ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-498/95-21
50-499/95-21

Licenses: NPF-76
NPF-80

Licensee: Houston Lighting & Power Company
P.O. Box 1700
Houston, Texas

Facility Name: South Texas Project Electric Generating Station, Units 1 and 2

Inspection At: Matagorda, Texas

Inspection Conducted: August 28 through September 14, 1995

Inspectors: Lawrence E. Ellershaw, Reactor Inspector, Maintenance Branch
Division of Reactor Safety

Kathy D. Weaver, Reactor Inspector, Maintenance Branch
Division of Reactor Safety

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Division of Reactor Projects

Approved: _____ 10/2/95
Dr. Dale A. Powers, Chief, Maintenance Branch Date
Division of Reactor Safety

Inspection Summary

Areas Inspected (Units 1 and 2): Special, announced inspection in which a followup assessment was performed regarding the licensee's response to the Unit 2 spent fuel pool loss of water inventory on July 18, 1995.

Results (Units 1 and 2):

Maintenance

- Sensitivity for potential gate seal failure was not adequate, and maintenance was allowed on the outer gate seal when the inner gate seal was exhibiting a deficiency which had not been evaluated to ensure it was still performing its function (Section 3).

Engineering

- Engineering personnel, assigned to evaluate information notices pertaining to spent fuel pool loss-of-water inventory events, performed very thorough evaluations and developed conservative actions to address those events (Section 4).

- Implementation of engineering specified actions regarding preventive maintenance and inspection of the spent fuel pool-to-cask connecting channel gate seals was not achievable under the circumstances, thus, was considered a weakness (Section 4).

Plant Support

- A weakness in the training program was identified regarding the use of training materials (drawings) that were not accurate. This had the potential for causing an operator to perform incorrect actions based on erroneous information (Section 4).

- During the exit meeting, the licensee committed to evaluate what appeared to be an inconsistency in the Updated Final Safety Analysis Report regarding radiation dose limits in the spent fuel pool under differing conditions (Section 4).

Attachment:

- Attachment - Persons Contacted and Exit Meeting

DETAILS

1 PLANT STATUS

At the beginning of this inspection period, both units were at full power. On Tuesday, August 29, 1995, Unit 1 tripped and subsequently was restored to full power on Thursday, August 31, 1995. Unit 2 remained at full power.

2 EVENT DESCRIPTION

On July 18, 1995, while performing preventive maintenance on the seal air supply, air pressure was lost to an outer spent fuel pool (SFP) gate seal resulting in water leakage from the SFP to the transfer canal. The preventive maintenance scope included calibration of the low pressure switch, replacement of the gauges and check valve, and performance of a leak check on the air system for each seal.

At a pre-job briefing, performance of the preventive maintenance was discussed. It was known that the seal on the transfer canal inner gate (SFP side) had an existing air leak (Service Request 200563), but that it was still able to maintain pressure. It was assumed that even though the seal had an air leak, it was holding pressure and no water leakage was occurring. Therefore, the seal was considered to be functional, and no additional evaluation of the integrity of the gate seal was performed. It was concluded that the preventive maintenance would not cause a loss-of-air pressure to the seals; therefore, the unit supervisor then instructed the technicians not to work on the seal with the air leak, but to work on the outer gate seal.

At approximately 11:15 a.m., the technicians started work on the SFP-to-transfer canal outer gate seal. Water level in the SFP was at 20.21 m [66.30 ft]. At approximately 11:18 a.m., in accordance with the work instructions, the technician placed the air pressure control valve to the indicated OFF position. At that time, the outer seal began to lose its air pressure and deflate. The technician had not noticed that the valve position indicating faceplate was loose and had rotated out of position. This caused the indicated positions to be 90° off the actual positions; thus, the indicated OFF position was really in the DEFLATE position. As the outer gate seal deflated, the technicians heard and saw the water leaking around the outer gate seal into the transfer canal. SFP level began to drop because the inner gate was also leaking due to the, until then, unknown degraded integrity of its seal. A local low pressure alarm sounded as the outer gate seal deflated and the technicians observed a low indicated pressure on the control panel gauge. The control room was notified and a nuclear plant operator was dispatched to investigate.

At 11:23 a.m., the "SFP Level HI/LO" alarm was received in the control room. During this time, the technicians placed the pressure control valve to the 0° (actual INFLATE) position. This reinflated the outer seal and stopped the leakage with the SFP level at 20.117 m [66 ft]. The unit supervisor entered

Procedure 0POP04-FC-0001, "Loss of Spent Fuel Pool Level or Cooling," and the reactor plant operator commenced refilling the SFP. At 12:23 p.m., the "SFP Level HI/LO" alarm cleared and Procedure 0POP04-FC-0001 was exited. At 12:49 p.m., the SFP level had been restored to 20.269 m [66.50 ft].

3 LICENSEE DETERMINATION OF EVENT CAUSE (IP 86700)

Licensee personnel initiated Condition Report 95-9104 on July 18, 1995, to investigate and identify the root cause(s) and contributing factors to this event. The inspectors noted that 22 items were identified as requiring some type of action.

Licensee representatives indicated that the primary cause for the event was a loose position faceplate for the air pressure control valve, which had rotated approximately 90° from its proper position. The mispositioned faceplate was not initially noticed by the instrumentation and controls technician performing the work. Therefore, when the technician moved the valve to the indicated OFF position as required by the preventive maintenance task, it was actually in the DEFLATE position. This resulted in a loss of air pressure to the outer gate seal and caused the seal to deflate.

The existence of an inner gate seal air leak had been previously identified by licensee personnel on Service Request 200563, dated May 14, 1994. But, since the pressure appeared to be holding as required (between 206.84 and 234.42 kPa [30 and 34 psi]), and the space between the gates was normally full of water, the seal was considered to be functional because leakage could not be observed. The assumption was that even though an air leak existed, the seal remained pressurized, thus, watertight. However, once the outer seal was deflated, the unknown degraded condition of the inner gate seal allowed water to leak past the inner gate seal. Since the inner seal had been considered functional, no test had been performed to determine its integrity and the consequences of the inner gate seal leaking were never adequately addressed. The licensee determined that sensitivity for potential gate failure was not adequate, and maintenance was allowed on the outer gate seal (second barrier) when the inner gate seal (first barrier) was exhibiting a deficiency, which had not been evaluated to ensure it was still performing its function.

Licensee personnel walked down and inspected the remaining SFP gate seal control panels in both units and no other discrepancies were found. Licensee representatives indicated that corrective action had been initiated to permanently mount all SFP gate seal control panel faceplates in the correct position.

4 ASSESSMENT OF LICENSEE PERFORMANCE RELATED TO THE EVENT (IP 86700)

The inspectors performed a walkdown of both the Unit 1 and 2 SFP areas on August 28, 1995. The transfer canal-to-SFP inner and outer gates are located at the northeast end of the SFP and are comprised of seismically qualified metal gates and nonsafety-related, nonseismic, inflatable seals that fit between the two sides and bottom of each gate and the sealing surface of the

gate frame. The inspectors observed a similar gate arrangement at the south end of the SFP, which separates the SFP from the cask pool area. Each gate seal has its own redundant air supply, electrical components, valves, pressure connections, and pressure gauges. In addition, a backup nitrogen supply existed for each gate seal.

The bases for classifying the seals as nonsafety-related and nonseismic were provided by the architect engineer (Bechtel Energy Corporation) in Interoffice Memorandum IOM-26142, dated June 7, 1984, which was concurred with by the licensee's site engineering department in Office Memorandum ST-HS-HS-13290 dated June 5, 1990. The inspectors verified that the bases met the criteria specified in 10 CFR Part 100 (for nonsafety-related classification) and Regulatory Position C.6 of Regulatory Guide 1.13 "Spent Fuel Storage Facility Design Basis," (for nonseismic classification). The inspectors also reviewed Section 9.1 in NUREG-0781, "Safety Evaluation Report Related to the Operation of South Texas Project, Units 1 and 2," dated April 1986. Section 9.1, "Fuel Storage and Handling," provides the results of NRC staff review of the design and materials used for the fuel handling building, fuel storage racks, storage pools (including the gates between the storage pools and cask loading pool), pool liners, fuel transfer canal, cask loading area, cooling and cleanup system, and monitoring and control equipment. The NRC staff concluded that the design and materials met the applicable General Design Criteria and, therefore, were acceptable.

The inspectors noted that the cask pool area consisted of a cask connecting channel, a cask pool, and a cask decontamination area. These concrete spaces were unfinished (unlined) and were of a much greater volume than the transfer canal. The inspectors also noted a substantial accumulation of boron crystals on the floor of the Unit 1 cask connecting channel near the base of the gate, and approximately one-third of the way up the east side of the gate. The inspectors also observed a lesser accumulation of boron crystals at the base of the Unit 2 cask connecting channel. Upon questioning by the inspectors, licensee representatives indicated that there were several possible reasons for the boron crystal accumulation, with the most likely being attributable to water leakage associated with preventive maintenance activities of the seal air supply system. During preventive maintenance of the air supply system, a certain amount of seal deflation occurs, thus, allowing water to leak by the seals. Upon evaporation of the water, boron crystals remained. Since licensee management did not consider it necessary or prudent to clean up the crystals (due to ALARA concerns), the boron crystals have continued to accumulate.

In the licensee's "Request for Low Power Operating License" letters dated May 26, 1987, for Unit 1, and December 3, 1988, for Unit 2, the cask pool areas were identified as not being complete, in that the liners had not been installed. No consequences were identified for not completing the structures prior to fuel load. The Unit 1 letter did state that the wet cask liner plate would be installed by 1997, and that normal spent fuel removal from the Unit 1

fuel handling building would not be undertaken until the liner plate was installed. The Unit 2 letter was similar, except no installation date was provided. Licensee representatives stated that communications with the Office of Nuclear Reactor Regulation were being initiated in order to discuss status change regarding completion of the cask pool areas.

The inspectors were informed that on July 24, 1995, licensee personnel identified that the cask pool area at the south end of the SFP had a drain and pumping system that was designed to handle the intended water inventory in that area. The position of the valves in that system have the potential to drain the SFP to a level approximately 0.305 m [1 ft] above the top of the active fuel. Those valves had not been included in valve lineup procedures. During the licensee's walkdown, all valves were found to be closed except for Valve ED-0359, a Unit 2 valve off of a 2.54 cm [1 in] drain line from the wet cask pool. This drain goes directly to the No. 3 sump in the fuel handling building. Since the cask pool area is an unfinished concrete structure, the associated drain and pumping system had not been included in the valve lineup procedures. Personnel immediately closed the valve and attached a caution tag. Subsequently, the design engineering department revised the applicable drawings to reflect the as-built and preferred (closed) configuration of the cask pool area drain valves. This action was taken, not as a regulatory requirement, but simply to reflect the existing as-built conditions of the plant, even though, as stated above, the cask pool area is an unfinished concrete structure.

The inspectors, during review of various fuel handling building drawings, determined that if a catastrophic failure of both gate seals occurred at the SFP-to-transfer canal location, assuming no operator action, water equalization would occur at an approximate elevation of 17.983 m [59 ft], which is nearly 6.401 m [21 ft] over the top of the active fuel. If the same failure occurred at the SFP-to-cask connecting channel location, water equalization would occur at an approximate elevation of 14.326 m [47 ft], which is nearly 3.048 m [10 ft] above the top of the active fuel. Both water equalization levels are below the SFP cooling return line, which is at an elevation of 19.202 m [63 ft]. However, Section 9.1.2.3 in Revision 3 to the licensee's Updated Final Safety Analysis Report states that a complete loss of SFP cooling is not considered a credible event since the SFP is designed to maintain leaktight integrity and makeup capability is provided by permanently installed connections to: the demineralized water system; the reactor makeup water system; and the refueling water storage tank, and because of the redundant design of the cooling systems. Therefore, no single failure would result in a complete loss of SFP cooling.

The inspectors also noted that General Arrangement Drawing 6F-18-9-N-5060, "Fuel Handling Building Plan," Revision 8, showed the existence of a watertight gate at the south end of the cask connecting channel. During the walkdown of the SFP area on August 28, 1995, the inspectors observed that these gates had not been installed. Licensee personnel informed the inspectors that the general arrangement drawings were not controlled and that they were used for familiarization purposes only. While the inspectors agreed

with this position, the inspectors noted during review of training and applicable lesson plans, that the general arrangement drawing information was contained in the lesson plans as a training aid. The inspectors questioned licensee personnel about the use of inaccurate training materials being presented to licensed and nonlicensed operators, and whether any type of validation effort is performed on training aids. The inspectors expressed concern over the potential for an operator to perform incorrect actions based on erroneous information, and considered this aspect of the training program to be a weakness. Licensee representatives stated that verification of accuracy is conducted only for those areas requiring the performance of tasks; however, the concern was acknowledged and Condition Report 95-10310 was initiated on August 30, 1995, to correct the training material and provide retraining to the operators.

The inspectors were provided a copy of the design engineering department's Office Memorandum ST-HS-HS-32661, dated August 31, 1995, which identified several options being evaluated to isolate the cask pool area from the SFP. This was in response to one of the action items identified in Condition Report 95-9104. The two primary options consisted of (1) fabricating and installing a gate, in accordance with the existing design, at the south end of the cask connecting channel, and (2) design, fabricate, and install a passive gate at either end of the cask connecting channel (essentially welding a stainless steel plate in place). The final decision had not been made at the conclusion of this inspection.

During the inspectors' review of the Updated Final Safety Analysis Report, it was noted that Section 9.1.2.1 addressed the adequacy of SFP shielding to protect plant personnel from radiation exposure by stating that a depth of approximately 3.048 m [10 ft] of water over the top of the spent fuel assemblies will limit direct radiation to 25 μSv/hr [2.5 mR/hr] (surface dose rate). Section 12.3.2.2.2.4, dealing with fuel transfer shielding, states that all spent fuel is handled under a minimum of 3.048 m [10 ft] of water to ensure that the deep dose equivalent rate above the SFP is less than 25 μSv/hr [2.5 mR/hr] from the fuel assembly being transferred. The inspectors requested clarification from licensee personnel on what appeared to be similar radiation limits, but under different conditions. During the telephonic exit meeting held on September 14, 1995, licensee representatives committed to conduct a review and, if necessary, submit changes needed to correct the Updated Final Safety Analysis Report.

The inspectors questioned licensee representatives about the length of time that the leaking inner gate seal was allowed to remain in place without taking any corrective actions (i.e., since the air leak was identified in Service Request 200563 on May 14, 1994). Repair work, identified on the service request which had been assigned a low level Priority 5, was initiated by technicians on September 8, 1994. However, the repair was unable to be made

and it was determined that the seal would have to be replaced, and that this would require filling the transfer canal. Since the seal appeared to be functional (i.e., able to hold the required air pressure) it was assumed that the seal would not leak. As stated before, there was no engineering evaluation or testing to validate the assumption.

The inspectors assessed the licensee's engineering evaluations performed to address issues identified in various NRC information notices that dealt with unintentional loss of SFP water inventory. In general, the assigned engineer performed very thorough evaluations and developed conservative actions to address the concerns in the information notices, including recognition and consideration for the potential loss of gate seals. The engineering evaluation specified the development and implementation of a preventive maintenance task to inspect the SFP gate seals (Units 1 and 2) in accordance with vendor and engineering requirements. Vendor information regarding seal life was not very explicit, in that 6 to 8 years was considered normal; however, upon inspection, if no wear, tears, or abnormal conditions existed, than the service life could be extended. The requirement to inspect the SFP gate seals for wear, tear, and abnormal conditions, was developed and incorporated into Procedure OPMP04-FH-0005-1, "In Containment Fuel Storage Area and Spent Fuel Pool Gate Removal and Reinstallation." The inspectors learned that the only gates that are removed and reinstalled are the SFP-to-transfer canal gates during refueling outages, and that the SFP-to-cask connecting channel gates have never been removed, thus, never inspected since the initial flooding of the SFP. While licensee personnel recognized and acted on the need to address maintenance and inspection of the gate seals, the implementation was not achievable in terms of the SFP-to-cask connecting channel gates because they were not required to be removed, thus, the procedure was not invoked. The inspectors concluded that implementation of the engineering specified actions was not achievable under the circumstances, were weak because Procedure OPMP94-FH-0005-1 did not include the SFP-to-cask connecting channel gates.

The inspectors learned that the only required, documented inspections of the SFP areas consisted of SFP water temperature, level, and water clarity. These observations were performed once each shift during operator rounds. The inspectors verified that these readings were being recorded by review of a sample of shift logs over the preceding 6 months for both units. Licensee representatives informed the inspectors that the operators also observed gate seal pressures, but these were not required to be recorded.

Other action items identified in Condition Report 95-9104 included establishing procedural clarification to permit monitoring of inner and outer gate seal integrity, and the development and implementation of preventive maintenance and/or inspection requirements (including acceptance criteria). The action items also addressed the establishment of periodicity for maintenance/inspections based on consideration of vendor recommendations and service conditions of the SFP. The licensee established a completion due date of October 7, 1995.

On August 15, 1995, licensee personnel initiated replacement of the degraded SFP-to-transfer canal inner seal under Work Order XF-2-200563. At that time, the transfer canal was flooded up. A replacement seal was acquired from the warehouse and inflated prior to installation. A leak of sufficient size was detected and the seal was discarded. A second replacement seal was acquired and it was inflated. There were no detectable leaks and the seal was installed. However, shortly after installation, an air leak developed around the air supply line. Service Request 337010 was initiated to repair the leak.

On September 13, integrity of the SFP-to-cask connecting channel outer gate seal in Unit 2 was tested, using Procedure OPOP07-FH-0001, "Spent Fuel Pool Gate Seal Operability Check," Revision 0. The test, which was observed by an inspector, involved pumping water from the spent fuel pool into the space between the inner and outer gates. As the level between the gates increased, air had to be vented from the inner seal to keep the seal internal pressure constant. No leakage was noted from the seal on the outer gate, but the outer gate was observed to move slightly as the seal compressed because of the weight of the water column between the gates. When the space between the seals was pumped back down, the outer gate appeared to return to the normal position, and the test was considered satisfactory.

It was noted that the pump was unable to drop the level between the gates below about 15.24 to 20.32 cm [6 to 8 in], therefore, a new bench mark of 15.24 to 20.32 cm [6 to 8 in] of water between the gates will be established for the reactor plant operators. At the time of this inspection, a temporary log was being maintained that required checking of the area between the seals every shift. This should insure that leakage past of the inner seal will not go unnoticed.

Licensee personnel informed the inspectors that a similar test will be performed on the Unit 1 SFP-to-cask connecting channel prior to the refueling outage in the spring of 1996.

4.1 Conclusions

The inspectors concluded that sensitivity for potential gate seal failure was not adequate, and maintenance was allowed on the outer gate seal when the inner gate seal was exhibiting a deficiency which had not been evaluated to ensure it was still performing its function. This, is part, contributed to the incident. However, once the incident was initiated, licensee personnel responded well. The licensee's engineering assessment of the event, which the inspectors considered to be very insightful and thorough, appeared to properly identify the causes and the appropriate corrective actions. The inspectors did not identify any regulatory or safety issues; however, weaknesses were identified regarding: (1) the manner in which preventive maintenance and inspection actions identified by engineering were handled, (2) the use of

training materials that had not been verified for accuracy, and which resulted in the dissemination of incorrect nonsafety-related information to plant operators, and (3) the nonconservative approach taken with respect to not including the cask pool area associated drain and pumping system in the valve lineup procedures and as-built drawings.

ATTACHMENT

Persons Contacted and Exit Meeting

1 PERSONS CONTACTED

1.1 Licensee Personnel

*T. Cloninger, Vice President, Nuclear Engineering
*J. Cook, Supervisor, NSSS System Engineering
*R. Dunn, Supervisor, Reactor Engineering
*S. Head, Supervisor, Licensing Compliance
*K. House, Staff Engineer
*D. Schulker, Compliance Engineer
*S. Thomas, Manager, Design Engineering Department
*H. Vann Weldon, Project Manager

1.3 NRC Personnel

*D. Powers, Chief, Maintenance Branch, Division of Reactor Safety

In addition to the personnel listed above, the inspectors contacted other personnel during this inspection period.

* Denotes personnel that attended the exit meeting.

2 EXIT MEETING

An exit meeting was conducted by telephone on September 14, 1995. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee did not express a position on the inspection findings documented in this report. The licensee did not identify as proprietary any information provided to, or reviewed by, the inspectors.