

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-498/89-26
50-499/89-26

Operating Licenses: NPF-76
NPF-80

Dockets: 50-498
50-499

Licensee: Houston Lighting & Power Company (HL&P)
P.O. Box 1700
Houston, Texas 77001

Facility Name: South Texas Project (STP)

Inspection At: South Texas Project, Bay City, Texas

Inspection Conducted: July 18-20, 1989

Inspector:

Dennis L. Kelley
D. L. Kelley, Reactor Inspector, Operational
Programs Section, Division of Reactor Safety

8/25/89
Date

Approved:

J. E. Gagliardo
J. E. Gagliardo, Chief, Operational Programs
Section, Division of Reactor Safety

8/25/89
Date

Inspection Summary

Inspection Conducted July 18-20, 1989 (Report 50-498/89-26)

Areas Inspected: No inspection of STP, Unit 1 was conducted.

Inspection Conducted July 18-20, 1989 (Report 50-499/89-26)

Areas Inspected: Nonroutine, announced special inspection of the failure of STP, Unit 2 Generator Output Transformer 2A.

Results: The transformer failure of July 13, 1989, appeared to be the result of the failure of the Phase A high voltage bushing. The inspector was satisfied with the scope and depth of the licensee's investigation.

DETAILS

1. Persons Contacted

HL&P

*L. H. Clark, Senior Consulting Engineer
A. W. Harrison, Supervising Licensing Engineer
A. C. McIntyre, Manager Support Engineering

The inspector also contacted other members of the licensee's staff during the inspection.

*Denotes person with whom telephone exit interview was held on July 20, 1989.

2. Damage to STP Unit 2 Generator Output Transformer 2A

On July 13, 1989, the Unit 2 Generator Output Transformer 2A was severely damaged by a Phase A ground fault. The inspector was dispatched to the South Texas Project site on July 18, 1989, to perform a followup inspection of the circumstances and assess the damage that resulted from the fault lockout trip.

2.1 Transformer Description

The Unit 2 generator output step-up transformer is made up of two identical three-phase transformers operated in parallel. The transformer total rating is 1,400,000 kVA (kilovoltamperes). The specifications and ratings for each transformer are as follows:

Manufacturer: McGraw-Edison

Rating: 700,000 kVA @ 55 C rise/784,000 @ 65 C rise
FOA (Forced oil and air)

Primary voltage 25 kV (kilovolts) Delta connected

Secondary Voltage 362.25 kV Wye connected (nominal voltage 345 kV)

Primary Bushings: General Electric Type T

Secondary Bushings: McGraw-Edison Type PA

Transformer Weight: Full dressed with oil - 851,700 lbs.

2.1.1 Event Description

At approximately 8 p.m. on July 13, 1989, Unit 2 Generator Output Transformer 2A experienced a Phase A to ground fault at full load resulting in generator/reactor trip. The fault resulted in extensive damage to both the external and internal portions of the transformer.

2.1.2 Damage Description

The phase-to-ground fault of the high voltage side of the transformer resulted in an explosion, which opened an 11-foot welded seam approximately 4 feet from top on the north side of the transformer. At its widest point, the open seam was approximately 1-foot wide. The force of the explosion damaged the north oil radiator and buckled its support members. A large volume of mineral oil and porcelain pieces was ejected through the split seam. It also appeared that the concussion broke the Phase B lightning arrester at its base.

Examination of the three high voltage bushings revealed that the lower porcelain of the Phase A bushing was missing. The corona shield was also missing (it was inside the transformer). Further examination of the Phase A bushing revealed arc strikes on the corona shield flange, the lower edge of the ground sleeve, and the bolting flange. The craft paper wrapping was torn and appeared to have arc tracks on it. The bushing to transformer connection showed no evidence of arc or mechanical damage.

The inspector did not examine the inside of the transformer because of the work in progress in preparation for moving the transformer. The inspector did, however, examine photographs and video tapes made by the licensee. The major portion of the damage inside the transformer appeared to have been caused by the shock wave of the explosion. The tap changers were all broken from their operating mechanism and some of the insulation was out of place. The Phase A bushing corona shield had slipped down around the connection pigtail. The connection mating surface of the Phase A pigtail showed no arc or mechanical damage. There was, however, arc strike evidence at the Phase A bushing penetration at the top of the transformer. There was also some porcelain from the bushing in the transformer windings.

A review of the transformer's history revealed that after receipt at STP, the transformer was loaned out to another HL&P power station in May 1985. The transformer was returned to STP in June 1986, but was again returned to the same power station that same month. The transformer was returned to STP in October 1987, and installed in place on Unit 2.

The inspector also reviewed the electrical and oil test records for Transformer 2A. These tests were performed after the return and installation on Unit 2. All the test results appeared to be within specifications.

2.1.3 Conclusions

From the observations, it would appear that the lower portion of the Phase A bushing failed and the subsequent arc over to ground caused an internal explosion, which caused the major portion of the visible damage.

2.1.4 Exit

The inspector held a telephone exit interview with Mr. L. H. Clark on July 20, 1989, to discuss the results of the inspection. The licensee did not identify any proprietary information to the inspector.