

U. S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket No.: 99900902

Report No.: 99900902/82-01, Report No. 2

Environmental Qualification Program: Duke Power Company, Verification Test for D. G. O'Brien Electrical Penetration Assembly (EPA) Including Mating Connector and Cable Assemblies; Report No. 2 - LOCA/HELB Accident Test.

Equipment Identification:

Test Specimen: EPA and Mating Connector/Cable Assemblies.

Type: C, D, E, F, K, and L Modules.

Equipment Spec. No.: MCS-1393.01-00-0003.

Test Organization: Wyle Laboratories (Eastern Operation), Scientific Services and Systems, 7800 Governors Drive, West; Huntsville, Alabama 35807.

Contract No.: Purchase Order No. 8828.05-3PM, Job No. 45869.

Inspection Conducted: March 15-24, 1982

Inspector:

J. R. Agee
J. R. Agee, Equipment Qualification Section
(EQS)

8/4/82
Date

J. J. Benson, Consultant, Sandia National
Laboratories

Approved:

H. S. Phillips
H. S. Phillips, Chief, EQS

8/4/82
Date

Summary: The purpose of the inspection was to verify that the test facility was capable of conducting a Loss of Coolant Accident (LOCA) test and to witness the start of a LOCA test when the facility and test specimen were ready.

Details Section

Prepared by J. R. Agee and J. J. Benson

A. Persons Contacted

Wyle Laboratories, Huntsville, Alabama Personnel

- *F. Johnson - Nuclear Equipment Qualification, Manager
- *E. Smith - Contract Manager
- *H. Smith - Senior Engineer

Duke Power Company, Personnel

- ** W. J. Foley, Jr. - Principal Engineer
- ** P. M. McBride - Engineer Specialist
- ** J. S. Tannery - Design Engineer
- ** C. J. Wyle - Chief Engineer

D. G. O'Brien Company Personnel

- ** R. J. Flaherty - Consultant to D. G. O'Brien
- H. P. Hilberg - Engineering Manager

Perk Company

- ** S. Perkinson - President

NRC Observer (Observer)

- ** K. D. Desai - NRC, Bethesda, MD
- * Attended Wyle Management Meeting
- ** Witnessed start of the LOCA Test

The NRC inspector also contacted and interviewed several other licensee and laboratory personnel, including members of technical, engineering and management staff.

- B. Summary: At the Wyle Laboratories, the inspector observed the installation, checkout and startup activities preceding and during the early stages of the Duke Power Company (DPCO), D. G. O'Brien Electrical Penetration Assembly (EPA), Loss of Coolant Accident (LOCA) test. The test was started on schedule, March 24, 1982, and progressed satisfactorily, with minor delays and anomalies, through the first temperature/pressure transient, the first temperature profile (340° F), the second temperature profile (300° F), and was then reduced to the beginning of the third temperature profile (250° F). The test plan required that the test remain

in this mode for the succeeding 46 hours. (Note: The NRC inspector's witnessing of the test ended at this stage of the test. The remainder of the test will be reported in NRC Report No. 99900902/82-02 Report No. 3).

C. Test and Facility Inspection

1. Objectives

The objectives of the inspection were to:

- a. Review applicable test plans and procedures.
- b. Witness ongoing activities relative to the construction, assembly and checkout of the test process system and facility.
- c. Witness applicable pre-LOCA functional testing.
- d. Examine capabilities of the Wyle facility for conducting simulated loss of coolant accident (LOCA) tests.
- e. Witness installation and checkout of the test specimen in the environmental test chamber.
- f. Witness the initial LOCA transients and verify the condition of the test specimen and the test system following the completion of the first temperature transient.

2. Method of Accomplishment

The preceding objectives were accomplished by:

- a. Review of the process system schematic diagram, LOCA 118, Duke Configuration, Revision D, dated February 9, 1982, including detailed discussions with the test engineer concerning the sequence of operation of the system.
- b. Review of the Wyle Test Procedure No. 543/6124-2/DK, Rev. B, dated March 17, 1982.
- c. Review of the Duke Power Company, Specification No. MCS-1393.01-00-0003, Electric Penetration Environmental Qualification Test Criteria, Types B-M, Revisions 1-4, inclusive, dated September 30, 1981, October 29, 1981, December 7, 1981, February 7, 1982, respectively.

- d. Review of the Wyle temperature oven charts for the thermal aging of the EPA components.
- e. Observing ongoing activities of the Wyle craftsman and technicians during the final assembly, checkout and functional testing of the test facility, test equipment, cabling, system instrumentation and process controls.
- f. Witnessing continuity and insulation resistance (IR) tests of the EPA modules and related cabling before and after installation of the test chamber dome on the test chamber flange.
- g. Witnessing final pressure/leak check of the test chamber prior to the LOCA test.
- h. Verifying the process instrumentation and the test measurement instruments (recorders, controllers, data loggers, etc.) were within their calibration cycle or had been calibrated prior to the start of the LOCA test.
- i. Review of the countdown and operations procedure for the LOCA test.
- j. Witnessing the startup and continuation of the LOCA test to the beginning of the third temperature profile.

D. General

1. The qualification test of the D. G. O'Brien EPA was developed by the DPCO to be representative of typical equipment to be installed in their plants. The DPCO prepared the test plan based on criteria for their plants whose construction permits pre-date the IEEE Standards of 1974. DPCO provided components for the test from their warehouse inventory of equipment scheduled to be installed in their nuclear power plants. DPCO was responsible for and developed the radiation aging criteria for the EPA components. Isomedix, Inc., Whippany, New Jersey, was contracted by DPCO to perform and complete the radiation aging of the components. Data concerning the required dose and dose rate for the radiation aging was not available for review at the Wyle site; however, DPCO had delineated the required dose rate (1×10^6 rads/hr.) and the total integrated dose (TID) (2×10^8 rads) in specification No. MCS-1393.01-00-0003. Wyle personnel had received a certificate of conformance form entitled "Electric Penetration Environmental Qualification Test Criteria, Types B-M," dated July 23, 1981, from Isomedix indicating the radiation aging had been performed.

Thermal aging was performed at Wyle in compliance with DPCO Specification No. MCS-1393.01-00-0003. As was done with the EPA components during the radiation aging, the components and cabling were separated into two separate groups and were thermally aged. Also, as was true for the radiation aging, no thermal aging data was available for review at Wyle concerning the method for determining the time and temperature required for the aging. However, it should be noted that Table 2 of DPCO Specification No. MCS-1393.01-00-0003 did delineate the required temperature and the total number of hours to which each individual component and cabling should be thermally aged.

The EPA was assembled at the Wyle facility from the components and cabling described above. The required pretest functional checks were performed by Wyle personnel and were adequately recorded. Photographs were made of the successive stages of assembly of the specimen.

E. Test

On Wednesday morning, March 24, 1981, just before start of the LOCA test, the final functional IR and current leakage measurements were made on the installed EPA modules and related cabling. The test chamber was secured and the LOCA test initiated by introduction of superheated steam into the test chamber. The pressure/temperature transient reached simulated LOCA conditions in less than 10 seconds to meet IEEE Standard 323-1974 criteria of 340° F.

This temperature profile was maintained for approximately 10 minutes and was then reduced to 300° F and held for approximately 1 hour. During this temperature profile, IR measurements were made of the EPA modules and related cabling. All measurements were within the required margins of the baseline functional tests. Near the end of the 300° F profile, the superheated steam supply valves were closed and the pressure and temperature of the steam chamber began to decrease.

Automatic pressure controls failed to open in-line solenoid operated valves (SOVs) to introduce saturated steam into the chamber. As a result, the steam chamber pressure decreased to approximately 0.2-psig and the temperature to less than 200° F before it was determined that power and control wiring to the solenoid valves had not been connected.

After correcting this condition, saturated steam was introduced into the test chamber and the pressure and temperature returned to the required conditions of 250° F and 15 psig for this stage of the test. The test stabilized at these conditions which were to be maintained for the succeeding 46 hours. (Note: The NRC inspector stopped witnessing the test facility at this time. The completion of the test, opening of the test chamber and examination of the test specimen will be observed and described in a subsequent NRC report).

F. Findings

The test system experienced two minor operating anomalies during the system startup and operation but neither anomaly adversely affected the quality of the test. One anomaly concerned the warm-up of the test chamber in which steam back flow through a solenoid valve allowed the steam chamber warm-up temperature to reach 200° F instead of the required 120° F. The 200° F was correlated to 120° F and the test continued within specified test parameters. The second anomaly occurred when automatic pressure controls called for introduction of saturated steam into the test chamber. The failure of two solenoid operated valves (SOV) to operate resulted in the reduction of test chamber pressure and temperature with an insignificant reduction in the EPA connector temperature. Upon the application of electrical power to the SOV's, the test parameters fully recovered and the test continued to completion within the test criteria and benchmarks.

The test was well coordinated and the minor anomalies were handled and corrected efficiently. Safety precautions were exercised for protection of personnel witnessing the test by barricading them from the high pressure steam area. Unauthorized personnel were discouraged from mingling with test personnel to prevent distractions from test activities.

During the time the above testing was witnessed, the NRC inspector observed that the test was adequately controlled in accordance with test procedures and met the test requirements of IEEE Standard 323-1974, and NUREG-0588, Revision 1.