Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379

Jack L. Wilson
Vice President, Sequoyah Nuclear Plant

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - UNITS 1 AND 2 - EAGLE 21 SIX-MONTH REPORT

References:
1. TVA letter to NRC dated January 18, 1991, "Sequoyah Nuclear Plant (SQN) - Unit 1 - Eagle 21 Six-Month Report"
2. NRC letter to TVA dated October 31, 1990, "Reactor Protection System Upgrades and Enhancements (TAC 75844) (TS 89-27) - Sequoyah Nuclear Plant, Unit 2"
3. TVA letter to NRC dated May 10, 1990, "Sequoyah Nuclear Plant (SQN) - Eagle 21 Functional Upgrade Commitments"

In Reference 3, TVA committed to submit periodic reports at approximately six-month intervals describing design hardware, design software, and maintenance problems encountered with the Eagle 21 reactor protection system during Unit 1 Cycle 5 operation. The information in Enclosure 1 provides the last of three reports and completes the Unit 1 commitment. This report covers the period from June 11 to December 12, 1991.

By Reference 2, TVA is committed to provide the same information during Unit 2 Cycle 5 operation at approximately six-month intervals. The information in Enclosure 2 provides the second of three reports to meet this commitment. This report covers the period from June 11 to December 12, 1991.

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Please note that the summary report discussed in Reference 1 in regard to a review of changes to the original Eagle 21 technical specification changes will not be provided. As discussed with NRC staff, this summary report is no longer needed since previous submittals have adequately covered this topic.

If you have any questions concerning the enclosed information, please contact Keith C. Weller at (615) 843-7527.

Sincerely,

J. L. Wilson

Enclosures
cc (Enclosures):
Mr. D. E. LaBarge, Project Manager
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852

NRC Resident Inspector
Sequoyah Nuclear Plant
2600 Igou Ferry Road
Soddy Daisy, Tennessee 37379

Mr. B. A. Wilson, Project Chief
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

ENCLOSURE 1

SEQUOYAH NUCLEAR PLANT (SQN)
EAGLE 21 UNIT 1
EQUIPMENT/SYSTEM FAILURES AND PROBLEMS
FROM JUNE 11 TO DECEMBER 12, 1991

Item 1

On June 18, 1991, the 15/MULT power supply in Rack 1-R-12 was identified with a high alternating-current ripple and degraded voltage.

Action Taken: The degraded condition was identified during the weekly performance of a preventive maintenance instruction that was written to provide early detection of failed input filtering capacitors. This power supply that supplied the tester subsystem of the MULTIBUS was replaced before the test sequence processor (TSP) went into an error handling state. The root cause of the failure was due to corroded leads on the input filtering capacitors made by Mepco/Centralab. This root cause is the same as that identified in the July 10, 1991, six-month report from TVA to NRC in that the capacitor lead opened due to internal chloride corrosion. This was the last power supply degradation and/or failure of this type on Unit 1 as the MULT/15 and 15/MULT power supplies with Mepco/Centralab input filtering capacitors have had the capacitor replacements completed with those of an acceptable vendor.

Item 2

During a routine channel calibration on December 12, 1991, in Rack 1-R-8, it was discovered that the calibration input signal for a steam generator level channel did not properly respond; therefore, causing the automatic surveillance for that channel to fail.

Action Taken: The routine channel calibration was being performed during the Unit 1 [illegible] refueling outage. Troubleshooting within the rack identified an intermittent failure (i.e., loose connection) on the lead signal injection response (SIR) bus from the front tester panel to the first input/output (I/O) circuit card in termination frame one. The lead SIR bus was subsequently replaced. The SIR bus is basically a ribbon cable that injects surveillance inputs from the high precision digital to analog converters to the input circuit boards and is only required for surveillance testing. No impact to Eagle 21 safety functions was or could be created by this failure.

Item 3

The following Eagle 21 description of work was not a result of an Eagle 21 failure.

Description: As a result of a 10 CFR Part 21 notification by the vendor (Westinghouse Electric Corporation), all the Unit 1 Eagle analog input, Eagle resistance input, and Eagle partial trip circuit boards were removed from the racks and inspected to determine the date of production of the component in question. The

10 CFR Part 21 notification involved a Burr-Brown direct-current to direct-current (dc/dc) converter that was environmentally qualified by Westinghouse. Approximately 97 of the I/O circuit boards inspected had dc/dc converters that required replacement because of the date of production. All the Unit 1 circuit boards have had the potentially bad dc/dc converters replaced during the Unit 1 Cycle 5 outage. This design concern was identified just after SQN Unit 1 start-up and the Eagle 21 installation. This concern was documented in the first Unit 1 Six-Month Report from TVA to NRC dated January 18, 1991, for the period of June 17 through December 16, 1990. The 10 CFR Part 21 notification was issued just before SQN Unit 2 installation and was, therefore, corrected by Westinghouse before Unit 2 start-up.

Update

Eagle 21 problems with lockups of ISP and loop calculation processors because of timing deficiencies have become nonexistent following the replacement of the clock generators. Eagle 21 problems with power supplies, software, and dc/dc converters have also been corrected. The remaining failures, which have been seen during the Unit 1 Cycle 5 operation, are considered random failures with no apparent generic implications.

ENCLOSURE 2

SEQUOYAH NUCLEAR PLANT (SQN)
EAGLE 21 UNIT 2
EQUIPMENT/SYSTEM FAILURES AND PROBLEMS
FROM JUNE 11 TO DECEMBER 12, 1991

Item 1

A test sequence processor (TSP) in Rack 2-R-3 experienced a lock-up on July 15, 1991.

Action Taken: The TSP was reset and returned to service. This TSP had not yet been upgraded to the new Intel Corporation microprocessor. As identified in the previous six-month report from TVA to NRC dated July 10, 1991, Westinghouse Electric Corporation and Intel identified, with a high degree of confidence, that the cause of the lock-ups was attributed to the Intel 82284 clock generator and that replacing the Intel clock generator with a Seimons model should eliminate the lock-ups. The Unit 2 loop calculation processors and TSPs were changed out as of July 21, 1991, and since that time there have been no lock-ups.

Item 2

During a channel functional test of a steam generator (S/G) level environmental allowance modifier and trip time delay channel in Rack 2-R-11 on August 14, 1991, all four S/G level signals went offscale high.

Action Taken: Before the surveillance testing and through the first automatic channel accuracy testing, all four channels were operating properly. A second automatic channel accuracy test was performed by instrument technicians to minimize analog to digital inaccuracies to near zero. It was during this second automatic surveillance test that all four channels failed upscale high. As all four S/G level channels are processed through an Eagle analog input (EAI) circuit board in termination frame four, it is suspected that a failure of this board was the cause. The EAI board was replaced and the channels were returned to service. The cause of the board failure is unknown, but a root-cause evaluation is in progress. It does not appear that the EAI board failure was intermittent; therefore, it is unlikely that it failed before the removal from service for the surveillance test. No further problems have been experienced.

Item 3

During a channel functional test of a delta temperature and temperature average channel in Rack 2-R-6 on August 19, 1991, the TSP reported an error message, "Failure to Set Injection Relay NY-421B1."

Action Taken: The injection relays on the Eagle 21 input circuit boards are used to change the input from the normal process signal to the surveillance signals. At the beginning of the functional test, the injection relay for a nuclear instrumentation system (NIS) input either failed to change state or the microcontroller

subsystem on the circuit board that processes the signal for the injection relay failed. The surveillance test was aborted, and NIS process inputs were verified to be operating normally through dynamic analog test points. The Eagle resistance input circuit board in termination frame four that contains the injection relay and microcontroller subsystem was replaced. The channel functional test was reperformed and verified the channel to be operating properly. The cause of the board failure is presently unknown, but a failure analysis will be performed.

Item 4

During normal operation, several main control room annunciations were received, and indicators went downscale low on channels located in Rack 2-R-3 on October 9, 1991. The incident occurred for about ten minutes and then all channels returned to normal.

Action Taken: A few minutes after the channels returned to normal, the rack was checked for obvious degradations including possible loose connections. The power supply was checked both for drift and alternating-current ripple, but nothing was found. All indications and measurements, including the tester subsystem diagnostic routines, identified there were no problems. An action plan was developed to have a quick response of technicians on next occurrence, and planning was initiated to replace the Eagle 21 digital filter processor (DFP). The DFP is basically the analog to the digital converter for the rack. The next event took place early in the morning on October 22, 1991, at which time technicians were able to observe that the +12-volt, direct-current (VDC) light emitting diode (LED) was not lit. The 12 VDC LED returned to normal when the technicians closed the rack door. The MULT/15 power supply was replaced and sent to the vendor for a postmortem evaluation of the intermittent failure. To date, Westinghouse has been unable to recreate failure of the +12-volt (V) power supply.

Item 5

During routine preventive maintenance monitoring of the Eagle 21 power supplies on November 21, 1991, the 15-VDC "B" power supply in Rack 2-R-11 was found with a voltage ripple of approximately 46-milivolt alternating current (mVAC).

Action Taken: The acceptance criteria for the 15-V supplies are less than 35 mVAC. The 15-VDC "B" supply is located in the 15/MULT power supply drawer and is not normally used unless there is a failure in the primary 15-V supply. This high ripple does not appear to be indicative of an input filtering capacitor failure. For an input filtering capacitor failure, the ripple typically would rise to at least 200 mVAC. Also, the input filtering capacitor failures, as seen in the past, occurred on only highly loaded supplies. The power supply has been replaced and is being sent to Westinghouse for a failure analysis.