

FINAL REPORT ON LACK OF QUALIFICATION TESTING DOCUMENTATION
FOR REPAIRED POWER CABLE

San Onofre Nuclear Generating Station, Units 2 and 3

INTRODUCTION

This final report is submitted pursuant to 10CFR50.55(e)(3). It describes a condition found in construction relating to the lack of qualification testing documentation for electric power cable repaired by the manufacturer, General Electric (GE). This final report includes a description of the deficiency, an analysis of the safety implications and a summary of the corrective action taken. By letter dated November 5, 1979, Edison confirmed notification to the NRC of this condition which was considered reportable in accordance with 10CFR50.55(e).

BACKGROUND

During routine cable pulling activity, a reworked section of a jacket was discovered in a 600 volt single conductor safety related power cable supplied by GE. Upon further examination of this cable, it was determined that the cable conductor had been spliced (i.e., the 19 strand conductor was jointed by brazing; the insulation and the exterior jacket had been replaced in the joint area).

Although this condition (hereafter referred to as spliced cable) is not a violation of the technical specification or industry standards, the condition was unexpected. Further review of GE's explicit qualification data revealed that GE could not provide objective evidence that cable samples selected for previously completed LOCA testing contained spliced cable.

GE provides all safety related and non-safety related 600 volt power cable for San Onofre Units 2 and 3. This safety and non-safety related cable is utilized both inside and outside the containments. The GE 600 volt power cable consists of ASTM B8 Class B stranded copper conductor with ethylene propylene rubber insulation and a neoprene jacket on the individual conductors. For multi-conductor power cable, there is an additional neoprene jacket around the complete cable. The total anticipated quantity of safety and non-safety related GE supplied 600 volt power cable

is approximately 1.8 million feet. GE estimates that the total number of splices that might exist in this order is 200-300 splices. The GE cable of concern (i.e., that cable lacking objective evidence of qualification testing of reworked or repaired components) is limited to the safety related 600 volt power cable. Cable located inside the Unit 2 and Unit 3 containments is estimated as 75 cables per containment with a total length of approximately 18,000 feet per containment.

Other suppliers of safety related cable at San Onofre are Anaconda (8 KV power cable), Rockbestos (instrumentation and control cable) and Raychem (instrumentation and control cable). Rockbestos and Raychem safety related instrumentation and control cables are utilized both inside and outside containment while Anaconda safety related power cable is utilized only outside containment. The required qualifications and qualification tests for cable supplied by these manufacturers are discussed below.

In addition to the above defined concern, this evaluation also addresses mechanical strength testing and hot spot testing being conducted by GE and Rockbestos in order to fully address all possible technical concerns related to the use of spliced safety related cable utilized both inside and outside the containments.

DISCUSSION

The following discussion is responsive to 10CFR50.55(e)(3).

Description of Deficiency

For GE supplied safety related 600 volt power cable located inside the Unit 2 and 3 containments, GE lacks objective evidence that cable samples selected for previously completed LOCA qualification testing contained spliced cable. The samples selected were random samples from production lengths selected in accordance with IEEE 383-74. GE personnel concluded that spliced cable is functionally equivalent to virgin cable based on existing mechanical testing, material controls and material compatibility and based on existing in process factory procedures and quality control. Because of this, no explicit LOCA qualification testing on spliced cable was conducted.

Analysis of Safety Implications

Based on the following considerations, it is expected that the as built spliced cable is acceptable for both normal plant operation as well as performing its intended safety function in a post-LOCA environment:

- (1) Cable splicing in GE's Bridgeport manufacturing facility is a common practice and has not resulted in any known cable failures.
- (2) Existing GE mechanical and electrical tests show acceptable equivalence between virgin cable and spliced cable.
- (3) Existing GE factory procedures and quality control procedures result in a reproducible product that receives all final electrical testing in the as-spliced configuration.
- (4) Material control and compatibility with the original cable materials coupled with existing factory procedures result in a jacket and insulation functionally equivalent to virgin material.

However, this condition is reportable in accordance with the extensive evaluation criteria of 10CFR50.55(e)(3).

Corrective Action

GE will complete within four months LOCA qualification testing on representative spliced cable. This testing will be done in accordance with the criteria defined in IEEE standard 383-1974 and IEEE standard 323-1974. In addition to this LOCA qualification testing, GE is conducting hot spot testing to verify that the spliced conductor does not generate unusual temperature rises in the vicinity of the splice. Existing mechanical testing data will also be submitted for retention in the project files.

Rockbestos provides safety related multiconductor control and instrumentation (I & C) cable some of which is utilized inside the containments. Rockbestos, in general, uses a similar (to GE) manufacturing process with respect to cable splicing. The application of this cable differs from that of the GE power cable in

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that the electrical ampacity loading is much lower than for power cable and is thus operated in its normal condition well below its allowable ampacity and voltage rating. Rockbestos is presently conducting LOCA qualification testing on conductors with insulation rework. Hot spot tests and mechanical pull tests are also being conducted in order to insure that brazed joints in conductors do not create a hot spot or result in a mechanically weak conductor joint. All of the above testing should be complete by March 1980.

Raychem is no longer a cable supplier to San Onofre Units 2 and 3. Previously supplied safety related cable from Raychem is multi-conductor I & C cable some of which is located inside the Unit 2 and 3 containments. Based on discussions with Raychem, it has been determined that Raychem has not provided I & C cable to the San Onofre project that contains jacket and insulation rework or conductor joints. No additional testing is required.

Anaconda is supplying safety related 8 KV power cable. None of this is utilized inside containment. Therefore, no LOCA qualification testing is required. In addition, Anaconda does not splice conductors or repair insulation for the 8 KV power cable supplied to San Onofre. Additional mechanical or hot spot testing is thus not required.