



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE ENVIRONMENTAL QUALIFICATION
OF TAPE SPLICES FOR SUBMERGENCE
COMMONWEALTH EDISON COMPANY
BRAIDWOOD STATION, UNITS 1 AND 2
DOCKET NOS. STN 50-456 AND STN 50-457

1.0 INTRODUCTION

As a result of an inspection finding at Braidwood Station, Commonwealth Edison Company (ComEd, the licensee) evaluated the environmental qualification (EQ) of Okonite tape splices for "local submergence" due to a line break accident. These splices are used in containment to splice low-voltage power and control cables in junction and pull boxes. These splices are not used in EQ instrument circuits. The licensee has stated that the cables are qualified for submergence. The licensee submitted information in support of qualification of the splices on November 21, 1992, and supplemental information dated January 7 and April 15, 1994. The staff's safety evaluation, issued on September 8, 1994, concluded that the licensee had not demonstrated qualification for submergence for the tape splices.

In response to the staff's initial safety evaluation dated September 8, 1994, the licensee submitted an analysis of the qualification of the tape splices on January 26, 1995, and supplemented that submittal with additional information on July 17, 1995. The following is the staff's evaluation of those submittals.

2.0 EVALUATION

Braidwood Station has some taped cable splices installed inside junction and pull boxes in safety-related power and control circuits. The staff's concern is that a number of tape splices may become submerged during an accident recovery period because some junction and pull boxes may not have drain holes. Water from the accumulation of condensate and from chemical spray can accumulate inside the junction and pull boxes up to a level of 3/8 inches. The tape splices, if submerged, might not function properly. The malfunction could result in either a phase-to-phase or a phase-to-ground short circuit that would prevent equipment from performing its safety function.

The licensee reports that condensate accumulation above the nominal 3/8 inch box lip is not possible. That accumulation is not immediate, but occurs during the first hour of a design basis event. The safety-related equipment that may have Okonite T-95 tape splices in its circuitry will complete its

splices under submerged conditions for more than 36 hours at 98 degrees Celsius (208 degrees Fahrenheit) or higher, in a condensate/chemical spray solution demonstrates the acceptability of the splices for in-containment applications.

The licensee has submitted a number of EQ test reports to support qualification of these splices for partial submergence. The tests were for a variety of conditions, with a total of 29 tested specimens that were either identical in construction or constructed to be more susceptible to potential degradation than the splices installed in the plant. These 29 specimens were tested to more severe conditions than the postulated accident condition for installed splices.

The November 21, 1992, submittal included four test reports as Appendices A through D. The Appendix A tests had no submergence. However, the splices were aged to an end-of-life condition and subjected to chemical spray during the design basis accident test. No failures were evident. The Appendix B tests successfully submerged six tape splices although there was no aging and no chemical spray. The Appendix C test submerged three aged specimens that had no jacket tape. The licensee believes that this is a conservative test configuration representative of the installed splices. The splices were submerged for 46 hours in a chemical solution. The circuits were energized during the test and no failures occurred, although insulation resistance was not monitored during the test. In the Appendix D test, 20 aged splices were submerged in 3/8 inches of water for up to 54 hours. There were no failures of the Okonite tape splices during this test.

The licensee states that splice installation locations and box configuration make it unlikely that the splices will exist at the bottom of the box to be subject to submergence. If some of the splices are located at the bottom of a junction or pull box, it is unlikely that the full length of a splice is lying flat against the box bottom. Furthermore, it is unlikely that splices in redundant circuits are all configured in the postulated worst case condition. The tested configuration was representative of worst case submerged condition. A number of samples passed partial submergence tests. The splices will be submerged mostly in condensate and not spray during a design basis accident. The splices are in power and control circuits only, not in instrumentation circuits, therefore, a small leakage current is less important.

The staff's evaluation included a review of the additional information and consideration of several factors relative to the qualification of the cable splices which may be subject to partial submergence due to the lack of drain holes in their respective junction/pull boxes. The factors considered were: (1) the splices of interest are in circuits that complete their safety functions in 36 hours or less; (2) the splices are only used in power and control cables where leakage currents are a not significant concern; (3) the splices are not likely to be in the bottom of the junction/pull boxes where submergence could potentially occur, and (4) some of the splices are in junction/pull boxes which have drain holes (the licensee has been unable to

verify that all junction and pull boxes containing these splices have drain holes).

Based on the staff's evaluation described above, we have determined that the licensee has demonstrated qualification of these tape splices for partial submergence based on their analysis of the various tests of the tape splices. The number of samples tested with no failures gives reasonable assurance that the splices would perform their safety function during and following a design-basis event during which the splices would be partially submerged.

3.0 CONCLUSION

The staff finds that, based on the licensee's analysis and consideration of the factors described above, the licensee has demonstrated qualification for partial submergence for the tape splices at Braidwood. Although the licensee submitted test reports in 1992 and 1994 to support qualification of the splices, no analysis of the applicability of the test results was provided to demonstrate their qualification. The analysis dated January 26, 1995, allows the staff to accept the licensee's claim that the splices are qualified for partial submergence. However, the only tape splices that are acceptable are those at Braidwood Station in power and control circuits located in junction and pull boxes. Any other use of these splices in submerged EQ applications must be evaluated separately by the staff.

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