July 15, 2003

LICENSEE: South Texas Project Nuclear Operating Company

FACILITY: South Texas Project, Unit 1

SUBJECT: SUMMARY OF SECOND MEETING WITH STPNOC REGARDING SOUTH TEXAS PROJECT, UNIT 1 REACTOR VESSEL AND BOTTOM MOUNTED INSTRUMENTATION PENETRATION INTERFACE LEAKAGE

On June 5, 2003, STP Nuclear Operating Company (STPNOC), the licensee for South Texas Project (STP), Units 1 and 2, met with the U.S. Nuclear Regulatory Commission (NRC) staff at the NRC Headquarters. The purpose of the meeting was for STPNOC to brief the NRC staff and management regarding STPNOC's continuing efforts to address the issues arising from the April 12, 2003, discoveries of indications of leakage from the STP, Unit 1, bottom mounted instrument (BMI) penetrations 1 and 46. There are 58 BMI penetrations at STP, Unit 1.

Enclosure 1 contains the licensee's presentation view-graphs. A list of meeting attendees is included as Enclosure 2.

The STPNOC outlined its desired meeting outcomes to keep NRC fully informed; and to explain the nondestructive examination (NDE) results, future NDE activities and testing, and supporting analyses and schedules. The STPNOC provided answers to NRC questions and understood the future NRC needs for information. The STPNOC summarized that the BMI penetration 1 had 150 mg of residue due to leakage. Penetration 46 had 3 mg of residue due to leakage. The licensee stated that it had completed NDE inside the vessel, selected vendor, commenced design of and preparation for half nozzle repair. The licensee has also established a root cause investigation team using the Electric Power Research Institute (EPRI) Material Reliability Program (MRP) failure modes and effects analysis technique.

Ultrasonic Testing (UT) and Eddy Current Testing results showed small axial cracks in BMI penetrations 1 and 46, confirming the leakage pathway. The licensee did not find any cracks in other penetration tubes that were inspected. The licensee did not find any surface breaking indications in any J-groove welds.

Future planned activities will include additional inspections, design and repair activities, sample removal and analysis, NRC reviews of documents submitted for approval, and analyses of the root and probable cause(s).

The licensee stated that it was pursuing a deliberate and careful process, the NDE campaign has been successful, the condition and the scope of the needed repair are known, and the completion of repairs will enable return to safe operation. Close cooperation with industry and the NRC on cause analysis will continue.

NDE Activities

The licensee stated that its approach to BMI leakage evaluation objectives follows the EPRI MRP control rod drive mechanism approach, consisting of identification of the relevant flaw mechanisms, defining inspection locations and volumes, and defining the range of flaws that

need to be addressed. The licensee designed and procured a mockup to aid the examination process. The licensee will demonstrate that the protocol and schedule of activities will ensure that the NDE objectives of identifying relevant flaw mechanisms, defining inspection locations and volumes, and defining the range of flaws that need to be addressed, are met.

Based on the inspections performed thus far, the licensee listed the results of its findings as follows:

Penetration 1

- Three axial indications, one leak path
- Flaw 1 is approximately 1-3/8" in length and extends $\sim$ 1/16" above the weld to $\sim$ 1/4" below the weld
- No crack-like indications on J-groove weld
- Visual Grinding marks on the sides of the tubes.

Penetration 46

-Two axial indications, one leak path
- No crack indications on the J-groove weld

The licensee confirmed its findings by bobbin coil eddy current examination of penetration inside diameter (ID), and array coil eddy current examination of J-groove weld. Additional confirmatory inspections and tests will include phased array UT of wastage, rod test, helium bubble test, profilometry, visual of tube ID, metallurgical sample, and boat sample.

Cause Analysis and Status

The licensee summarized the findings as follows:

- Residue on two nozzles
- Total of five flaws in two nozzles
- One flaw in each nozzle provides a leak path
- Three embedded flaws
- Presence of discontinuities at the tube to weld interface for numerous penetrations
- Grinding marks
- No flaws in other 55 nozzles (penetration 31 has stuck thimble)
- No evidence of circumferential cracks
- No evidence of ID initiated cracks

The licensee deduced the most likely causes to be

- Residual fabrication stresses
- Lack of J-groove weld fusion to nozzle outside diameter
- Weld cracking; fabrication defects; contaminants
- Combination of one or more causes with primary water stress corrosion cracking

Repair Plans

The licensee outlined its repair plans for the “half-nozzle repair” option, as shown in the schematic illustrations (pages 73-82) in Enclosure 1. This method consists of cutting the guide

tube and deploying a plug. This is followed by inspection for any leaks. The nozzle is then cut flush with the bottom head surface. A weld pad is then placed on the vessel head and the nozzle tube is then machine bored and weld prepared. The new nozzle is then installed in the nozzle bore, ensuring adequate gap between it and the old tube, to allow for differential expansion during operation. The plug is then removed.

The licensee performed analyses of residual stresses and limiting flaw, crack growth rates, corrosion, and stress and fatigue.

Based on the evaluations so far, the licensee has concluded that repair and startup can be safely accomplished. Severe consequences such as a small break loss of coolant accident are not likely due to axial crack indications and no circumferential crack indications, and there is no evidence of vessel wastage. There is no significant likelihood of loose parts hazards because there are no flaws above the weld, no circumferential flaws, and residual stresses would favor axial crack orientation.

Corrosion Studies

The licensee also discussed the results of its half-nozzle replacement corrosion studies for the small gap between alloy 600 remnant tube and the new alloy 690 nozzle, and carbon steel in the annulus region exposed to primary coolant. Based on those studies, the licensee concluded that the corrosion rates are generally acceptable for STP, Unit 1.

Concluding Remarks

The licensee also summarized the schedule of deliverables. The licensee stated that it planned to continue its close cooperation with the industry and the NRC on cause analysis.

The licensee completed its presentation by concluding that the NDE effort was successful, condition and repair scope are known, and repairs will enable STP, Unit 1 to return to safe operation.

The public was offered an opportunity to ask questions or to provide comments. There were no questions or comments from the public. The meeting was then adjourned.

***/RA/***

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Office of Nuclear Reactor Regulation

Docket No. 50-498

Enclosures: 1. View-graphs (ADAMS Accession No.: ML031920229)
2. List of Attendees

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Based on the evaluations so far, the licensee has concluded that repair and startup can be safely accomplished. Severe consequences are not likely, small break loss of coolant accident will have minimal impact due to axial crack indications and no circumferential crack indications, and there is no evidence of vessel wastage. There is no significant likelihood of loose parts hazards because there are no flaws above the weld, no circumferential flaws, and residual stresses would favor axial crack orientation.

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ON JUNE 5, 2003

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