APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-498/91-02
50-499/91-02

Operating Licenses: NPF-76
NPF-80

Dockets: 50-498
50-499

Licensee: Houston Lighting & Power Company (HL&P)
P.O. Box 1700
Houston, Texas 77251

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

Inspection At: STP, Matagorda County, Texas

Inspection Conducted: January 14-18, 1991

Inspectors: W. F. Bundy for 1/29/91
M. F. Bundy, Reactor Inspector, Test Programs Section, Division of Reactor Safety — Date

W. F. Bundy for 1/29/91
M. E. Murphy, Reactor Inspector, Test Programs Section, Division of Reactor Safety — Date

Accompanied By: W. C. Seidle, Chief, Test Programs Section, Division of Reactor Safety (January 17-18, 1991)

Approved: W. C. Seidle 1/29/91
W. C. Seidle, Chief, Test Programs Section Division of Reactor Safety — Date

Inspection Summary

Inspection Conducted January 14-18, 1991 (Report 50-498/91-02; 50-499/91-02)

Areas Inspected: Routine, announced inspection of the results of the licensee's post-refueling startup testing.

Unit 1 Results: No inspection was performed for Unit 1.

Unit 2 Results: The test procedures were well written and logical. The chronological test logs indicated that the tests had generally proceeded smoothly. Reactor engineering staff members appeared to be well trained and competent. Test results indicated that thermal and reactor physics parameters met acceptance and review criteria and were very close to predicted values. It was observed that the two coordinating test result packages did not receive formal review and approval signatures. Licensee management indicated at the exit meeting that a more structured review and approval process would be developed for application to similar future test packages. No violations or deviations were identified.

DETAILS

1. PERSONS CONTACTED

HL&P

*S. Rosen, Vice President, Nuclear Engineering
*M. Wisenburg, Plant Manager
*M. Chakravorty, Executive Director, Nuclear Safety Review Board
*D. Keating, Director, Independent Safety Engineering Group
*T. Jordan, General Manager, Nuclear Assurance
*D. Denver, Manager, Plant Engineering
*D. Hoppes, Division Manager, Reactor Engineering
*D. Sanchez, Manager, Maintenance Planning
*C. Ayala, Supervising Engineer, Licensing
*A. Khosla, Senior Engineer, Licensing
D. Gephart, Reactor Operator, Operations Support
D. C. Batyko, Instrumentation and Control (I&C) Engineer, Plant Engineering Department (PED)
B. Schoonover, I&C Engineer, PED
J. Eichenlaub, Reactor Performance Engineer

NRC

J. Tapia, Senior Resident Inspector
R. Evans, Resident Inspector

The inspectors also interviewed other licensee employees during the inspection.

*Denotes those attending exit meeting conducted on January 18, 1991.

2. STARTUP TESTING, POST-REFUELING (72700)

This inspection involved the review of data from startup testing for Unit 2, Cycle 2 operation following Refueling Outage 1. Core physics and other applicable test results were reviewed to verify compliance with NRC requirements, vendor requirements, and licensee procedures. To establish requirements, the inspectors reviewed the following documents:

- Technical Specifications covering reactivity control systems, power distribution limits, instrumentation, and special test exceptions
- Report WCAP-1287, "The Nuclear Design and Core Management of the South Texas Unit 2 Nuclear Power Plant, Cycle 2," dated December 1990
- STPEGS Unit 2, Cycle 2 Core Operating Limits Report, Revision 0, dated November 15, 1990

- Letter ST-UB-HL-00835, Westinghouse to HL&P, "Reload Safety Evaluation - Unit 2, Cycle 2 (Final)," dated November 29, 1990

- Letter ST-UB-HL-00819, Westinghouse to HL&P, "Reload Safety Analysis Checklist, Unit 2, Cycle 2," dated November 26, 1990

The inspectors reviewed several completed test packages to verify that the stated procedural objectives were met, acceptance criteria for tests were met, changes to procedures and tests were satisfactorily reviewed, approved, and incorporated, test results were adequately reviewed, and test deficiencies were satisfactorily dispositioned. The inspectors found that the procedures were generally well written and logical. With the exceptions discussed below, the inspectors were satisfied with one acceptance criteria and one review and approval. The few deficiencies identified were satisfactorily resolved.

Overall startup testing including sequencing of operations and reference to completion of associated procedures was covered by Procedure OPEP02-ZX-0010, Revision 1, FCR 90-1106, "Reload Initial Start-Up Testing," completed January 8, 1991.

The inspectors observed that Procedure OPEP02-ZX-0010 effectively coordinated all startup testing. The chronological test log indicated that the tests had generally proceeded smoothly. The reactor engineering staff responded knowledgeably to inspectors' questions regarding the testing. The test results appeared to have been adequately reviewed and approved. However, the reviews were not documented in accordance with usual industry practice in that there were no signatures indicating that the acceptance criteria had been satisfied and that an overall test results review had been performed. Completion of associated tests comprised the acceptance criteria. The inspectors noted that there were two check marks beside each criterion. These observations were discussed at the exit meeting with licensee management who indicated that they would take actions to make the review and approval process more structured.

One of the procedures referenced by Procedure OPEP02-ZX-0010 was Procedure OPEP02-ZX-0002, Revision 3, FCR 90-2359, "Initial Criticality and Low Power Physics Testing," completed December 9, 1990. In addition to initial criticality, it covered all the core physics testing up to 5 percent rated thermal power (5% RTP). Procedure OPEP02-ZX-0002 was well written and effectively coordinated low-power core physics testing. The results indicated that the testing had proceeded without significant problems. The test results indicated that the thermal and reactor physics parameters met acceptance and review criteria and were very close to predicted values. As discussed for Procedure OPEP02-ZX-0010 above, there was no formal review and approval signature. However, there was a statement in the chronological test log that all acceptance and review criteria had been satisfied and that the test log was closed. This was signed by the test director, who had been a participant in the testing. Also, there was one signature to indicate all acceptance and review criteria had been satisfied. The inspectors concluded that individual criterion appeared to be important enough to deserve a separate initial or signature indiciating acceptance. Licensee management indicated that they would consider these observations in developing a more structured review and approval process, as discussed above.

The inspectors reviewed the following supporting test packages:

- Procedure 0PEP02-ZX-0001, Revision 2, "Reactivity Computer Checkout," completed December 9, 1990
- Procedure 0PSP10-RC-0002, Revision 0, "Core Exit Thermocouple (TC) Resistance Temperature Detector (RTD) Cross Calibration," completed 567°F plateau on December 3, 1990
- Procedure 2PSP03-RI-0001, Revision 0, "Digital Rod Position Indication Operability Test," completed December 4, 1990
- Procedure 2PSP03-RS-0001, Revision 0, "Monthly Control Rod Operability," completed January 11, 1991
- Procedure 2PSP03-ZO-0002, Revision 3, "Modes 1, 2, 3, and 4 Operator Logs," completed January 14, 1991
- Procedure 0PSP10-DM-0001, Revision 2, "Rod Drop Time Measurements," completed December 4, 1990

The reactivity computer checkout appeared complete and comprehensive. The results of the core exit TC/RTD cross-calibration testing showed close correlation among the various temperature readings. Failures were minimal, and there was very close correlation between demand and digital rod position indications. The rod drop times were well within acceptance criteria and were consistent.

Specific areas of core physics testing are discussed in the following subsections.

2.1 Surveillance of Core Power Distribution Limits (61702)

The inspector verified that the licensee was using approved data analysis codes for processing information obtained by the movable incore instrumentation. These codes were discussed in the core design report (WCAP-1287) described above. A flux map was obtained in accordance with Procedure 0POP02-II-0001, Revision 4, "Movable Incore Detector System Operation." Calculations of the heat flux and nuclear enthalpy rise hot channel factors were performed in accordance with Procedure 0PSP10-II-0003, Revision 4, "Determination of Limiting Hot Channel Factors and Axial Offset." Completed test result packages at the following rated thermal power (RTP) level plateaus were reviewed by the inspector:

- 29.5 percent RTP performed on December 15, 1990
- 76.3 percent RTP performed on December 16, 1990
- 100 percent RTP performed on December 26, 1990

All hot channel factor measurement results were within design predictions and Technical Specification limits. The following results were obtained at the 100 percent RTP plateau:

- Highest heat flux hot channel factor was 1.8912 versus a limit of 2.367
- Highest nuclear enthalpy rise hot channel factor was 1.3805 versus a limit of 1.46

It is also a test requirement to determine that the incore axial flux difference (AFD) corresponds to the excore axial flux difference measurements within 3 percent. These measurements were satisfactorily completed in accordance with Procedure OPSP10-II-0001, "Incore - Excore Cross Calibration," in lieu of Procedure OPSP10-II-0003, and are further discussed in Subsection 2.2 below. The target AFD was predicted on December 9, 1990, and determined by measurement on December 30, 1990, in accordance with Procedure OPSP10-NI-0001, Revision 5, "Target AFD Determination." The predicted and measured values were close.

The inspector reviewed AFD and quadrant power tilt data taken during power changes from 100 percent to 60 percent and back to 100 percent RTP on January 8 1991. The AFD values remained within the established target band, and the quadrant power tilt remained well within the Technical Specification limit of 1.02.

The inspector concluded that appropriate surveillances of core power distribution limits were being performed and the plant was being operated well within design predictions and Technical Specification limits.

2.2 Calibration of Nuclear Instrumentation Systems (NIS) (61705)

The purpose of this part of the inspection was to verify that the source, intermediate, and power range detector calibrations and the incore/excore detector calibration had been properly performed and at the required frequency. The inspector reviewed test results for the following procedures:

- Procedure 2PSP05-NI-0031, "Source Range Neutron Flux Channel I Calibration"
- Procedure 2PSP05-NI-0036, "Intermediate Range Neutron Flux Channel II Calibration"
- Procedure OPSP03-NI-0001, "Daily Power Range NI Channel Calibration"
- Procedure OPSP10-II-0001, "Incore - Excore Detector Calibration"

The inspector verified that the correct, approved procedures were used. Test results satisfied the stated acceptance criteria and, where necessary, accuracies of trip set points, alarms and signal processing equipment were reestablished. Test result evaluations were sufficiently reviewed, and deficiencies correctly dispositioned.

2.3 Core Thermal Power Evaluation (61706)

The purpose of this part of the inspection was to determine that the core thermal power was correctly established by calorimetric calculations at the

required intervals during the startup and that the procedure was technically acceptable. The inspector reviewed Procedure OPEP02-ZX-0007, "100% Power Instrument Alignments."

The procedure was found to be technically acceptable. The inspector reviewed a 1-month sampling of core thermal power calculations to verify that the frequency of evaluations was as prescribed by the Technical Specifications and that all acceptance criteria were met. Calculations were independently verified by the inspector, and the completed data packages were reviewed and approved in accordance with the licensee's administrative requirements. The inspector further verified that the licensee completed required sign-offs, satisfied stated prerequisites, and correctly reviewed and approved changes to the procedure.

2.4 Determination of Reactor Shutdown Margin (61707)

The purpose of this part of the inspection was to determine that adequate reactor shutdown margin had been established prior to operation above 5 percent of rated thermal power. It was also conducted to determine that the licensee was ensuring adequate shutdown margin through the operating cycle and to verify that changes in shutdown margin because of inoperable control rods were properly addressed, if applicable.

The inspector reviewed Procedure OPSP10-ZG-0006, "Post-Refueling Shutdown Margin Verification." This review determined that calculations to assess the reactivity contributions to the total core reactivity change were correctly performed for the required parameters. The results of the shutdown margin calculation met the conditions prescribed by the Technical Specifications. The inspector also reviewed selected data packages for Technical Specification surveillance requirements, these were found satisfactory.

There were no instances during Cycle 1 that the shutdown margin could not be met.

2.5 Isothermal and Moderator Temperature Coefficient Determination (61708)

The purpose of this part of the inspection was to verify that the licensee's determination of the moderator temperature coefficient of core reactivity was technically consistent with the predicted values and Technical Specification requirement. The inspector reviewed the following procedures:

- Procedure OPSP10-ZG-0001, "Determination of Moderator Temperature Coefficient (BOL)"
- Procedure OPSP10-ZG-004, "Determination of Moderator Temperature Coefficient at Power (EOL)"

The inspector reviewed the completed data packages for these procedures. The post-refueling data satisfied all measurement test precautions and prerequisites. Actual plant conditions established during the test were the same as those

assumed in the analytical predictions. The moderator temperature coefficient value determined was consistent with the predicted value and within Technical Specification requirements.

The end of life determination for Cycle 1 was also satisfactory and met the requirements of the Technical Specifications.

2.6 Control Rod Worth Measurements (61710)

The predictions for control rod worths were included in the core design report (WCAP-1287). Rod worths were determined for each bank by the rod swap method in accordance with Procedure OPEP02-ZX-0002. The data reviewed by the inspector indicated that the testing had been properly controlled and the results were correctly interpreted. The total rod reactivity worth turned out to be 3 percent low compared to the criterion of +/- 10 percent. Also, all bank worths were well within the review criteria.

2.7 Summary of Findings

The test result packages indicated all requirements of the startup testing program had been met. A more structured review process for the coordinating test packages could be beneficial. No violations or deviations were identified.

3. EXIT MEETING

The inspectors met with the licensee representatives denoted in paragraph 1 on January 18, 1991, and summarized the scope and findings of this inspection. Proprietary materials provided to the inspectors were returned at the conclusion of the inspection and none of their contents are reproduced in this report.