



Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

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July 2, 1984

Mr. James G. Keppler, Regional Administrator
United States Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Subject: Byron Generating Station Units 1 and 2
Electrical Conductor Butt Splices
NRC Docket Nos. 50-454 and 50-455

- References (a): May 17, 1984 letter from D. L. Farrar
to J. G. Keppler.
- (b): May 25, 1984 letter from R. L. Spessard
to Cordell Reed.
- (c): June 6, 1984 letter from R. L. Spessard
to Cordell Reed.
- (d): June 12, 1984 letter from T. R. Tramm to
J. G. Keppler.

Dear Mr. Keppler:

This letter provides the second interim report of a deficiency potentially reportable pursuant to 10 CFR 50.55(e) regarding butt splices in electrical conductors at Byron station. A final report is expected to be available by July 10, 1984. For tracking purposes, this deficiency is numbered 84-03.

As indicated in the first interim report submitted in reference (d), a reinspection program was undertaken in May, 1984 to verify the acceptability of crimped butt splices in electrical conductors. This letter presents an overall summary of the data accumulated during this reinspection program. Attachment A to this lists contains the acceptance criteria utilized for the reinspection of both uncovered and covered butt splices. It identifies by unit the quantity of deficiencies identified for each criterion. Attachment B to this letter presents our evaluation of the reinspection data.

During this reinspection, 1,311 butt splices were identified on conductors of safety-related cables on Byron 1 and 2. 747 of these installed butt splices were found uncovered (i.e., without a tape and cement or heat shrink covering). Documented visual inspections were performed on all 747 splices. The remaining 564 installed butt splices

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identified were found covered with heat shrink material or nuclear cement and tape. Their installation location was documented by identifying the cable number on which they were installed, the specific conductors of the cable, and the equipment number of the component in which they were located. Of the 564 covered butt splice installations identified, 92 were determined to be associated with redundant cables. These 92 butt splices were cut out and had the covering material removed. Documented visual inspections were performed on all 92 splices.

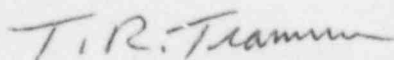
A total of 839 butt splices were visually inspected. 65 of these splices are considered unacceptable for various reasons as described in Attachment A. The reject rate is 7.7%, well below the 10% threshold established in reference (a) for expansion of the reinspection program. The visual inspection work has therefore been terminated.

In general, it appears that the butt splice installation discrepancies observed are relatively minor. The spliced conductor would probably have performed satisfactorily for the life of the plant. The potential safety significance of all defects will, however, be determined. This work is now in progress and the results will be reported in the final report on this discrepancy.

This is still considered to be a discrepancy which is potentially reportable pursuant to 50.55(e). The final determination of reportability cannot be made until the engineering evaluations have been made to determine if these butt splice deficiencies could have adversely affected the safety of plant operations if they had not been detected.

As identified in reference (b), the implementation of this reinspection program has been under constant surveillance at Byron by Region III electrical inspectors.

Very truly yours,



T. R. Tramm
Nuclear Licensing Administrator

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Attachment

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ATTACHMENT A

Deficiencies Identified in Electrical Butt Splices

There was a total of 747 uncovered butt splices identified during the program which were visually inspected. Of these, 653 on Unit 1 and 31 on Unit 2 were determined to be acceptable. All 747 butt splices were inspected per the criteria in Table A-1 below. This table identifies by criterion the quantity of deficiencies identified on each unit during the reinspection program for uncovered butt splice installations.

TABLE A-1

Acceptance Criteria For Installed Butt Splices
UNCOVERED

<u>Criterion</u>	<u>Deficiencies</u>	
	<u>Unit</u> <u>1</u>	<u>Unit</u> <u>2</u>
1. The butt splice installed appears to have been crimped with the proper tool.	2	0
2. The butt splice installed is the proper size for the size of cable it is installed on.	0	0
3. The conductor crimp is approximately centered on the wire barrel.	11	0
4. The end of the conductor is visible beyond the point of crimp.	47	4
5. The conductor insulation is approximately flush with or under the insulating sleeve of the butt splice.	0	0
	60	4
Total Deficiencies Identified:	60	4

Note: 1 butt splice was deficient for both criteria 3 & 4, so there were 64 deficiencies on 63 splices.

Attachment A

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There was a total of 92 covered butt splices identified during the program which required the removal of the covering material so that a visual inspection could be performed. Of these, 90 were determined to be acceptable. All 92 of these butt splices were associated with Unit 1 cables, and they were all inspected per the criteria in Table A-2 below. This table identifies by criterion the quantity of deficiencies identified on each unit during the reinspection program for covered butt splice installations.

TABLE A-2

Acceptance Criteria For Installed Butt Splices
COVERED

<u>Criterion</u>	Deficiencies	
	<u>Unit</u> <u>1</u>	<u>Unit</u> <u>2</u>
1. The butt splice installed appears to have been crimped with the proper tool.	0	0
2. The butt splice installed is the proper size for the size of cable it is installed on.	0	0
3. The conductor crimp is approximately centered on the wire barrel.	2	0
4. The end of the conductor is visible beyond the point of crimp.	$\frac{0}{2}$	$\frac{0}{0}$

Note: The covering on these splices made it unnecessary to impose any acceptance criterion on the conductor insulation, as was done for uncovered splices.

ATTACHMENT B

Evaluation of Butt Splice Reinspection Data

PROGRAM

The butt splice reinspection program consisted of the inspection and documentation of previously installed butt splices on conductors of safety-related control and instrumentation cables located in safety-related panels, switchgear, motor control centers and both sides of electrical penetrations. The four basic phases of this reinspection program were:

1. Inspect the butt splices which were found to be uncovered and document the results of these inspections.
2. Document the installation location (i.e. equipment, cable and cable conductors) of butt splices found which were covered with heat shrink material or nuclear cement and tape.
3. For any redundant cables identified in item 2 above, remove the butt splice(s) installed on one of the cables, remove the covering material and document the inspection concerning the condition of the butt splice as it was found to be installed.
4. Accumulate the results of items 1 and 2 above and determine the overall inspection rate for installed butt splices. If the rejection rate for the overall program was greater than 10%, then all remaining butt splices identified in item 2 above would be required to be reinspected or replaced.

The inspection activities associated with this reinspection program identified 1,311 butt splices installed on approximately 454 safety related cables associated with Byron Units 1 and 2. For this reinspection effort, 7,246 safety-related cable ends were documented as having been inspected. The inspection documents and the butt splices which were removed and dissected are all on file.

Attachment B

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RESULTS

The tabulation of the results of this butt splice inspection as it relates to these four phases of the program are:

1. Uncovered Butt Splices

The total quantity of uncovered butt splices identified and reinspected was 747.

a) Quantity rejected by the initial inspector		<u>275</u>
b) Quantity found acceptable by 2nd inspector after dissection	16	
c) Quantity found acceptable based on manufacturer's documented test data	<u>196</u>	
Total Acceptable After Dissection		212
d) Quantity rejected for inspection criterion (1)	2	
e) Quantity rejected for inspection criterion (3)	10	
f) Quantity rejected for inspection criterion (4)	<u>51</u>	
Total Rejected After Dissection		<u>63</u>
Total Dissected Butt Splices		<u>275</u>

The accumulated results for uncovered butt splices inspected, therefore, yields 63 rejectable butt splices identified out of a total of 747 inspected.

In reference to item 1.(a) above, the butt splices which were initially inspected in the plant and found rejected, were cut out and tagged to identify the cable and the conductors on which they were found. These butt splices were then brought into the office and dissected and reinspected by a second QC inspector. This inspection was documented and attached to the original inspector's inspection report [see item 1.(b)]. This was done because the conditions surrounding installed butt splices did not always allow easy accessibility for reinspection.

2. Covered Butt Splices

A total quantity of 564 covered butt splices have been identified and their installation location has been documented.

3. Redundant Butt Splice Installations

Of the 564 covered butt splices identified in item 2 above, 92 butt splice installations were identified as being redundant and required inspection. These butt splices were all cut out and dissected in the construction office with the following results:

Attachment B

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a)	Quantity of covered butt splices removed and dissected		<u>92</u>
b)	Quantity found to be acceptable after inspection	16	
c)	Quantity found to be acceptable based on manufacturer's documented test data	<u>74</u>	
	Total Acceptable After Dissection		90
d)	Quantity rejected for criterion (3)	<u>2</u>	
	Total rejected after dissection		<u>2</u>
	Total covered butt splices dissected and inspected		<u>92</u>

4. Accumulated Results

There was a total of 1,311 installed butt splices identified in this program. 747 were found uncovered and were inspected. 564 were found covered with heat shrink material or nuclear cement and tape, and were inspected.

a)	Total quantity of uncovered butt splices inspected	747	
b)	Total quantity of covered butt splices dissected and inspected		<u>92</u>
c)	Total quantity of butt splices installations inspected in the program		<u>839</u>
d)	Total quantity of uncovered butt splices found rejected	63	
e)	Total quantity of covered butt splices dissected and found rejected		<u>2</u>
f)	Total quantity of butt splice installations inspected and found rejected during the program		<u>65</u>

The rejection rate for the overall program (item f divided by item c) is calculated to be 7.7%.

BASIS FOR ACCEPTANCE

With reference to items 1.(c) and 3.(c) above, during this butt splice inspection program, installed butt splices (size #16-14) were identified which appeared to be crimped with a #22-18 crimping tool rather than the size #16-14 tool. While this tool is not the correct tool for crimping a #16-14 size butt splice/wire, it is, an acceptable ("proper") crimping tool for butt splice installation. Tests on such splices by the manufacturer and at Byron station indicate that the #22-18 tool makes crimps in #16-14 butt splices which are in all respects acceptable and in some respects superior to those produced with the size #16-14 tool. After evaluation of these test results, previously installed butt splices which were identified to have been crimped with the #22-18 crimping tool were considered to be acceptable and items of this nature previously reported were removed from the deficiency population.