UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
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ATLANTA, GEORGIA 30303-8931

July 21, 2003

Tennessee Valley Authority
ATTN: Mr. J. A. Scalice
Chief Nuclear Officer and
Executive Vice President
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: SEQUOYAH NUCLEAR POWER PLANT - NRC SUPPLEMENTAL INSPECTION REPORT NO. 05000328/2003008

Dear Mr. Scalice:

By letter dated January 21, 2003, you were informed that the Nuclear Regulatory Commission (NRC) would conduct a supplemental inspection at your Sequoyah Nuclear Power Plant for a White Performance Indicator (PI) in the Initiating Events Cornerstone for Unit 2. On June 27, 2003, the NRC completed this supplemental inspection. The enclosed report documents the inspection results that were discussed with Mr. Mike Lorek and other members of your staff on July 8, 2003.

The purpose of this supplemental inspection was to examine your problem identification, root cause and extent-of-condition evaluation, and corrective actions associated with the White PI. The PI had crossed the threshold from green to white for Unit 2 Unplanned Scrams per 7,000 Critical Hours for the fourth quarter of calender year 2002. The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel associated with your response to the PI.

Based on the results of this inspection, the NRC determined that the problem identification, root cause and extent of condition evaluation, and corrective actions for the White PI were thorough.

No findings of significance were identified during this inspection.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams/index.html (the Public Electronic Reading Room).

Should you have any questions concerning this letter or this report, please contact us.

Sincerely,

/RA/

Stephen J. Cahill, Chief,
Reactor Projects Branch 6
Division of Reactor Projects

Docket No. 50-328
License No. DPR-79

Enclosure: NRC Inspection Report 05000328/2003008
w/Attachment

cc w/encl: (See page 3)

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No:	50-328
License No:	DPR-79
Report No:	05000328/2003008
Licensee:	Tennessee Valley Authority (TVA)
Facility:	Sequoyah Nuclear Plant, Unit 2
Location:	Sequoyah Access Road Soddy-Daisy, TN 37379
Dates:	March 18, 2003 - June 27, 2003
Inspector:	S. Freeman, Senior Resident Inspector, Sequoyah Nuclear Plant
Approved by:	Stephen J. Cahill, Chief Reactor Projects Branch 6 Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000328/2003-008; 3/18/2003 to 6/27/2003; Sequoyah Nuclear Power Plant, Unit 2; Supplemental Inspection IP 95001 for a White Performance Indicator in the Initiating Events Cornerstone.

This inspection was conducted by a senior resident inspector. No findings of significance were identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, Reactor Oversight Process, Revision 3, dated July 2000.

Cornerstone: Initiating Events

This supplemental inspection was conducted to assess the licensee's evaluation associated with a White Performance Indicator (PI) in the Initiating Events Cornerstone. The Unit 2 Unplanned Scrams per 7,000 Critical Hours PI crossed the threshold from green to white for the fourth quarter of calender year 2002. Specifically, the licensee experienced four reactor trips during the last three quarters of 2002. The first reactor trip, which occurred on May 19, 2002, was a manual trip during low power physics testing when portions of two banks of control rods would not move in the presence of a slightly increasing reactivity trend. The second reactor trip, which occurred on May 31, 2002, was an automatic trip from approximately 71 percent power caused by a valve failure on the stator cooling system heat exchanger. The third reactor trip, which occurred on July 12, 2002, was an automatic trip from approximately 100 percent reactor power caused by a loss of one start bus when the alternate supply breaker closed while being racked to the test position. The fourth reactor trip, which occurred on December 26, 2002, was an automatic trip from approximately 100 percent reactor power caused by an over-current condition on a reactor coolant pump.

During this supplemental inspection, performed in accordance with NRC Inspection Procedure 95001, the inspector determined that the licensee performed a comprehensive evaluation of the four reactor trips leading up to the White Performance Indicator. The licensee expanded the scope of the evaluation to include 10 other reactor trips in the previous five years plus several other events that involved a forced outage or could have resulted in a reactor trip. The licensee's evaluation identified 13 common causes associated with the expanded scope of events. These causes included human performance and process issues as well as equipment issues. The licensee has developed a corrective action plan that addressed these causes, including the development of a trip-sensitive equipment list and an equipment reliability improvement plan. The licensee has begun appropriate implementation of the corrective actions.

Based on the results of this inspection, the NRC determined that the problem identification, root cause and extent of condition evaluations, and corrective actions for the White PI were thorough. Implementation of the licensee's corrective actions will be reviewed during future inspections.

Report Details

01 INSPECTION SCOPE

The purpose of this supplemental inspection was to assess the licensee's evaluation associated with a White Performance Indicator (PI) in the Initiating Events Cornerstone of the Reactor Safety strategic performance area. The Unit 2 Unplanned Scrams per 7,000 critical hours PI crossed the threshold from green to white for the fourth quarter of calender year 2002. Specifically, the licensee experienced four reactor trips during the last three quarters of 2002. The first reactor trip, which occurred on May 19, 2002, was a manual trip during low power physics testing when Group 2 of Shutdown Bank B and Control Bank D control rods would not move in the presence of a slightly increasing reactivity trend. The second reactor trip, which occurred on May 31, 2002, was an automatic trip from approximately 71 percent power caused by a failure on the raw cooling water inlet valve to the stator cooling system heat exchanger. The third reactor trip, which occurred on July 12, 2002, was an automatic trip from approximately 100 percent reactor power caused by a loss of one start bus when the alternate supply breaker closed while being racked to the test position. The fourth reactor trip, which occurred on December 26, 2002, was an automatic trip from approximately 100 percent reactor power caused by an over-current trip of Reactor Coolant Pump (RCP) No. 3.

This supplemental inspection was conducted in accordance with the requirements of NRC Inspection Procedure (IP) 95001. Consequently, the following report details are organized by the specific inspection requirements of IP 95001, which are noted in italics.

02 EVALUATION OF INSPECTION REQUIREMENTS

02.01 *Problem Identification*

a. *Determination of who (i.e., licensee, self revealing, or NRC), identified the issue and under what conditions*

The four reactor trips were self-revealing events that occurred during the course of normal operational conditions. The May 19, 2002, trip occurred during the process of unit startup following a planned refueling outage. Plant operators manually tripped the reactor when Group 2 of Control Bank D control rods would not respond to insert commands. Prior to Control Bank D, the operators had attempted to insert Shutdown Bank B. Group 2 of that bank did not move which resulted in a slightly increasing reactivity.

The May 31, 2002, trip occurred during power ascension following a planned refueling outage. Stator cooling temperature began to increase after the main generator was put on line. The main turbine tripped on stator cooling failure as operators were attempting to ensure proper cooling flow to the stator cooling system. The turbine trip caused the reactor to trip.

The July 12, 2002, trip occurred when two RCPs experienced an undervoltage condition due to the loss of Start Bus 2B. The start bus was lost when the alternate feeder breaker attempted to close while being racked to the connect position. Due to interlocks, the normal feeder breaker tripped open, resulting in no supply to Start Bus 2B.

The December 26, 2002, trip occurred when the No.3 RCP tripped because of an over-current condition on the motor.

b. *Determination of how long the issue existed, and prior opportunities for identification*

The licensee performed a detailed analysis of 14 reactor trips in the previous five years plus several other events that involved a forced outage or could have resulted in a reactor trip. The analysis involved reviewing the associated Problem Evaluation Reports (PERs) and answering several questions. Two of the questions discussed prior opportunities, one concerning whether or not the event could have been avoided and another determining whether or not the PER adequately addressed previous events.

The licensee concluded that two of the trips that resulted in the White PI were avoidable, and therefore that they did have prior opportunities for identification. The May 31, 2002, trip was caused by the failure of a manual valve in the raw cooling water supply to the stator cooling heat exchanger. The valve stuck closed due to seat swelling and binding. This trip was avoidable if a root cause analysis had been performed on similar raw cooling water valve failures in 2000. Those valves were repaired under a work order but no PER was written. The July 12, 2002, trip was caused by improper assembly of the operating mechanism of the alternate feeder breaker during refurbishment. This trip was avoidable if receipt inspection had identified the improper assembly or a previous occurrence of the breaker improperly closing had been communicated to the shift manager.

The licensee believes that the remaining two trips were unavoidable; the May 19, 2002, trip because of the intermittent nature of the problem and the December 26, 2002, trip because of equipment failure that occurred at or near the time of the trip. Prior opportunities for identification for these trips was therefore limited. The inspector determined the licensee's evaluation was appropriate.

c. *Determination of the plant-specific risk consequences (as applicable) and compliance concerns associated with the issue*

The licensee performed a beyesian update analysis on the four reactor trips, plus two more that occurred after the performance indicator crossed the white threshold, and concluded that the change in core damage frequency was less than 1.0E-6 and that the change in Large Early Release Frequency (LERF) was less than 1.0E-7.

The inspector reviewed the licensee's evaluation and assumptions and discussed them with an NRC senior risk analyst, who concluded the results were reasonable. However, the inspector noted that this beyesian analysis was not originally included in the licensee's analysis. It was added as a result of inspector questioning. Compliance issues were appropriately discussed in the associated Licensee Event Reports (LERs).

02.02 *Root Cause, Extent of Condition, and Extent of Cause Evaluation*

a. *Evaluation of method(s) used to identify root cause(s) and contributing cause(s)*

The licensee used the Performance Improvement International (PII) guidance for a mini-common cause for 10-15 events and guidance from TVAN Business Practice BP-250, Corrective Action Program Handbook, Revision 0. This document included several root cause tools including PII, Kepnor-Tregoe, and barrier analysis. The licensee evaluated the associated PERs for 14 reactor trips plus several other events to ensure that the root and contributing causes were identified and adequate corrective actions were developed. If any cause affected more than three events, the licensee evaluated that cause as a common cause for all the events. This resulted in a list of 13 common causes. The inspector concluded that this method systematically determined the common causes and considered the various hardware, process, and human performance issues that resulted in the four reactor trips.

b. *Level of detail of the root cause evaluation*

In performing the cause analysis for the 14 reactor trips and other events over the previous five years, the licensee evaluated each event by answering nine broad questions. These questions addressed areas such as: root cause, contributing causes, extent of condition, previous similar events, proper corrective actions, and effectiveness of corrective actions. The inspector reviewed the nine questions and determined that the questions addressed causes within licensee control; thoroughly explored all possible causes, including people and process causes; and examined whether or not corrective actions were adequate to prevent recurrence.

c. *Consideration of prior occurrences of the problem and knowledge of prior operating experience*

The licensee analysis for the 14 reactor trips and other events over the previous five years did take into account previous similar events and whether or not operating experience or vendor recommendations would have prevented any given event. The licensee determined that the reactor trip of July 12, 2002, could have been prevented had the Operations Shift Manager been aware of previous problems with the start bus alternate supply breaker. The inspector determined that the analysis broadly questioned the applicability of similar events, assessed the appropriateness of previous root cause analyses, and reviewed prior documentation of problems.

d. *Consideration of extent of condition and extent of cause of the problem*

The main purpose of the licensee analysis for the 14 reactor trips and other events over the previous five years was to determine the extent to which causes were common among the events. In evaluating the causes of each event, if any cause affected more than three events, the licensee evaluated that cause as a common cause for all the events. This resulted in a list of 13 common causes. The inspector determined that the analysis did consider extent of condition and the applicability of root causes across disciplines, different programmatic activities, human performance, and different types of equipment.

02.03 *Corrective Actions*

a. *Appropriateness of corrective action(s)*

The licensee identified 24 corrective actions to address the common causes of the 14 reactor trips and other events over the previous five years. An attachment to the analysis assigned one or more corrective actions to each common cause. One prevailing theme of these corrective actions was the development of a trip-sensitive components list and the use of that list at the site. The inspector determined that the corrective actions were clearly defined and did not create new or different problems.

b. *Prioritization of corrective actions*

Corrective actions for the four reactor trips were properly prioritized. The inspector determined that the prevailing theme of developing a trip-sensitive component list was consistent with the licensee's risk assessment of the four reactor trips.

c. *Establishment of a schedule for implementing and completing the corrective actions*

The licensee designated an accountable individual and due date for each corrective action identified by the licensee analysis for the 14 reactor trips and other events. These actions were listed in PER 02-015571-000. The inspector reviewed the corrective actions and the PER and noted that the actions listed in the analysis matched those in the PER, except for some minor differences.

d. *Establishment of quantitative or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence*

One corrective action in the licensee analysis of the 14 reactor trips and other events was to perform an effectiveness review six months following the completion of the corrective actions. Another corrective action was generated to add a requirement for effectiveness reviews to the administrative procedure that governed the corrective action program. This requirement would apply to all top level PERs in the licensee's programs.

03 MANAGEMENT MEETINGS

Exit Meeting Summary

The inspector presented the inspection results to Mr. Mike Lorek and other members of licensee management at the conclusion of the inspection on July 8, 2003. The inspector confirmed that proprietary information was not provided or examined during the inspection.

These issues were discussed further during a meeting on July 15, 2003 at the Sequoyah site between Mr. Rick Purcell, Site Vice President of the Sequoyah Nuclear Plant, and Mr. Stephen Cahill, Chief, Reactor Projects Branch 6 of the NRC Region II office. This constituted the Regulatory Performance Meeting required per the NRC Action Matrix (contained in NRC Manual Chapter 305, Operating Reactor Assessment Program) for a licensee in the Regulatory Response Column. As discussed in the NRC Annual Assessment Letter dated March 4, 2003, Sequoyah Unit 2 is in the Regulatory Response Column due to the White PI that was the subject of this inspection.

SUPPLEMENTARY INFORMATION

A. Persons Contacted

Licensee Personnel

J. Bajraszewski, Licensing Engineer
G. Buchanan, Supervisor, Component Engineering
T. Carson, Maintenance and Modifications Manager
E. Freeman, Operations Manager
C. Kent, Radcon/Chemistry Manager
D. Koehl, Plant Manager
M. Lorek, Assistant Plant Manager
D. Lundy, Site Engineering Manager
R. Proffitt, Nuclear Engineering, Licensing Specialist
R. Purcell, Site Vice President
P. Salas, Licensing and Industry Affairs Manager
J. Smith, Site Licensing Supervisor
K. Stephens, Security Manager
J. Vincelli, Superintendent, Radiation Control

NRC personnel:

R. Bernhard, Region II Senior Reactor Analyst

B. Items Opened, Closed, and Discussed

Opened

None

Opened and Closed

None

Closed

None

C. List of Documents Reviewed

PER 02-015571-000, Unplanned Reactor Trip on Unit 2 Causes Performance Indicator to exceed the white threshold

Attachment

May 19, 2002, Reactor Trip

LER 50-328/2002-002-00, Manual Reactor Trip Resulting From the Failure of Control Rods to Respond

PER 02-005600-000, Unit 2 Reactor Manually Tripped Due to Inability to Move Shutdown Bank B and Control Bank D

May 31, 2002, Reactor Trip

LER 50-328/2002-003-00, Automatic Reactor Trip Resulting from a Generator Stator Cooling Water High Temperature Caused by a Raw Cooling Water Valve Failure

PER 02-006086-000, Unit 2 Turbine and Reactor Trip From a Stator Cooling Water System Failure

PER 02-006114-000, Stator Cooling Water Valve 2-VLV-024-0531 Disc Cracked on Both Sides of Valve Post

PER 01-005036-000, Pratt Butterfly Valve Issues

July 12, 2002, Reactor Trip

LER 50-327/2002-002-00, Automatic Reactor Trip Resulting From a Failure of a Breaker Causing an Undervoltage Condition on Two Reactor Coolant Pumps and Failure to Perform a Technical Specification Required Action

PER 02-008460-000, Unit 2 Reactor Trip Caused by Inadvertent Closure of Breaker 1412

PER 02-008493-000, Offsite Power not Demonstrated Operable Within One Hour Following Loss of Start Bus 2B

December 26, 2002, Reactor Trip

LER 50-328/2002-004-00, Reactor Trip Resulting From the Loss of a Reactor Coolant Pump

PER 02-015494, Unit 2 Reactor Trip on December 26, 2002

PER 03-000190, Root Cause Analysis for the Unit 2, Number 3 Reactor Coolant Pump Motor Failure