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TO:	FROM:	DATE OF DOCUMENT
Mr. Edson G. Case	Indiana & Michigan Power Company New York, N. Y. John Tillinghast	11/23/77
		DATE RECEIVED 12/5/77

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DESCRIPTION

Notorized 11/23/77...trans the following:

(4-P)

ENCLOSURE

Consists of info. re. the use of butt spliced connections for electrical penetrations on the inside of the containment.....

(6-P)

PLANT NAME: Cook Units 1 & 2
RJL 12/6/77

3 ENCL / REPRO BALANCE

FOR ACTION/INFORMATION

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INDIANA & MICHIGAN POWER COMPANY
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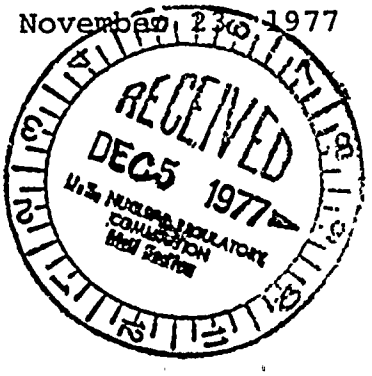
BOWLING GREEN STATION
NEW YORK, N. Y. 10004

Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
DPR No. 58 and CPPR No. 61

November 23, 1977



Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Case:

On November 17, 1977, we met with the NRC Staff to discuss the use at Donald C. Cook Nuclear Plant of multi-pin connectors on safety cables at the connection to the inside of containment electrical penetrations. We stated in our letter to you of November 17, 1977 that we were committed to qualifying these connectors in the post-accident containment environment or replacing them with connections that are qualified. As a result of the Staff's concerns on this issue, we agreed to suspend power operation of Unit 1 on November 18, 1977.

Since that time, we have had underway a program to test the capability of the connectors to withstand the temperature (maximum of 250°F), steam pressure (maximum 15 psig), and flooding conditions which they would face in the post LOCA environment. A potential replacement for the connectors -- the straight through butt splice -- is also being subjected to the same test program. As of the present time, both the connectors and the butt splices are functioning satisfactorily in this test environment. However, qualification of these connectors for all accident conditions would require, in the absence of knowledge regarding the temperature environment in the location of the connectors during a steam line break, that integrity be maintained at temperatures as high as 325°F. Because documented experimental data on environmental qualifications for the butt splice materials to show their capability under all post-accident conditions is more available than for the connectors, we shall replace the multi-pin connectors with butt splices.

The straight through butt splice described above is comprised of a Burndy tin-plated copper sleeve, Chemelex adhesive sealant (a room temperature vulcanizing silicone sealant) and Raychem WCSF heat shrinkable boot with Type-N adhesive sealant. The splice is qualified for the post-accident environment.

Eight assembled butt splices identical to those to be used at Cook Nuclear Plant have been successfully tested under post-accident conditions of a steam environment (250°F, 15 psig) for six (6) hours followed by a 190°F, 12 psig borated water (2500 ppm boron) and pH of 6. These conditions simulate accelerated aging. The post-accident aging simulation will follow the 10°C half-life temperature rule. Because the test is being conducted at a temperature in excess of 190°F, which is significantly greater than the post-accident ambient temperatures, 30 days real time is simulated by an estimated 7 days testing time. Survival of this test with an insulation resistance (pin or pin to ground) of greater than 70,000 ohms (at 50 volts d.c.) is an acceptable qualification test. The insulation resistance currently being measured is in excess of 7000 megohms as measured by a 500 volt Megger.

In addition to this test, Raychem has qualified an assembled splice, with the heat shrink materials to be used at Cook Nuclear Plant, in a simulated post-accident environment. This test environment included radiation (2×10^8 Rad), chemistry, (0.2% boric acid spray buffered to pH = 10) and temperature (360°F for five hours, then 320°F for six hours, twenty-four hours at 250°F, twelve days at 221°F and 100 days at 212°F). It should be noted that the current butt splice test includes submergence in water with 2500 ppm boron resulting in a pH of approximately six (6). The Raychem test splice materials were successfully tested in a spray environment with a pH of 10. These two pH extremes envelope the predicted post-accident conditions in the Donald C. Cook Nuclear Plant containments. This test experience, in combination with our current testing of butt splices for the post LOCA conditions at Cook Nuclear Plant, fully demonstrate the capability of the butt splices to successfully operate in any post-accident environment at Cook Nuclear Plant.

To confirm the capability of the butt splice being used at the Cook Nuclear Plant to perform at higher temperature than our current tests, we shall as soon as practical test the butt splices under a temperature profile that fully envelopes the environment that might occur as a result of a main steam line break inside the containment. The temperature profile for this test is a steam environment of 340°F for one (1) hour, 250°F for

five (5) hours and 190°F water environment for 18 hours. At all times the pressure shall be greater than or equal to 12 psig. It is our intent to run this test as soon as possible and to complete it by December 7, 1977.

All of the multi-pin connectors in use on safety circuits inside the containment will be replaced by straight-through butt splices for each conductor of the cables involved. These connections are all at the containment instrumentation penetrations. A list of all of the associated instruments and their function was provided in Attachment A to our letter of November 17, 1977 on this subject.

The existing multi-pin connectors will be cut off so that the length of the cables used in these connectors will not be re-used. The straight-through butt splice method is a mechanically and electrically sound connection that is widely used in industry, including nuclear power plant applications. The only components of the splice connection besides the cables themselves are a tin-plated copper seamless tube sleeve, a heat shrink boot and the adhesive sealants. Attachment A is the procedure that will be used for making the splices at the penetrations after the multi-pin connectors have been cut out. The same method was used for the splices in the environmental qualification testing program.

All of the plant splices shall be done under the strictest quality control conditions with full documentation and close inspection.

After the butt splice installation has been completed each instrument loop will be re-energized and checked utilizing existing approved plant procedures for the following: continuity, proper polarity, and leakage current. A single point loop calibration check will be made to insure that instrument calibration has not been affected.

As shown above, the replacement of the connectors with butt splices assures that properly qualified connections have been installed in all safety related systems required to perform under accident conditions. Having met the

requirements of your Order of November 18, 1977, we therefore intend to resume power operation once installation, checkout and pre-operational testing of the butt splices have been completed.

Very truly yours,

John Tillinghast
Vice President

JT kb
Attachment

Sworn and subscribed to before
me on this 23rd day of November,
1977 in New York County, New York

Kathleen Barry
Notary Public

KATHLEEN BARRY
NOTARY PUBLIC, State of New York
No. 41-4606792
Qualified in Queens County
Certificate filed in New York County
Commission Expires March 30, 1979

cc: R. C. Callen
P. W. Stekett
R. Walsh
R. J. Vollen
D. V. Shaller - Bridgman
R. W. Jurgensen
G. Charnoff

ATTACHMENT A

INDIANA & MICHIGAN POWER COMPANY

DONALD C. COOK NUCLEAR PLANT

PROCEDURE COVER SHEET

Procedure No.	Special 012-2
Revision No.	0

TITLE: Procedure for making butt splices from two or four conductor twisted, shielded cables to three or five conductor instrumentation penetration feedthrough wires.

SCOPE OF REVISION

SIGNATURES

	ORIGINAL	Rev. 1	REV. 2	Rev. 3
PREPARED BY	J Mustaro			
QUALITY ASSURANCE REVIEW				
INTERFACING DEPARTMENT HEAD CONCURRENCE				
DEPARTMENT HEAD APPROVAL				
PLANT NUCLEAR SAFETY COMMITTEE				
PLANT MANAGER APPROVAL				
DATE OF ISSUE				

Indiana and Michigan Power Company

Donald C. Cook Nuclear Plant

Procedure for Making Butt Splices from Two or Four Conductor Twisted, Shielded Cables to Three or Five Conductor Instrumentation Penetration Feedthrough Wires

1. General

This specification sets forth the criteria for the installation of two and four conductor twisted shielded splices used on the Plant Safety Systems for the D. C. Cook Plant Units 1 and 2. The installation of all two and four conductor twisted shielded splices used on Plant Safety Systems shall be in accordance with this specification.

1.2 Quality Assurance

The splices covered by this specification are vital to the operation of the reactor under normal operating conditions and are essential to the operation of the Reactor Protection System and therefore are essential to the protection, health and safety of the public. Consequently, they are to be installed utilizing good construction practices and to the Quality Assurance and Control Requirements as outlined in Section 6 of this procedure.

2. Precautions

2.1 When using cleaning materials such as alcohol, insure adequate ventilation to prevent effects on personnel and possible fire hazards.

2.2 Exit temperature of the heat gun may approach 1000°F. Caution should be exercised to prevent injury to personnel and combustion of surrounding materials.

2.3 Before disconnecting connector, verify that circuit is de-energized and cables are properly identified.

3.0 References

4.0 Installation

4.1 Disassembly of connectors

4.1.1 Verify correct cable number

4.1.2 Verify clearence on this cable

4.1.3 Break connection by unscrewing outer clamp ring.

4.1.4 Disassembl each half of the connector. Identify each wire by pin positions in the connector. Tag the wires on the penetration side of the connector. Note the color code of the wires from the cable side.

4.1.5 After wires have been identified - cut the wires off at the back side of the connector insulator as close as possible to the end.

4.1.6 Remove all connector components from the cable and penetration wires.

4.1.7 Wipe cable jacket, cable wires and penetration wires with a rag dampened but not saturated with alcohol if oil or dirt is present. Dry dust may be removed with a clean, dry rag.

4.2 Splice

4.2.1 Untwist slightly, 10" of the penetration wires. Brush in chemeflex adhesive sealant RTVW on 6 inches of the untwisted portion towards the penetration. Retwist after brushing in sealant.

4.2.2 Slide the 6 inch piece of raychem WCSF-115-6-N over the portion of the wires coated in 2 and heat shrink on until red sealant from heat shrink tubing appears at end. Proceed with heat gun to other end.

4.2.3 Measure the shield wire 1 inch from the end of the heat shrunk piece in step 3 and cut. Label each conductor from this point on so that label is not removed after cutting wire.

4.2.4 Measure each succeeding wire one additional 3/4" inch each and cut so as to stagger the splices.

4.2.5 Strip kapton insulation off each cut conductor 1/4 inch back from cut end.

4.2.6 Crimp each conductor stripped in 6 into a Burndy YSV14 connector using the appropriate crimping tool. Make sure wire is visible through holes in sleeve.

4.2.7 Cut five (5), 2 inch long pieces of raychem WCSF 070-12-N heat shrinkable tubing and slide over the 3 longest conductors.

4.2.8 Measure back 4 inches on the cable to be spliced to the penetration wires and strip off outer rubber jacket being careful not to damage individual conductor insulation.

4.2.9 Measure each individual wire in the cable 1 inch, 1 3/4 inch, 2 1/2 inch, 3 1/4 inch and 4 inch to correspond to the conductors of the feedthrough and cut. (ie. - the one inch piece of feedthrough wire will

be butt spliced to the 5 inch piece of cable wire etc.) Strip mylar wrappers and foil tape to outer jacket of insulated cable.

4.2.10 Slide the two remaining pieces of 2 inch long Raychem WCSF 070-12-N over the longest two conductors of the rubber insulation cable.

4.2.11 Slide a 12 inch piece of raychem WCSF 200-12-N over the rubber insulated cable.

4.2.12 Strip 1/4 inch of insulation off each individual wire in the insulated cable.

4.2.13 Crimp each wire stripped in 13 to its corresponding wire from the feedthrough.

4.2.14 Slide raychem 070-12-N over each crimp, so that at least 1/2 inch of 070-12-N overlaps the Burndy connector on each end and shrink.

5. Testing

5.1 Testing shall include cable identification, conductor identification, conductor continuity and insulation resistance in accordance with approved plant procedures.

6. Quality Control

The QC inspector shall sign off each step of the installation procedure. He shall also sign off that materials designated by this procedure have been used.

Table 1

The following items are necessary to meet the requirements of this standard.

1. Chemeflex adhesive sealant RTVW
2. 3 or 5 Burndy YSV14 connectors
3. 3 or 5 2 inch pieces of Raychem WCSF 070-12-N heat shrinkable tubing.
4. 1 - 12 inch piece of Raychem WCSF 200-12-N heat shrinkable tubing.
5. 1 - 6 inch piece of Raychem WCSF 115-6-N heat shrinkable tubing.
6. Knife or razor blade.
7. Ruller with one division every 1/32 inch.
8. Heat gun, Raychem model 500A or equivalent.
9. 1 - Crimping tool
10. 1 - Wire cutter.
11. Wire stripper
12. Brush for application of adhesive.
13. Alcohol and cleaning rags.