



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

Report Nos.: 50-280/89-12 and 50-281/89-12

Licensee: Virginia Electric and Power Company
Glen Allen, VA 23060

Docket Nos.: 50-280 and 50-281

License Nos.: DPR-32 and DPR-37

Facility Name: Surry 1 and 2

Inspection Conducted: April 10-14 and May 10-12, 1989

Inspector: For M. D. Hunt by A. B. Ruff 6/6/89
M. D. Hunt, Team Leader Date Signed

Team members: N. Merriweather, Reactor Inspector, RII
A. B. Ruff, Reactor Inspector, RII
J. R. Harris, Reactor Inspector, RII

Accompanying Personnel: T. E. Conlon, Section Chief, PSS, RII

Approved by: A. E. Woodson 6/6/89
T. E. Conlon, Section Chief Date Signed
Plant System Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This special announced inspection was in the areas of; followup on NRC Bulletin 88-01, "Defects in Westinghouse Circuit Breakers," repair and testing of inside and outside recirculation spray pump motors, breaker maintenance, NAMCO limit switches, separation of divisional cables, HFA Relays (NRC Bulletin 88-03), and followup on a previous inspection finding involving safety-related circuits.

Results:

There were no major weakness or strengths in the licensees programs or activities associated with areas covered by this inspection.

One violation was identified which involved cable tray covers not reinstalled after maintenance activities, paragraph 4. A record violation was identified by the licensee involving cable routing, but was not cited for reasons discussed in paragraph 4.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *W. R. Benthall, Surry Licensing Supervisor
- *K. S. Berger, Electrical Engineer
- *R. C. Bilyen, Licensing Engineer
- *R. W. Cross, Nuclear Specialist
- P. Doody, M.O.V. Project Leader
- *E. S. Grecheck, Assistant Station Manager
- *M. F. Haduck, Electrical Maintenance
- *D. S. Hart, Supervisor, Quality
- *C. D. Miller, Licensing Coordinator
- *J. W. Ogren, Maintenance
- *T. B. Sowers, Engineering
- *E. F. Watts, Electrical Engineer

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

NRC Resident Inspectors

- *W. Holland
- *L. E. Nicholson

- *Attended exit interview

2. Safety-Related Circuit Breakers

a. 4160 V Circuit Breakers and 480 V Electric Operated Circuit Breakers

On February 14, 1989, with the plant in cold shutdown, an event occurred at Surry Nuclear Power Station that is described in their LER 89-005. The event was caused when a non-safety-related 4160 volt circuit breaker failed to fully close in preparation for a special test (ST-241, Unit 1A Train Bus Deactivation Test). An investigation by the licensee showed that accumulation of dust and dirt in the mechanical operating mechanism of the circuit breaker prevented the breaker from closing fully. These breakers had been in service at the site since approximately 1972. One breaker counter showed the breaker had cycled 2,437 times. The other breaker cycles ranged from approximately 200 to 1,200 times.

The licensee had been doing regular preventive and corrective maintenance on the breakers but the breaker timing tests were not performed. These timing tests may have revealed the above pending problem if it had been performed and timing tests trended. The

licensee stated that the timing test would be incorporated in a future revision to the PM program. The licensee's PM program did not require lubrication of bearing or rolling surfaces. This was based on the manufacturer's Instruction Manual that stated this lubrication had been done at the factory during assembly and should not require any further lubrication during the life of the equipment. A later discussion with the manufacturer's representative indicated that these breakers should be cleaned up and refurbished.

The inspection, cleaning and testing of the safety-related 4160 volt circuit breakers are required to be completed before restart of the applicable plant (Unit 1 or 2). This has been included in Region II's Confirmation of Action Letter (CAL) dated March 9, 1989, to the licensee.

A review of the licensee's program to satisfy this CAL requirement was conducted and is considered satisfactory. All 4160 volt safety-related and non-safety-related circuit breakers and all 480 volt safety-related electric operated circuit breakers are being refurbished. The refurbishment is being performed under contract by a company that has a Quality Assurance Program in accordance with the requirements of 10 CFR 50, Appendix B. Vepco had recently (March 1989) conducted an audit of this company (Power Distribution Technology, Inc., Newport News, Virginia) to verify the company's Quality Assurance Program.

At the time of the inspection, the refurbishment program was well underway. The following is a tabulation of the status at that time:

4160 Volt Circuit Breakers

	<u>Unit 1</u>		<u>Unit 2</u>	
	<u>S/R</u>	<u>N-S/R</u>	<u>S/R</u>	<u>N-S/R</u>
Total safety-related	19		19	
Total non-safety-related		40		40
S/R refurbished	10		5	
Non-S/R refurbished		13		0
Breakers at refurb. fac.	3	6	1	7

480 Volt Electric Operated
Safety-Related Breakers

	<u>Unit 1</u>	<u>Unit 2</u>
Refurbished	4	8
Working	4	0
To be worked	6	6

Upon completion of the refurbishment program, it is considered that the CAL item for safety-related breakers will be satisfied.

b. Molded Case Circuit Breakers

The NRC issued Bulletin 88-10, Nonconforming Molded Case Circuit Breakers, on November 22, 1988. The licensee responded with their first letter dated April 3, 1989. In that letter, they stated twenty-six (26) non-traceable molded case circuit breakers were in the station's warehouse supplies and that these would be removed to preclude their use in safety-related systems. A continuing review was being performed to determine traceability of these type breakers that may have been installed between August 1, 1983, and August 1, 1988. This information, along with a schedule for replacement, will be provided to the NRC prior to restart. The licensee also indicated, in this letter, that it was their intention to replace any non-traceable molded case circuit breakers that are installed in safety-related systems.

3. NAMCO Limit Switches

Surry's screening action of Operating Events Reports on INPO Network (IPR 51351) identified a concern that was possibly applicable to Surry. The concern involved cracks in the plastic lever arms of some MSIV NAMCO limit switches. Surry examined the NAMCO limit switches on their MS trip valves and found no similar problems and they determined that the potential problem switches were traced to date code for the 18th week of 1982. Surry stated that they had none of these 1982 limit switches. The inspector's review indicated that Surry's action with regard to this item was satisfactory.

4. Separation of Divisional Cables

A station deviation report (DR) No. 51-89-629, dated March 10, 1989, identified several problems that existed in the cable tray systems for both Units 1 and 2. These problems are identified as:

- a. Various cable tray covers required for Appendix R commitments are missing.
- b. Redundant safety-related cables do not meet the separation requirements of NUS-357.
- c. Non-safety-related cables cross boundaries between Train A and Train B cable trays. No documented analysis for acceptability in meeting single failure criteria.
- d. Color coding on cable trays does not match station drawings.
- e. Administrative program for installing cables is inadequate.
- f. Field labeling of cable trays is inadequate and does not show safety-related train separation.

g. Discrepancies in cable routing drawings.

Discussions were held with the licensee's representatives at which time the NRC inspectors expressed a concern relating to the accuracy of the cable routing data submitted and used for walkdown and acceptance of the various fire areas at the time of the Appendix R inspection (see Report No. 50-280,281/87-07). It should be noted that the Appendix R inspections depend on accurate routing information for the evaluation of cable separation and protection within fire areas.

The licensee presented a draft of a plan to examine the cable separation issue at the end of the first NRC inspection period. Telephone discussions were held later with the licensee in which they presented a statistical sampling program which would provide 95% assurance that no more than 5% of the Appendix R designated cables were improperly routed. The routing verification of these cables was to be accomplished for 60 cables out of a population of 638 cables. The sample selected contained 20 power cables, 20 control cables and 20 instrumentation cables. Should one of the selected Appendix R cables be found not in accordance with the Appendix R analysis it will be defined as a defect which would require additional sampling. When a cable is determined to be misrouted, not in agreement with the routing drawings (schedule), an evaluation is to be performed to determine if it still meets the Appendix R criteria.

The second NRC inspection was in response to the concern that out of the first 22 cables tested, five had been identified as not being routed in accordance with the routing drawings. A review of the five cables was performed and it was determined that only two of the five cables required evaluation. These are identified as Cable #1H6PL327, which is a control cable routed to the opposite side of Emergency Switchgear Room but is now installed in 4160V/480V power tray; and Cable #H10PL406, a control cable which is routed in an instrumentation cable tray.

On June 1, 1987, the licensee submitted evaluations for these two cables in support of their contention that both meet the requirements of Appendix R even though they are not routed as defined in the Surry 1 and 2 specification for cable separation. The evaluations are as follows:

Cable No. 1H6PL327 is a 2/C #2 power cable that provides 480V, single phase power to the bypass transformer (alternate source) for UPS 1A-2. The routing for the cable was originally designed to include tray C10 in the Unit 1 Emergency Switchgear Room (ESR). However, the cable is actually installed in tray B10 which is also located in the ESR.

The installed routing is acceptable because:

- (1) Tray B10 is a power level tray installed in the same fire area and,

- (2) Cable ampacity for the subject cable is adequate for the installed condition because the cable was derated to compensate for the designed routing (i.e., tray C10 is random fill).
- (3) The 480V power to the bypass transformer will not be affected by its proximity to other 480V cables or 4160V cables.

Cable No. 1H10PL406 is a 9/C #12 control cable associated with the Unit 1 pressurizer relief isolation valve MOV-1535. The routing for the cable was originally designed to include tray C10 in the Unit 1 ESR. However, the cable is actually installed in tray Section A16 which is also located in the ESR. Due to the routing being in the same fire area, the Appendix R fire is not a concern. Since A16 is an instrument level tray and the subject cable is an ungrounded 120 VAC control circuit, which includes circuits for the MOV starter contactor and indicating lights, there is a potential concern regarding the introduction of noise in the instrument cables installed in the tray as a result of switching transients in the control circuits. The converse, that is instrument cables influencing the control cable, is not a concern. UFSAR Section 7.2 documents control cables and nonsensitive instrumentation cables were run in the same tray in certain areas.

The inrush and steady state current associated with the size 1 motor starter that provides power to the valve are approximately 2 amps and 1/2 amp, respectively, at 120 VAC.

IEEE Standard 690-1984, "Standard for the Design and Installation of Cable Systems for Class 1E Circuits in Nuclear Power Generating Station," Appendix "A," describes methods that can be used to reduce the likelihood of inducing noise on instrument cables. They are:

- ° Provide physical separation between the instrument circuits and potential noise sources. There is no guidance, however, regarding specific spatial separation.
- ° Provide twisted pair cable to reduce the effects of electromagnetic coupling.
- ° Provide shielded cable to reduce the effects of electrostatic coupling.

ANSI/IEEE Standard 518-1982, "Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controller from External Sources," does provide specific separation distances, but does not uniquely address the installation described above. Applying the definitions found in the standard regarding the levels of circuits, the instrument circuits in questions can be considered as Level 1 and the control circuit as Level 3. The separation distance between Level 1 and Level 3 circuits include those that operate from

50-250VDC and up to 20 amps AC or DC. The subject control cable operates at a substantially lower current and voltage as noted above.

Accordingly, since each instrument cable installed in the tray includes twisted pairs with an overall shield, which is grounded at one end, the following applies:

- (1) The electromagnetic coupling that results from currents of the above magnitudes will have minimal effect introducing spurious signals in the instrument circuits since the instrument cable conductor twist will provide mutual cancellation of induced voltage.
- (2) The effects of electrostatic coupling resulting from control circuit transients are similarly minimized because the instrument cable shield is grounded.

The above discussion indicates it is highly improbable that cable 1H10PL406 could adversely affect the instrument cables routed in tray A16.

The licensee's program for verification of cable separation is being conducted as directed by Engineering Work Request (EWR) No. 89-294 which contains the instructions for the inspection and rework required of cables for color separation. The cables to be inspected for location are identified in the instructions, and the documentation of the as-found conditions is required. The tone tracing equipment instructions used for the location verification are part of the EWR. The instructions include calibration tests for the equipment. Observation of the performance of this EWR revealed that the personnel performing the task are competent and understand the methodology for ensuring that the proper tone signals are followed. EWR-132 has been written to direct the activities surrounding the replacement of cable tray covers in the containment building. The licensee advised the inspector that the cable tray cover installation inside containment should be completed by May 23, 1989 and cable tray covers for those trays located outside containment will continue after restart. Fire watches will be posted for areas outside containment where the cable tray covers have not been restored.

It appears that these cable tray covers have been removed over a period of time for various tasks but not replaced at the completion of the activity. Various cable deficiencies had been identified by Quality Control Audit Report Nos. AR87-451 and AR-87-462 performed in the latter months of 1987. Deviation Reports SI-88-1380 and SI-89-629 further identified cable and cable tray deficiencies. It therefore appears that the units were not in compliance with the approved Appendix R commitments. This is identified as a violation, 50-280/89-12-01, Failure to Maintain Cable Tray Covers in Place as Required by Appendix R. Although this item was identified by the licensee, it does not meet all the requirements of 10 CFR Part 2, Appendix C, Section V.G. for not citing. The issue was not reported to NRC and measures for preventing recurrence have not yet been established.

The licensee identified 14 cables which were not routed as specified in the original cable specification. Of these cables all were found to have minor deviations which did not impact on the compliance requirements of Appendix R. Of these 14 cables, 4 were identified as being installed after the original construction of the unit had been completed. It is to be noted that this is not a Regulatory Guide 1.75 plant and therefore different separation criteria applied. However, it is the responsibility of the plant personnel to properly install any cables added after the unit is placed in operation and this includes meeting the requirements of specifications and drawings. The licensee has identified the fact that there was not adequate controls for installing cables in the past. They have now issued specification NUS 2030, Electrical Installation, which establishes controls for cable installation including the documentation and verification by the Quality Control personnel. The lack of control for the installation of cables 1J6PL1, 1H6PL327, 1J3PH12 and 1NIW136 is classified as a violation of Severity Level IV. No Notice of Violation is being issued due to the fact that:

- a. It was identified by the licensee,
- b. It is classified as a Level IV severity
- c. It was reported,
- d. It was or will be corrected including measures to prevent recurrence, and
- e. It was not a willful violation.

5. NRC Bulletins (NRCB)

- a. (Closed) NRCB 88-01, Defects in Westinghouse Circuit Breakers. The licensee's response dated April 5, 1988, advised the NRC that there are no Westinghouse Type DS circuit breakers installed at Surry Power Station.
- b. (Closed) NRCB 88-03, Inadequate Latch Engagement in HFA Type Latching Relays Manufactured by General Electric (GE) Company; and IEB 84-02, Failure of General Electric Type HFA Relays in Use in Class 1E Safety Systems. The inspector was informed that the licensee has now identified and has installed replacement HFA relays having a date code more recent than November 1987 in Unit 1. The licensee advised that there was one remaining safety-related HFA relay to be replaced in Unit 2. The licensee committed to install the relay prior to restart.

6. Action on Previous Inspection Findings (92701)

(Closed) URI 50-280,281/89-03-01, Degraded IRSP Motor Power Cables

During the previous inspection (89-03), the inspector requested the licensee to provide additional information supporting their position statement in EQ Qualification Documentation Review Package (QDR)-S-6.4 that Continental Silicone Rubber Cable (with formulation CC2115) was provided under purchase order SN-330 (Specification NUS 326). The

licensee provided excerpts from Revision 2 of Specification NUS-326 dated January 12, 1970, which states in Section 8 that the type of compound was CC2115 Silicone Rubber. At first, this appeared to be adequate to support the licensee's claim that formulation CC2115 was supplied by Continental under P.O. SN-330. However, confusing information contained in plant records revealed a Stone and Webster Source Inspection Report dated May 7, 1970, that indicated that the supplied cables were tested by Revision 1 of the Specification due to the fact that Revision 2 was not on hand at Continental. This was considered important because Revision 1 of NUS-326 does not identify the cable type. This information was left blank. Thus, no connection could be made to formulation CC2115. To resolve this concern, the licensee agreed to contact Continental and have them review their records to determine, if possible, if formulation CC2115 was indeed supplied under P.O. SN-330. Subsequent to the inspection, the licensee received a letter from Continental dated May 18, 1989, which confirmed that their records show conclusively that CC2115 was indeed the cable supplied to Surry site and Amphenol under the subject purchase order. Based on the above, this concern is now considered closed.

During a previous inspection, the licensee discovered the power feeder cable to the Unit 1 "B" Inside Recirculation Spray Pump Motor in a deteriorated state. After discovery of this finding, the licensee undertook an inspection program to look at the cables on all the IRSP motors for both Units. The results of the visual inspections revealed that some degradation had also occurred on Unit 2's "A" and "B" IRSP motors. However, other discrepancies were identified. On January 26, 1989, the licensee made a formal report to NRC under 10 CFR 50.73(a)(2)(V) (LER 89-003). The licensee had samples of the silicone rubber cable, manufactured by Continental, analyzed by an independent laboratory to (1) determine the most likely mechanism of the cable anomalies and (2) qualitatively establish any mechanical or electrical property degradation of the cable insulation. In addition, the licensee had a cable expert, formerly with Continental, also evaluate the possible causes for the cable damage. The overwhelming conclusion reached by both parties was that the damage mechanism was mechanical and not due to thermal degradation, chemical attack, or electrical arcs or insulation breakdown. The opinions, however, differed on whether the cables could have been damaged during initial installation or from subsequent maintenance. However, this issue is now moot because the licensee chose to replace the silicone rubber cable on all IRSP pump motors. The cables were replaced and the inspector had the licensee perform preliminary pull calculations to verify that the manufacturer's pull tensions or sidewall pressures were not exceeded during the cable installation. Results show that the pull tensions and sidewall pressures were well within the manufacturer's allowable limits. Also, normal installation tests on the cables support the calculated results.

During investigation of the degradation of the IRSP motor power cables, the licensee discovered other problems involving an improperly crimped lug on Unit 2 "B" IRSP motor termination and damaged motor pigtail lead insulation at the motor lead seal area. Inspection revealed the Kapton

insulation damaged on Unit 2 "B" IRSP with fraying of the glass tape (mechanical protection) on the other pump motors. The design of the motor leads consist of Kapton insulation covered with a glass tape with a varnish coating. The glass tape and varnish provide both a binder for the insulation and mechanical protection. The licensee had all four motors shipped offsite and repaired by the manufacturer. The root cause for the problems has been evaluated and included in Technical Report No. PE-0010, Revision 0, (dated May 12, 1989), Root Cause Evaluation for the Reported Deficiencies on the Recirculation Spray Pump Motors, Surry Power Station - Units 1 and 2.

In response to the finding of an improperly crimped lug on Unit 2 "B" IRSP motor, the licensee inspected all outside recirculation spray pump motors under EWR 89-089. The inspections performed by EWR 89-089 identified such problems as cuts on motor leads, questionable motor lead extensions, improper splice hardware, and signs of overheating on the 1-RSP-2B motor leads. As a result of these findings, the licensee issued EWR-89-148 which expanded the inspection program to include other motor terminations. The NRC team reviewed the results of some of the inspections performed on other safe shutdown equipment. Based on the results of these inspections, the team concluded that the licensee's inspection program should be expanded to include equipment other than motors. The licensee agreed and developed an Engineering Justification/Analysis on Electrical Terminations dated April 28, 1989, which is a detailed description of the licensee's planned corrective action for the termination concerns. The licensee's proposed actions described in this document were reviewed by the NRC and found to be acceptable.

Action On Previous Inspection Findings (92701)

(Closed) Unresolved Item 50-280/281/86-32-01 - Maintenance Program Procedures Issued by Memorandum, The licensee has issued Maintenance Department Administrative Procedure No. 11, Systematic Maintenance Action Repair Program, which contains the program for the performance of failure trending and analysis. This procedure is a controlled document and requires review for approval when revised. This item is closed.

7. Exit Interview

The inspection scope and results were summarized on April 14, 1989, with those persons indicated in paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection results listed above. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

280/89-12-01, Failure to maintain Cable Tray Covers
in Place as Required by Appendix R. (Unit 1 only)

Licensee management was informed that three bulletins and two URI's discussed in paragraphs 5 and 6 were closed.