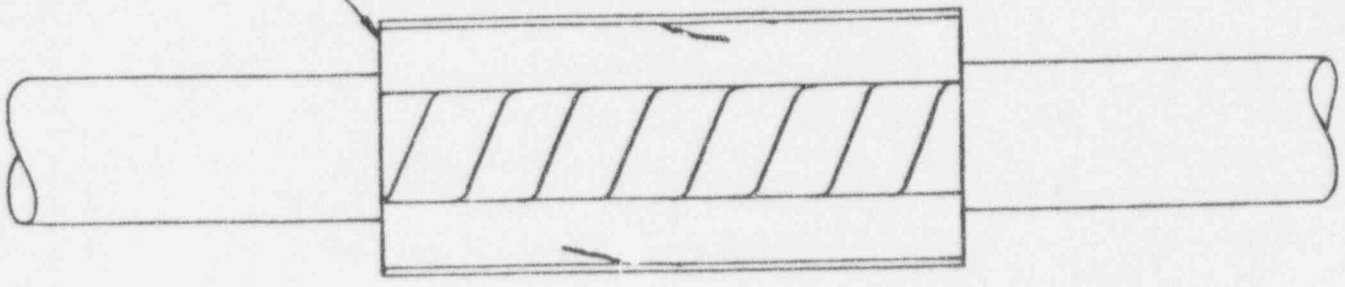
Form: CJR-1

JRC/row
Attachments



CAREFULLY CUT THRU THE JACKET AS OUTLINED. BE SURE NOT TO CUT OR SCORE SHIELDING TAPE

LIFT FLAPS AND EXAMINE TAPE. IF NO DAMAGE * PROCEED TO NEXT STEP



BUFF WITH ALOXITE CLOTH, CLEAN AND COAT WITH THIN FILM OF OKONITE SPLICING CEMENT

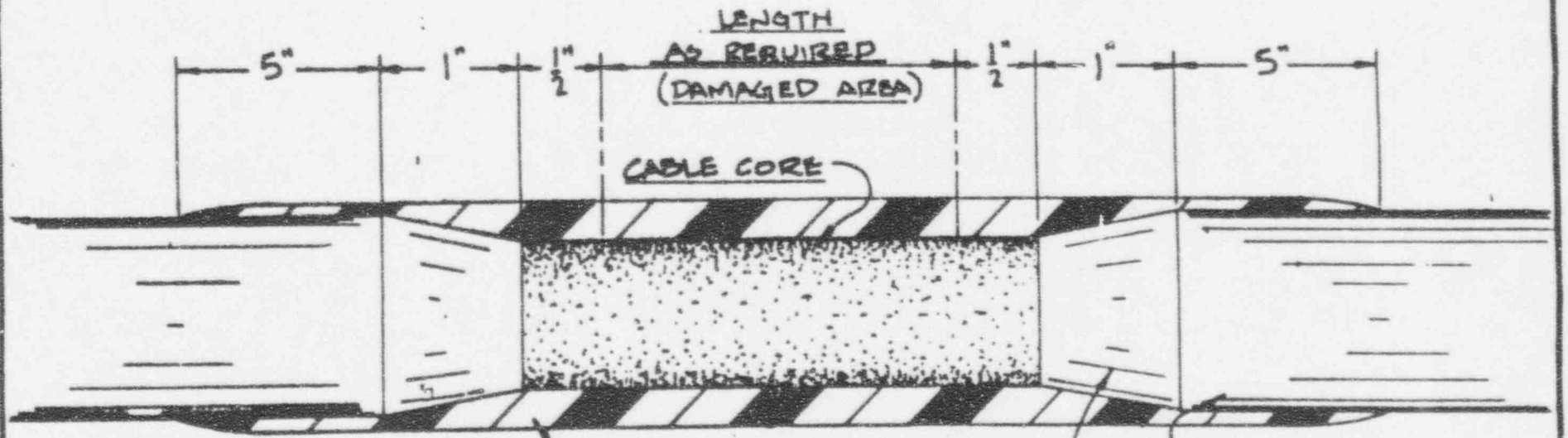
THREE HALF LAPPED LAYERS OKONITE #9 35 JACKETING TAPE

NOTE: FOR M/C NON-SHIELDED CABLES SKIP STEPS A & B UNLESS THERE IS 100% PENETRATION THROUGH THE OUTER JACKET

* IF DAMAGED CONSULT MANUFACTURER

JACKET REPAIR

THE OKONITE COMPANY RAMSEY. N.J. U.S.A.	DATE 4-21-83 SCALE NTS DR. TR. CH. APP. JRC 4/21/83	REVISIONS DRAWING NO. D-5731



THREE HALF-LAPPED LAYERS OKONITE No. 55 JACKETING TAPE

FACTORY APPLIED CABLE JACKET

JACKET PENCILLED AND BUFFED WITH ALOXITE CLOTH AND COATED WITH OKONITE SPLICING CEMENT

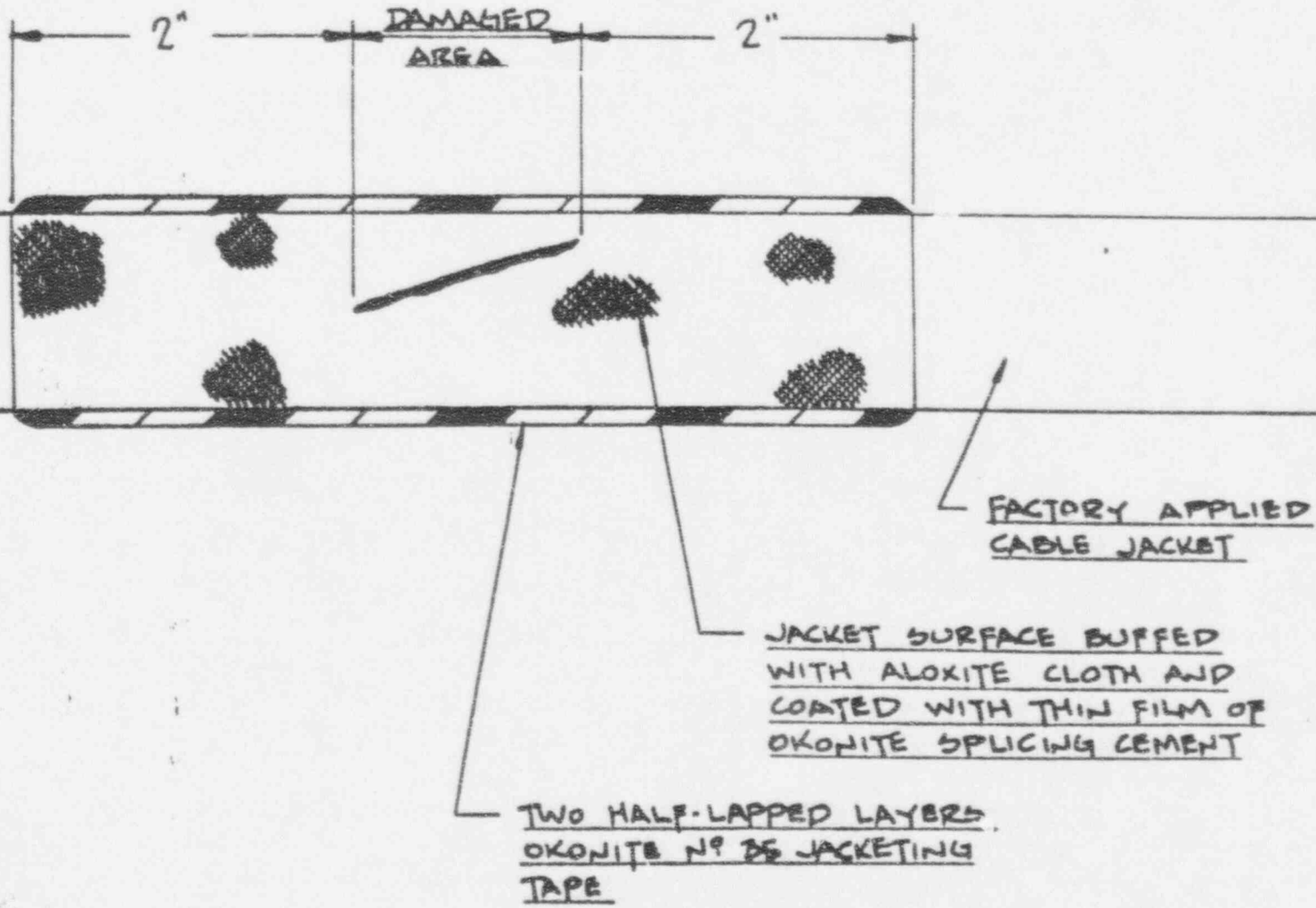
JACKET REPAIR

THE OKONITE COMPANY
RAMSEY, N.J. U.S.A.

DATE 9-5-72 | SCALE FULL | REVISIONS

DR. TR.
CH. APP. JRC

DRAWING NO. D-5715



JACKET REPAIR FOR SURFACE DAMAGE (MINOR SCRATCH & ABRASION)

THE OKONITE COMPANY
RAMSEY, N.J. U.S.A.

DATE 1-17-84	SCALE NTS	REVISIONS
DR. TR		
APP. JR		DRAWING NO. D-5721

ATTACHMENT 2

PWR 5974

2.1.1.18

SARGENT & LUNDY
ENGINEERS
FOUNDED BY FREDERICK SARGENT-1891
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603
TELEPHONE — 312-269-2000
CABLE ADDRESS — SARLUND-CHICAGO

BOB G. TREECE
ASSOCIATE
312-269-2150

December 11, 1978
Proj. Nos. 4391/2 & 4683/4

Commonwealth Edison Company
Byron/Braidwood Stations - Units 1 & 2

Cable Splices in Cable Trays

Mr. J. T. Westermeier
Project Engineer
Commonwealth Edison Company
P. O. Box 767
Chicago, Illinois 60690

Attention: Mr. J. J. Dennehy

Gentlemen:

At recent construction meetings at Byron, Edison (Construction) has requested permission to install cable splices in the cable pans on an "as-needed" basis. Edison (and S&L) Engineering personnel have responded that cable splices should be installed only where specifically called for on the S&L drawings and that any additional cable splices proposed by Construction personnel will be reviewed and approved or rejected on a case-by-case basis.

In response to Mr. J. J. Dennehy's question as to the basis (justification) for prohibiting cable splices in the cable pans, this will confirm my December 8, 1978 conversation wherein I advised Mr. Dennehy that Regulatory Position C.5 of NRC Regulatory Guide 1.75 (Revision 1, January, 1975, copy attached) states that "Cable splices in raceways should be prohibited".

Mr. J. T. Westermeier
Commonwealth Edison Company

December 11, 1978
Page 2

In addition to this NRC requirement, Section 5 of S&L Standard EA-122, Revised 7-28-78 (copy attached) allows cable splices to be made only at locations and in the cables specified on the Electrical Installation drawings. This revised S&L Standard will soon be issued to the Electrical Installation Contractor.

Please advise if you require further information on this matter.

Yours very truly,

B. G. Treece
Senior Electrical Project Engineer

BGT:bmh
In duplicate
Enclosures
Copies:
J. C. LaVallee (1/1)
K. T. Kostal (1/1)
E. R. Crass (1/1)
R. F. Carlton (1/1)

ATTACHMENT 3

SARGENT & LUNDY
ENGINEERS
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603
(312) 269-2000
TWX 910-221-2807

J. T. Westermeier
PWR 81223
(I)
2.20.1.116

October 10, 1983
Project Nos. 4683/4-00

Commonwealth Edison Company
Braidwood Station - Units 1 & 2

Electrical Installation Work
S&L Specification L-2790
CECo P.O. 231360

Mr. R. Cosaro
Braidwood Construction Superintendent
Project Construction Department
Commonwealth Edison Company
P. O. Box 81
Braceville, Illinois 60407

Attention: Mr. C. A. Mennecke

Dear Mr. Cosaro:

There are many circumstances which require the extension of previously pulled cables during electrical installation. There have been many discussions regarding the decision to splice such cables or to add terminal blocks (in junction boxes) to extend these cables.

Regarding power cables, it has been Sargent & Lundy's position on this project that power cables should be spliced only where absolutely necessary. Therefore, power cables will rarely be extended and will require new cables be pulled if cable extension is necessary.

For control and instrumentation cables, we believe the use of terminal blocks is the best method for the following reasons:

1. The terminations at the terminal blocks are open for inspection, testing, and maintenance activities which may be required through the 40 year life of the plant.

2. The terminations can easily be revised if required due to design changes or installation errors.

3. Terminations at terminal blocks are more reliable and require less installation time than a splice.

4. Both the installation of terminal blocks or a splice requires the addition of a junction box.

5. For future modifications, the installation of a new cable terminated at the terminal block will require less time and be more reliable than the installation of a new cable and splice.

In view of the above, we believe it to be in Commonwealth Edison Company's best interest to add terminal blocks where cable extension is required for control and instrumentation cables.

However, due to recent test results on Marathon terminal blocks in boxes exposed to a LOCA environment, it is a requirement that, in such environments, safety-related low level instrumentation circuits shall not be terminated at terminal blocks provided and installed by the electrical contractor

Therefore, where cable extension is required for control circuits, terminal blocks should be used. Where extension of cables with low level instrumentation circuits is required: 1) for safety-related circuits exposed to a LOCA or a Main Steam Line Break environment, a splice must be used; 2) in all other cases, terminal blocks should be used.

If you have any questions, please call me.

Yours very truly,

F. G. Gogliotti

F. G. Gogliotti
Electrical Project Engineer

FGG:dmm
In duplicate
Copies:
J. T. Westermeier
B. G. Treece
D. L. Leone/W. C. Cleff
R. J. Metzel

ATTACHMENT 4

ATTACHMENT 5

ATTACHMENT 6

ATTACHMENT 7

QUESTION 040.3

"Qualification of Safety-Related Cable

"The Regulatory staff is currently requesting, of all plants in OL review, information on the use of polyethylene type cable in safety systems. These type cables were found to have degraded considerably after many years of installed operation at the Savannah fuel processing plant.

"Identify all safety related cable used in your design that has polyethylene in its construction. Provide the following information for each type of cable identified:

a) Type of cable by name and Cat. No.

b) Manufacturer.

c) Type of polyethylene used.

d) How is the polyethylene used in the cable construction, i.e., insulation and/or jacket.

e) Results of environmental qualification tests performed."

RESPONSE

a,b) The safety-related cable purchased by Commonwealth Edison Company for the balance-of-plant systems is of the following design and manufacturer:

Power and Control Cable:

Type of Cable	Cat. No.	Manufacturer
EPR/HYP	Okolon	Okonite

Instrumentation Cable:

Type of Cable	Cat. No.	Manufacturer
EPDM/HYP	-	Samuel Moore

c) Hypalon (Chlorosulfonated Polyethylene)

d) Jacket

e) The cable as supplied by Okonite and Samuel Moore for the Byron/Braidwood Project has been qualified by each of the respective manufacturer's to the following standards:

1. IEEE 383-1974

2. IEEE 323-1974

3. IEEE 323-A-1975

OVERSIZE DOCUMENT PAGE PULLED

SEE APERTURE CARDS

NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARDS 3

9404250197-01-03

APERTURE CARD/HARD COPY AVAILABLE FROM

RECORDS AND REPORTS MANAGEMENT BRANCH