

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No: 50-461/90024(DRS)

Docket No: 50-461

License No: NPF-62

Licensee: Illinois Power Company
500 South 27th Street
Decatur, IL 62525

Facility Name: Clinton Power Station

Inspection At: Clinton, IL 61727

Inspection Conducted: November 7 through December 21, 1990

Inspector: H. A. Walker for
M. J. Kopp

1/10/91
Date

Approved By: H. A. Walker
H. A. Walker, Acting Chief
Maintenance and Outages Section

1/10/91
Date

Inspection Summary

Inspection on November 7 through December 21, 1990 (Report No. 50-461/90024(DRS)).

Areas Inspected: Special safety inspection to review allegations concerning the installation of uninsulated AMP parallel splices and the training of personnel responsible for performing the splice work (Module 62703).

Results: Within the areas inspected no violations were identified and the allegations were not substantiated. One Unresolved Item was identified that concerned the use of AMP splice 34318 in applications for which it was oversized.

DETAILS

1. Persons Contacted

Illinois Power Company (IPCo)

- +J. Cook, Plant Manager
- +S. Baker, Supervisor, Stores
 - G. Bell, Director, Material Management
 - W. Bousquet, Supervisor, Quality Engineering
 - L. Dunn, Supervisor, Procurement Specialist
- +J. Emmert, Supervisor, Electrical Design and Analysis
- +R. Langley, Director, Design and Analysis
 - M. Menamin, Electrical Engineer, Design Analysis
- +R. Phares, Director, Licensing
 - J. Puzauskas, Assistant Director, Design and Analysis
 - A. Ruwe, Director, Systems and Reliability Engineering
- +J. Sipek, Supervisor, Regional Regulatory Interface

United States Nuclear Regulatory Commission (USNRC)

- P. Brochman, Senior Resident Inspector, Clinton
- +F. Brush, Resident Inspector, Clinton

+Denotes those participating in the telephone exit on December 21, 1990.

2. Allegation (RIII-90-A-0111) (Closed)

- a. On November 1, 1990, Region III received several allegations regarding the installation of uninsulated AMP parallel splices. These splices were used to splice EQ wires in safety-related electrical penetrations. The allegations concerned Clinton Power Station (CPS) procedure 8492.01, "Cable Termination and Repair," Revision 16, and the lack of acceptance criteria to address the following conditions:

- (1) Disturbing the lay of wire strands to allow insertion into the barrel of the splice.
- (2) The birdcaging of wire strands during splicing.
- (3) Failure of one or more wire strands to pass through the length of the barrel (not visible at the far end).
- (4) Reduction of the circular mil area (cma) of stranded #18 AWG wires due to the severity of the crimp, and filing of the splice barrel to remove raised edges caused by the crimp

The allegations were due to concerns that AMP splice 34138 was too small to splice a #12 AWG stranded wire to a #12 AWG solid Kapton wire. The size of the AMP splice was questioned because it was necessary to unravel or disturb the lay of the wires in order to

insert the wires into the barrel. In addition, it was not possible to pass all of the wire strands through the splice barrel, and the wire strands would spread out or birdcage after the crimp was made. This led to the additional concerns regarding the crimp used on the splice barrel for #18 AWG wire, and the filing of the barrel to remove raised edges.

The allegers identified these concerns to the licensee but stated that the licensee failed to provide an acceptable resolution.

NRC Review

To assess these concerns, the NRC inspector reviewed CPS procedure 8492.01, performed a sample inspection of AMP splices, interviewed the licensee's staff, including QC inspectors and craftsmen, responsible for the splice installations, discussed these concerns with representatives of the AMP Corporation and reviewed AMP test data and information concerning the installation of uninsulated parallel splices.

The craftsmen were trained, in accordance with CPS procedure 8492.01, to measure the circular mil area (cma) of each wire to be spliced. These measured cma values were combined. The combined value was then used to determine the splice barrel required for that application. This method led to the use of AMP splice 34318 (acceptable within a cma range of 13,100 to 20,800) to splice a #12 AWG stranded wire to a #12 AWG solid wire. However, Illinois Power Company (IPCo) Engineering subsequently determined that AMP splice 34318 was oversized and that the craftsmen in the field had misinterpreted the procedure for selecting the proper splice barrel. According to the IPCo Engineering, measurement of the wire cma determined the wire size. Once the wire size was determined, Appendix K of CPS procedure 8492.01 should have been used to determine the nominal cma of each wire. Use of the nominal wire cma values led to the use of AMP splice 34138 (acceptable within a cma range of 5,180 to 13,100) to splice a #12 AWG solid to a #12 AWG stranded wire.

The NRC inspector reviewed data provided by the wire manufacturer and concluded that use of the nominal wire cma values to determine the correct AMP splice to use was acceptable. Review of the data provided by AMP confirmed that AMP splice 34138 was the proper splice to use when the combined nominal wire cma was within a range of 5,180 to 13,100. The NRC inspector also determined that the nominal wire cma for two #12 AWG wires was 13,080 which falls within the use range limit for AMP splice 34138. Disturbing the lay of the wires, birdcaging, and failure of all the strands to pass through the splice barrel were a direct result of the tight fit caused by use of the smaller AMP splice. Concerns regarding reduction of the cma of the wires, deformation of the splice barrel, and the removal of raised edges by the use of a file were discussed with representatives of the AMP Corporation. The "W" type crimp, used on

the uninsulated parallel splice barrel, was designed to be severe and, according to AMP, results in raised edges on the splice barrel. This crimp does not result in deformation of the splice or a reduction in the cma of the conductors, but ensures an adequate connection. Removal of raised edges with a file was considered acceptable provided that care was taken and that only a slight amount of material was removed. The NRC inspector observed an electrician filing off the raised edges in the field and determined that the guidelines set by AMP were followed. The concerns identified by the allegers were determined to have no impact on the electrical integrity of the splices. Further discussion concerning the use of AMP splice 34318 can be found in Paragraph 3 of this report.

- b. Also during this inspection, additional allegations were made regarding the training of electricians responsible for the electrical penetration splice work. The specific concerns were:
- (1) Certain electricians received only verbal training in lieu of the hands-on instruction required by the procedure.
 - (2) One electrician was trained in a radiation area. The alleger was concerned that this was not the appropriate place to conduct training.

NRC Review

In order to assess these concerns the NRC inspector reviewed Training Guide No. JT52005-01, "Crimping Terminal Lugs," the associated training attendance records and interviewed quality control inspectors and electricians responsible for performing the penetration splice work.

Based upon this review, it appeared that inspectors and electricians assigned to this work received the appropriate training as required by the licensee's training program. The personnel interviewed were not aware of any instance where only verbal training was conducted or any instance where individuals were trained in radiation areas. The NRC inspector concluded that these allegations were not substantiated.

3. AMP Splice 34318

CPS Condition Report (CR) 1-90-11-007, dated October 31, 1990, identified that AMP parallel splice 34318 had been installed in applications for which the wire cma was less than 13,100. According to AMP specifications, this splice should be used within a cma wire range of 13,100 to 20,800. In order to determine the acceptability of these splices the licensee performed a tensile strength test, and a millivolt (mv) drop test. Industry standards for the tensile strength specified a minimum pull out force of 70 pounds for this splice configuration. However, the splice tested was capable of only meeting a pull out force

of 60 pounds. The licensee's engineering analysis stated that the splices installed in the plant were not under tension and therefore a 60 pound pull out force was acceptable. The industry acceptance criteria for the mv drop test required that voltage measurements taken across the splice not exceed 5mv. The samples tested passed the mv drop test and the licensee concluded that the splices were acceptable.

The NRC staff reviewed the licensee's tests results and engineering analysis and identified concerns with the failure of the splices to meet the tensile strength test requirements. In addition, the staff informed the licensee that their engineering analysis failed to address the affects of fault currents, the function of the circuits in which the splices were used, and whether or not AMP concurred with the tests conducted and results achieved. The licensee committed to revise the engineering analysis to address these concerns prior to the startup from the current outage, tentatively scheduled for the end of January 1991. This is considered an Unresolved Item (50-461/90024-01(DRS)).

4. Unresolved Item

An unresolved item is a matter about which more information is required in order to ascertain whether it is an acceptable item, an open item, a deviation, or a violation. An unresolved item disclosed during this inspection is discussed in Paragraph 3.

5. Exit Interview

The Region III inspector met with the licensee's representatives (denoted in Paragraph 1) at the conclusion of the site inspection on November 14, 1990, and discussed the findings by telephone at the conclusion of the inspection on December 21, 1990. The licensee acknowledged this information. The inspector also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any such documents/processes as proprietary.