UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report Nos.: 50-327/94-38 and 50-328/94-38

Licensee: Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Docket Nos.: 50-327 and 50-328 License Nos.: DPR-77 and DPR-79

Facility Name: Sequoyah Nuclear Plant Units 1 and 2

Inspection Conducted: October 25 through 28, 1994

Inspector: S. Rudisail 11/23/94
S. Rudisail Date Signed

Approved by: M. Shymlock 11-23-94
M. Shymlock, Chief Date Signed
Plant Systems Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This routine, announced inspection was conducted to review the following potential restart issues for Unit 2. Essential Raw Cooling Water (ERCW) cable for ERCW pump K-A had failed during a routine Hi-pot test. The corrective action for this cable failure was reviewed. Arrow-Hart motor starter contact failures were also reviewed.

Results:

In the areas inspected, violations or deviations were not identified. The inspector determined the corrective actions for the cable failure and the present cable monitoring program were adequate. The corrective action for the Arrow-Hart motor starters was on-going at the completion of this inspection. The resident inspectors were continuing to follow this issue.

REPORT DETAILS

1. Persons Contacted

*J. Bajraszewski, Licensing Engineer
*D. Brock, Maintenance Manager
*L. Bryant, Outage Manager
*M. Burzynski, Engineering and Materials Manager
*C. Butcher, Nuclear Engineering, Electrical
*R. Collins, Nuclear Engineering
*M. Cooper, Technical Support Manager
*R. Driscoll, Nuclear Assurance and Licensing Manager
*F. Fink, Business and Work Performance Manager
*T. Flippo, Site Support Manager
*K. Meade, Compliance Licensing Manager, Acting
*L. Poage, Manager Quality Assurance
*R. Rausch, Maintenance and Modifications Manager
*O. Zeringue, Vice-president, Operations

Other licensee employees contacted during this inspection included craftsmen, engineers, technicians, and administrative personnel.

NRC Employees

*W. Holland, Senior Resident Inspector
*D. Starkey, Resident Inspector
*M. Shymlock, Region II, Section Chief, Plant Systems Section
S. Schaeffer, Resident Inspector

2. ERCW Cable Failure and Replacement (IP 92701)

During DC hi-pot testing in May 1994, one phase of a 3800 foot 8 kV, 2/0 AWG cable failed. The cable that failed was installed in an underground duct bank between the power house and the ERCW Pumping Station. The failed cable supplied one phase of the 6.9 kV AC power to one of four train A ERCW pump motors. The conductor that failed faulted between 5000 and 6000 VDC as the voltage was being increased to perform a DC hi-pot test of the motor to which the cable was attached. These tests are limited by the motor to 13 kV. If any anomalies are identified during the test the cable is detached and tested to the maximum 29 kVDC. This is in accordance with IEEE Standard 400, IEEE Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field.

After the fault was detected the failed section was isolated by cutting sections of the cable at selected manholes and performing high voltage insulation resistance tests. The fault was isolated to a single-phase 340 foot long section between manhole MH321A1 and hand hole HH53A1.

All three phase cables were removed in the 340 foot long section and the cables replaced. The removed cable was inspected by the licensee for visual damage and none was identified. The fault location could not be identified by visual examination.

There are four ERCW pumps for each unit at Sequoyah. Two are required to be in operation continuously. The cables for the ERCW pumps were installed in 1979 during plant construction. Portions of the cable had been subject to long term immersion in water due to inadequate maintenance of sump pumping systems in the manholes and handholes.

The licensee shipped the failed cable to Altran Materials Engineering Inc. for fault location determination and probable cause identification. The inspector reviewed the report developed by the test laboratory, Altran Materials Engineering Inc. Technical Report 94341. The conclusions of this report were that the most likely cause of field test failure of the ERCW cable was the presence of water trees. Water trees are a breakdown of insulation caused by moisture intrusion. This results in a progressive treelike failure of the insulation which can eventually cause a complete breakthrough of the insulation.

The inspector reviewed the cable monitoring program in place at the Sequoyah Nuclear Station. The inspector reviewed a letter dated January 23, 1989 which detailed the cable monitoring program for low and medium voltage safety related cables. This monitoring program was initiated to address postulated cable failures due to bend radius concerns. However, this monitoring program had been used to address other cable issues such as manhole flooding which could have affected the operability of systems.

Maintenance Instruction 0-MI-EPM-317-102.0, Insulation Resistance Test of Cables and Motors was used to monitor the insulation resistance of the ERCW cables. This MI required an insulation resistance check for cables and consisted of meggering, high potential, and step voltage monitoring of the cables. Part of the monitoring program includes calculation of the polarization index. This requires measuring insulation resistance at one minute and ten minutes with the acceptance criteria for both readings being greater than 1 megohm. Polarization index is then calculated by dividing the ten minute reading into the one minute reading. The acceptance criteria for this calculation is greater than two. This acceptance criteria is defined in IEEE Standard 400.

After completion of the meggering and calculation of the polarization index, a DC high potential test and step voltage test was conducted. These tests are conducted by measuring leakage current as voltage is increased incrementally. A plot of voltage versus leakage current is made and analyzed. The results of these tests on the cable are reviewed

and trended by the cognizant system engineer. For the cable that failed, ERCW K-A, a lower polarization index was noted during the previous test and from the test which resulted in cable failure. However, the results during these tests were still above the acceptable limit.

The inspector considered the current cable monitoring program adequate to identify cable insulation resistance deterioration. The licensee plans to continue the normal scheduled testing program which requires a test of each ERCW cable every 18 months.

The inspector also reviewed the preventive maintenance schedule for these cables and found that the cable monitoring was being accomplished as committed.

The DCN for replacement of the failed section of the ERCW pump motor K-A was also reviewed. This DCN M10891A replaced the section of cable 299675A between manhole MH321A1 and hand hole HH53A1. Appropriate instruction and techniques were referenced in this DCN. Adequate post installation testing of the cable was accomplished.

3. Arrow-Hart Motor Starter Contactor Failures (IP 92701)

Prior to the start of this inspection, Problem Evaluation Report SQN940856PER was initiated after the failure of two valves to open. Valve 2-FCV-62-133 failed to re-open during response time testing on September 28, 1994 and valve 2-FCV-62-132 failed to open on October 22, 1994.

The problem was identified to be the Arrow-Hart motor starters which had a high resistance between the auxiliary contacts. At the completion of this inspection the licensee was still trying to determine the cause of the high resistance. Licensee actions at the time were adequate to address any restart issues for Unit 2 and the equipment operability for Unit 1.

Subsequent to the completion of this inspection, the licensee determined that the high resistance was caused by a buildup of non-conducting contaminants and corrosion products on the contacts. The licensee also identified a design weakness due to the lack of self cleaning action of the contacts during operation. Previous abrasive cleaning methods had damaged the silver contact surface and left non-conductive contaminants. Also, inadequate cleaning for previously identified lubrication residue was identified as a contributing factor to the high resistance problem. The licensee planned to conduct resistance measurement checks of all Arrow-Hart motor contacts and re-clean the contacts using a new process. The new cleaning process includes brushing of the springs to remove accumulated debris, removal of tarnish from the contacts with a silver polish, and an agitated rinse with isopropyl alcohol using ultrasound cleaners. These actions will be repeated each refueling outage until trending data indicates a change in frequency is warranted. The actions were considered acceptable for Unit 2 restart.

The licensee planned to review Maintenance Instruction 0-MI-EPM-317-040.0, Arrow-Hart Magnetic Contactor/Starter Maintenance. Revision of this procedure was being considered to ensure that appropriate maintenance of the subject equipment was being properly performed in view of the contact high resistance problem.

The inspector reviewed the initial evaluation of the operability determination for Unit 1 contacts. All safety related contacts resistance on Reactor MOV and EDG Auxiliary Boards were measured. Those contacts which had a resistance higher than the 1 ohm threshold were evaluated for their affect on equipment operation. The majority of the contacts identified with high resistance were spares, equipment administratively controlled with power removed, non-1E equipment, or in indicating light circuits. The other contacts with high resistance were analyzed for their impact on circuit operability and determined not to affect circuit operation. The inspector reviewed this evaluation and agreed that the operability determination for Unit 1 was adequate.

4. Exit Meeting (IP 30703)

The inspection scope and results were summarized on October 28, 1994, with those individuals indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection findings. There was no dissenting comments received from the licensee. Proprietary information is not contained in this report.

5. Acronyms and Abbreviations

AC	Alternating Current
AWG	American Wire Gage
DC	Direct Current
DCN	Design Change Notice
EDG	Emergency Diesel Generator
ERCW	Essential Raw Cooling water
FCV	Flow Control Valve
IEEE	Institute of Electrical and Electronic Engineers
kV	Kilovolts
MI	Maintenance Instruction
MOV	Motor Operated Valve
PER	Problem Evaluation Report
VDC	Volts-Direct Current