APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-498/88-30
50-499/88-30

Operating License: NPF-76
Construction Permit: CPPR-129

Dockets: 50-498
50-499

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

Facility Name: South Texas Project, Units 1 and 2 (STP)

Inspection At: STP, Matagorda County, Texas

Inspection Conducted: April 25-29, 1988

Inspector: A. R. Johnson — 6/13/88
A. R. Johnson, Reactor Inspector, Plant Systems Section, Division of Reactor Safety — Date

Approved: R. E. Ireland — 6/13/88
R. E. Ireland, Acting Chief, Plant Systems Section, Division of Reactor Safety — Date

Inspection Summary

Inspection Conducted April 25-29, 1988 (Report 50-498/88-30)

Areas Inspected: Routine, announced reactive inspection of Unit 1, during the startup testing phase, with regard to inadvertent material substitutions of Buna-N (nitrile rubber) used for hydraulic cylinder and pump seals in each of four steam generator (SG) power operated relief valves (PORV).

Results: The NRC inspector determined that the HL&P/Bechtel equipment qualification (EQ) documentation file for PORVs Model No. PF 89270-500 did not adequately establish qualification for the installed PORV configuration in the STP plant, Unit 1, which used Buna-N cylinder and pump shaft seals. The licensee did not have a written justification for continued operation (JCO) in the HL&P/Bechtel EQ documentation file. The licensee's 10 CFR 50.59 evaluation, with regard to changes not described in the STP Final Safety Analysis Report (FSAR), did not address EQ equipment important to safety in accordance with 10 CFR 50.49 requirements for survival in harsh environment.

The lack of documentation in the EQ file is considered an apparent violation to 10 CFR 50.49 (498/8830-01).

Inspection Conducted April 25-29, 1988 (Report 50-499/88-30)

Areas Inspected: No inspection of Unit 2 was conducted.

Results: Not applicable.

DETAILS

1. Persons Contacted

HL&P

M. R. Wisenburg, Plant Superintendent, Unit 1
J. E. Geiger, General Manager, Nuclear Assurance
S. J. Eldridge, Operations Support Manager
R. D. Bradford, Senior Health Physicist
*G. E. Schinzel, Supervisor, Plant Engineering Department (PED)
R. Delong, PED
C. B. Thiele, PED
*V. R. Albert, PED
*S. M. Mitchell, PED
*R. F. Dunn, PED
L. R. Casella, Engineering
D. Shekari, Engineering
G. L. Jarvela, Health Physics, Plant Operations
*S. N. Head, Support Licensing Engineer
*J. D. Green, Operations (OPS), Quality Assurance
*R. C. Munter, Support Engineering
*S. M. Dew, Manager, OPS Support
*G. E. Vaughn, Vice President, Nuclear Operations
*P. L. Walker, Support Licensing Engineer

Bechtel

R. Ulanday, Supervisor, Equipment Qualification Department, Houston Office

*Denotes those attending the exit interview.

2. Steam Generator Main Steam Line Power Operated Relief Valves (93702)

The NRC inspector investigated and reviewed the licensee's 10 CFR 50.59 written safety evaluation with regard to changes not described in the STP FSAR and the inadvertent material substitutions (Buna-N, nitrile rubber) used for hydraulic cylinder and pump shaft seals in each of the plant's four SG PORVs, supplied by Control Component Inc., and manufactured by Paul-Munroe Enertech. The STP plant, Unit 1, was operating during the startup testing phase at the 30 percent power plateau during this inspection.

a. Background

The cold shutdown capability of the plant has been evaluated, and is outlined in the STP FSAR, Appendix 5.4.A. Under accident conditions, the plant must be capable of achieving residual heat removal (RHR) system initiation conditions of approximately 350°F, and 350 psig

within 36 hours. To ensure that the plant can be taken to cold shutdown, the STP cold shutdown design enables the reactor coolant system (RCS) to be taken from no-load temperature and pressure to cold conditions using safety-related systems (including environmentally qualified components), with only onsite power available.

When the reactor coolant temperature and pressure are reduced to approximately 350°F and 350 psig, respectively, the second phase of cooldown starts with the RHR system being placed in operation. Cooldown of the RCS is continued using available RHR trains and following cooldown rate limits. The time required to reach the cold shutdown conditions is defined in the technical specifications and depends upon the number of RHR trains available, and the component cooling water (CCW) and emergency cooling water (ECW) temperatures.

b. Accident Conditions on Power Operated Relief Valves

The PORVs and associated pressure controls are provided on each main steam line (MSL) to provide the capability for a controlled plant cooldown when the turbine bypass system is unavailable. Credit for the operability of the PORVs is taken at STP for safe shutdown decay heat removal during the mitigation of the following four accident conditions concurrent with the loss of offsite power: (1) SG tube rupture, (2) feed line break, (3) loss of main feed, and (4) small break loss-of-cooling accident (LOCA). During accident conditions, a higher than normal environment may exist at the SG main steam line isolated valve cubical where each respective PORV is located. Each accident analysis contained in Chapter 15 of the FSAR takes credit for two out of four SG PORVs being operable. Two out of four SGs and associated PORVs are required to cool the plant down from 100 percent thermal power after 4 hours of hot standby conditions to the initiation of RHR operation. At 30 to 50 percent thermal power, the 4 hours is estimated to extend up to 8 hours. During these periods, a higher than normal accident environment may be experienced at each main line isolated valve cubical where each PORV is located.

c. Environmental Qualification of Power Operated Relief Valves Important to Safety

The required accident environment levels of 335°F, 2.8 psig, 100 percent relative humidity (RH), and 3.5×10^5 Rads (TID), for 30 days were documented on the EQ system component evaluation worksheet (SCEW) contained in HL&P/Bechtel EQ documentation file for the plant PORVs. These values specify the type testing requirements for each PORV to demonstrate qualification, and preclude inoperability as a result of the accident environment. The inadvertent material substitution of Buna-N for Viton and EPR may compromise the functional capability of the PORV to perform its safety-related function. This is particularly true when an already

identified incompatibility between the Buna-N seal materials and hydraulic fluid (Fyrquel EHC) exists and is known to degrade the PORV cylinder and pump seals. The incompatibility determination was made by Stauffer Chemical Company on the basis of industry standards for swell and shrinkage where elastometers exhibiting greater than 15 percent swell and 5 percent shrinkage are considered incompatible.

Based on an HL&P augmented surveillance program to detect seal degradation, the mean-time-to-failure (MTTF) for Buna-N PORV seals during hot normal service at STP has been 76 days. The EQ requirements as specified on the SCEW sheet require a qualified normal service life (QL) of 40 years, with scheduled replacement of cylinder and pump seals every 5 years. The demonstrated 76-day QL, being less than the required 5 years under normal service environment conditions, demonstrate these components unqualified to survive the harsh environment of an accident. Furthermore, the postaccident operability time is specified as 30 days under the higher than normal service environment under which the seals would not survive.

The HL&P/Bechtel EQ documentation file demonstrated qualification of the PORVs by type testing in accordance with 10 CFR 50.49. The complete valve operator assembly No. PF 89270-500 (PORV which includes the hydraulic cylinder and hydraulic pump) are manufactured by Paul-Munroe Enertech. The complete assembly was environmentally type tested and qualified for the Alvin W. Vogtle Nuclear Plant, at Wyle Laboratories - Norco Facility, and have met the worst case accident environment requirements for the STP plant conditions provided identical type test components are installed in the STP plant. However, substitution of Buna-N seals for Viton in the hydraulic cylinder and Rexroth pump, constitutes a breakdown of similarity between the type test configuration and that installed in the STP plant.

Sandia National Laboratories, contractor to NRC, identified the Buna-N material as a poor performer at high temperatures and RH. Only a small amount of damage has been known to occur, however, at the accident radiation levels established on the EQ SCEW sheet. An analysis by HL&P/Bechtel was not present in the EQ documentation file to demonstrate that Buna-N materials are acceptable for all of the accident environments, as substitutes for Viton and EPR. Also an analysis was not available to verify that all materials used in the installed refurbished PORVs are the same as those type tested at Wyle-Norco. Substitutions of materials are required to be documented by analyses and placed in the EQ documentation file in accordance with 10 CFR 50.49.

The NRC inspector determined that the licensee does not have an adequate basis, using Buna-N materials in place of Viton and EPR, to establish EQ of the PORVs. A prompt determination of operability regarding qualification of this equipment to withstand accident environment was not available in the HL&P/Bechtel EQ documentation

file. No written JCO, regarding alternate equipment that is qualified to accomplish its safety function, was available in the HL&P/Bechtel EQ documentation file. The licensee's 10 CFR 50.59 written safety evaluation failed to address EQ requirements. These actions are required in accordance with the 10 CFR 50.49 rule, and guidance is given as outlined in NRC Generic Letter 88-07, dated April 7, 1988.

The lack of documentation in the EQ file is considered as an apparent violation to 10 CFR 50.49 (498/8830-01).

3. Exit Interview

An exit interview was conducted with HL&P personnel on April 29, 1988, at the conclusion of the inspection, during which the inspection findings were summarized. The licensee did not identify any of the information discussed at the exit as being proprietary.