



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

Report Nos.: 50-338/87-10 and 50-339/87-10

Licensee: Virginia Electric & Power Company  
Richmond, VA 23261

Docket Nos.: 50-338 and 50-339

Facility Name: North Anna 1 and 2

Inspection Conducted: April 17 - May 12, 1987

Inspectors: RP Crotteau FOR 5/20/87  
J. L. Caldwell, SRI Date Signed  
RP Crotteau FOR 5/20/87  
L. P. King, RI Date Signed

Accompanying Inspector: R. Croteau

Approved by: F. Cantrell 5/20/87  
F. Cantrell, Section Chief Date Signed  
Division of Reactor Projects

SUMMARY

Scope: This routine inspection by the resident inspectors involved the following areas: plant status, unresolved items, licensee event report (LER followup), review of inspector follow-up items, monthly maintenance observation, monthly surveillance observation, operator safety verification, and environmental qualification problems. During the performance of this inspection, the resident inspectors conducted reviews of the licensee's backshift operations on the following days - April 20, 21, 22 and 24 and May 3, 4, 5, 7, 11 and 12, 1987.

Results: No violations or deviations were identified during this reporting period.

(Open) Unresolved Item 338,339/87-10-01 Verification of the Operability of the RWST Level Probes. (See paragraph 6)

(Open) Unresolved Item 338,339/87-10-02 Review Licensee Actions Following Discovery of Potential Unreviewed Safety Question. (See paragraph 9)

## REPORT DETAILS

### 1. Licensee Employees Contacted

- \*E. W. Harrell, Station Manager
- \*R. C. Driscoll, Quality Control (QC) Manager
- \*G. E. Kane, Assistant Station Manager
- \*E. R. Smith, Assistant Station Manager
- \*R. O. Enfinger, Superintendent, Operations
- \*M. R. Kansler, Superintendent, Maintenance
- \*A. H. Stafford, Superintendent, Health Physics
- \*J. Stall, Superintendent, Technical Services
- J. L. Downs, Superintendent, Administrative Services
- J. R. Hayes, Operations Coordinator
- D. A. Heacock, Engineering Supervisor
- D. E. Thomas, Mechanical Maintenance Supervisor
- G. D. Gordon, Electrical Supervisor
- R. A. Bergquist, Instrument Supervisor
- F. T. Terminella, QA Supervisor
- J. P. Smith, Superintendent, Engineering
- D. B. Roth, Nuclear Specialist
- \*J. H. Leberstein, Engineer
- G. G. Harkness, Licensing Coordinator

Other licensee employees contacted include technicians, operators, mechanics, security force members, and office personnel.

#### \*Attended exit interview

NRC Regional Management Site Visit: F. S. Cantrell visited the North Anna Power Station on May 5, 1987. Unit 1 was in a refueling outage and Mr. Cantrell, accompanied by the resident inspectors, conducted a tour of the Unit 1 containment.

### 2. Exit Interview (30703)

The inspection scope and findings were summarized on May 12, 1987, with those persons indicated in paragraph 1 above. The licensee acknowledged the inspectors findings. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspectors during this inspection.

### 3. Plant Status

#### Unit 1

Unit 1 commenced the inspection period operating at approximately 85% power. The unit was in a coastdown to a refueling outage which commenced April 19, 1987. On April 19, Unit 1 commenced a normal shutdown and, at approximately 66% power, the unit experienced an automatic reactor trip.

The trip signal, high negative flux rate, resulted from a blown fuse on control rod H2s stationary gripper coil causing the control rod to drop into the core. Control rod H2 was positioned such that two of the power range instruments experienced the trip signal. All systems required to function to support the reactor trip operated normally.

Unit 1 is, as of the end of the inspection period, in day 23 of the refueling outage with the fuel removed from the core. Prior to the reactor trip commencing the outage, Unit 1 had operated continuously for 170 days.

#### Unit 2

Unit 2 commenced the inspection period operating at approximately 100% power. The unit completed the inspection period operating at approximately 100% power with a continuous run of 206 days.

#### 4. Unresolved Items

An Unresolved Item is a matter about which more information is required to determine whether it is acceptable or may involve a violation or deviation.

Two unresolved items were identified during this inspection and are discussed in paragraph 6 and paragraph 9.

#### 5. Licensee Event Report Follow-Up (90712)

The following event reports were reviewed. The inspector verified that reporting requirements had been met, that causes had been identified, that corrective actions appeared appropriate, that generic applicability had been considered, and that the forms were complete. Additionally, the inspectors confirmed that no unreviewed safety questions were involved and that violations of regulations or Technical Specification (TS) conditions had been identified.

The licensee's methods for complying with 10 CFR 21 reporting requirements and evaluating 10 CFR 21 reports generated by other licensees and vendors were reviewed. The procedure (ADM-16.3) for complying with 10 CFR 21 requirements is satisfactory for reporting required events; however, it does not contain instructions for evaluating incoming 10 CFR 21 reports for applicability and actions required. No one licensee organization is responsible for coordinating incoming 10 CFR 21 reports and tracking required follow-up actions. The licensee is in the process of issuing a Nuclear Operations Department Standard to set a policy for receipt, control, evaluation, and distribution of vendor information including 10 CFR 21 reports. The draft procedure was reviewed and it does assign the Station Supervisor of Records Management as the overall responsible party for vendor information including tracking, screening, distribution, and feedback of results. This is a corporate standard procedure and site specific procedures will be needed to implement the standard procedures.

The following 10 CFR 21 reports were reviewed along with the available information on licensee actions:

(Open) 10 CFR 21 85-01. K-line breaker with Improper Overcurrent Trip Device. The 10 CFR 21 report stated VEPCO received some of the breakers manufactured during the period in question. The licensee provided a memorandum stating that none of the breakers manufactured during the period in question had been used at North Anna. This item remains open pending determination of the final use of the breakers received by VEPCO.

(Closed) 10 CFR 21 85-04. Security Key Card Incorrectly Coded to Allow Restricted Area Access. The licensee now uses an administrative procedure (ADM-SIP-31) to test all new key cards. The tests are documented and defective cards are destroyed. Test records are stored in station records. This item is closed.

(Closed) 10 CFR 21 85-05. Diesel Generator Connecting Rod/Rod Bearing Cap Nut Non-Parallel Fit-up. The licensee inspected all the nuts and replaced several which were damaged; however, the procedures used for the inspection did not contain any acceptance criteria other than "inspecting for damage." Since several nuts were replaced it appears the inspections were done properly. This item is closed.

(Open) 10 CFR 21 85-03. Dust Shield Cutting Wire in Brown Boveri K-Line Circuit Breakers. The licensee could not readily provide information on what was done in response to this problem and was locating documentation at the end of this inspection. This item remains open.

(Open) 10 CFR 21 84-01. Inadequate Barton Lot 1 Transmitters Supplied by Westinghouse. The licensee could not readily provide information on what was done in response to this problem and was locating documentation at the end of this inspection. This item remains open.

(Open) 10 CFR 21 85-02. Interpolar Connector Problems on Diesel Generators. The licensee could not readily provide information on what was done in response to this problem and was locating documentation at the end of this inspection. This item remains open.

No violations or deviations were identified.

6. Review of Inspector Follow-up Items (92701)

(Closed) Unresolved Item 338,339/87-01-02: Reverification of the Acceptability of the Recirculation Spray Heat Exchangers (RSHX). The licensee received a letter from Stone & Webster (SW) Engineering Corporation dated February 24, 1987, which stated that based on a finite element analysis (calculation 14938.01-NM(B)-475-IZC, Revision 1), one fatigue life of the RSHX diaphragm was 12 cycles. SW recommended, however, that the design of the RSHXs be modified to prevent the diaphragm from experiencing the containment test pressure or install a diaphragm

designed to withstand the containment pressure prior to the next type A pressure test. The licensee has committed to the NRC to make permanent repairs to the Unit 1 RSHX diaphragm to resolve this problem during the present refueling outage. Since the RSHX diaphragms in both units have experienced no greater than 5 pressurization cycles and per the SW calculations they can experience up to 12 cycles before failure, the RSHX diaphragm posed no safety hazard and this item is closed.

The inspectors are still concerned by the sequence of events leading up to the reverification of the SW calculations. The inspectors will continue to monitor the licensee's response to generic safety issues identified at either facility or by outside sources.

(Closed) Inspector Followup Item 338,339/84-33-02: Followup of Service Water Problems. The new service water system has been installed, tested and declared operational. Testing of the safety injection function of the newly installed valves will be tracked separately. This item is closed.

(Closed) Inspector Followup Item 338,339/84-43-01, RWST Level Indication Adequacy. This IFI identified a problem with the accuracy of the RWST level instruments. The installed RWST level instruments have an accuracy of +/- 3% and they are used to verify that the RWST level is maintained within a 2% Technical Specification (TS) band. At the time of the discovery the licensee setup level probes in the RWST which would alarm the control room on either high or low level anytime the RWST approached its TS limit. The licensee also set up a standing order which required the operators to use not only the level instruments to maintain the RWST level within TS limits but also verify that the alarms were not actuated. The combination of both the four level instruments and the level probes satisfied the inspectors as a short term solution to the accuracy problem.

As a long term fix, the licensee has decided to not install narrow range level instruments because of the cost. The licensee is considering a TS change which would lower the minimum RWST level to a level such that the +/- 3% accuracy of the wide range level instruments would be acceptable. This TS change and the supporting engineering evaluations are presently being reviewed by the licensee and have not been submitted to the NRC.

The inspectors have reviewed the calibration process of the four level instruments and understand that there is a high probability that the accuracy is much better than +/- 3%. Also, the combination of both the level instruments and the level probe alarm is satisfactory for the short term pending approval of the licensee TS change. However, during a review of the IFI, the inspector discovered that the licensee does not perform a surveillance test of the RWST level probe circuitry. This item is being closed and identified as an Unresolved Item 338,339/87-10-01 pending the licensee verifying the operability of the level probes and development of periodic tests of the circuitry to meet TS requirements.

## 7. Monthly Maintenance (62703)

Station maintenance activities affecting safety related systems and components were observed/reviewed, to ascertain that the activities were conducted in accordance with approved procedures, regulatory guides and industry codes or standards, and in conformance with Technical Specifications.

The licensee informed the inspectors that eddy current inspection of the incore flux thimbles had been completed and will result in the repair of five thimbles and the abandonment of one thimble. This eddy current inspection was being performed based on information the licensee had received on experiences at European plants and two other United States facilities. The licensee felt that, based on this information, it would be prudent to contract Westinghouse to perform eddy current inspections of their incore flux thimbles during the Unit 1 outage.

The areas of concern are the points where the thimbles exit the lower core plate and where they enter the fuel assembly thimble guides. At these two points, due to flow variations, the thimbles have a potential for wall thinning due to fretting. The Westinghouse criteria consists of: greater than 40% wall wastage, tube repair is required and greater than 50% wall wastage, tube replacement or isolation is required. The licensee chose to reduce the Westinghouse criteria to 35% and 45% respectively.

The results of the licensee's inspection indicated anywhere from no wall thinning up to 49% wall thinning. Six of the thimbles were greater than 35% through wall with one of the six greater than 45%. Westinghouse's repair consists of pulling the thimble two inches out of the core thereby placing new metal in the area of the potential fretting. The licensee will be performing this repair for six thimbles, and the one tube at 49% wastage will be isolated and not used following the repair.

The licensee is presently working with Westinghouse on a permanent solution for this problem and intends to perform eddy current inspection on the Unit 2 incore flux thimbles during the upcoming refueling outage in August 1987.

In March of 1987, the licensee identified two additional piston pin bushings in the 1H Diesel which had increased in size and appeared to be on the way to failure. Based on that discovery, the licensee committed to disassemble both the 1H and 1J Emergency Diesel Generators (EDG) during the Unit 1 refueling outage. Following the disassembly the licensee committed to replace all the floating bushings and piston pins and inspect the rest of the equipment and replace as necessary.

The 1H EDG overhaul commenced on April 24, 1987, and the diesel was reassembled, tested and declared operational on May 10, 1987. During the overhaul, all of the piston inserts, fixed bushings, floating bushings and piston pins were replaced with new ones. The new equipment was measured

prior to installation to establish a baseline for future measurements. In addition, the licensee changed out the lube oil, replaced the blower, completed several electrical design change packages and replaced a thrust bearing which was beginning to fail.

The preliminary results of the licensee's inspection of the piston pin bushings indicated one additional floating bushing which appeared to have extruded slightly and showed signs of abnormal wear and heating. This floating bushing was located in the number 10 upper piston insert. All the rest of the upper and lower piston pin bushings appeared to show normal wear. The licensee, along with Colt and the consultant, Trident Engineering, will continue to evaluate the results.

The impending failure of the lower thrust bearing was attributed to a manufacturing defect of the oil groove on the inside surface of the bearing. This defect as described by the licensee was a sharp edge which appeared to have staved the inner surface of the bearing of lube oil which resulted in overheating and wiping of the bearing surface. The licensee has discussed this situation with the vendor and requested they inspect all future bearing surfaces for such defects.

The 1J EDG is presently being prepared for disassembly. The inspectors will continue to monitor the licensee's maintenance and inspection activities of the EDGs.

The inspector toured the Westinghouse trailer housing the Steam Generator (SG) sludge lancing equipment and observed the sludge removal process of one of the SGs. The following amounts of sludge have been removed:

- "A" Steam Generator - 1250 lbs.
- "B" Steam Generator - 667 lbs.
- "C" Steam Generator - 1600 lbs.

The inspectors witnessed the receipt of new fuel elements and the placement of these elements in new fuel storage. The inspectors also observed the removal of fuel from the reactor vessel while observing the operation of the refueling bridge and fuel removal equipment.

During tours of the containment, the inspectors observed the following operations:

The removal of the lower diaphragms on the recirculation spray heat exchangers.

The replacement of the seal package on the "B" reactor coolant pump.

The teardown of the "A" reactor coolant pump motor for the five-year inspection.

The inspectors toured the turbine floor area and witnessed removal of the low pressure rotors and the 5B heat exchanger. The removal of the 5B heat exchanger and replacement with an exchanger that has new tubing material is part of the licensee's program to remove copper containing materials from the condensate and feed water systems.

The inspectors witnessed the removal of the trim assembly on the main feedwater regulating valves. These are being replaced with a new type trim assembly.

During this outage, the licensee removed the three pressurizer safety relief valves and the 15 Steam Generator (SG) Code Safeties and shipped them to Wyle Labs to be tested. The results of the testing indicated two of the three pressurizer safeties passed with one failing high. The licensee informed the inspector that the engineering department has determined, based on the pressure at which the failed safety lifted, that the accident analysis is still valid. The test results of the SG code safeties indicated that 3 of the valves lifted within the setpoint tolerance and the other 12 valves lifted below setpoint tolerances. The licensee is evaluating the significance of the 12 code safeties which failed to lift within the required setpoint tolerances.

No violations or deviations were identified.

#### 8. Monthly Surveillance (61726)

The inspectors observed/reviewed technical specification required testing and verified that testing was performed in accordance with adequate procedures, that test instrumentation was calibrated, that limiting conditions for operation (LCO) were met and that any deficiencies identified were properly reviewed and resolved.

The inspectors witnessed the following surveillances:

- 1-PT-57.4 - Safety Injection Functional Test
- 1-PT-83.1 - Simulated Blackout of 1-H Vital Bus
- 1-PT-66.3 - Containment Depressurization Actual Function Test

No major problems were noted, but due to the complexity of the tests and the valves or pumps that were racked out during the testing, the inspectors will need to review the completed test data.

The inspectors observed the performance of 1-PT-83.1. This surveillance test demonstrated the starting and load sequencing capability of the emergency diesel generator.

On April 20, 1987, the inspector reviewed the procedure and witnessed portions of the reactor coolant system hydrostatic test 1-PT-171.1, 1-RC-1. During the performance of this test, the licensee also completed several other 10 year Inservice Inspection hydrostatic tests involving

both high head and low head safety injection lines. Because of a SG sample valve leak inside containment, the licensee was unable to complete all of the required leakage inspection for the reactor coolant system hydrostatic test. This test will be conducted again at the completion of the outage.

During the performance of the outage, the licensee has contracted Westinghouse to perform numerous activities on the steam generators (SG). These activities include hydrostatic test inspections, eddy current inspections, tube end repairs, sludge lancing, J tube inspection and stress relieving techniques of both the tube U-bends and the support plate areas. The hydrostatic tests have been completed and indicate the following results:

- a. "A" SG had four leaking tubes in the hot leg side and one in the cold leg side. Most of the leaks were in the first row which have already been plugged.
- b. "B" SG had ten leaking tubes in the hot leg side; many of which were in the first row and no leaking tubes in the cold leg side.
- c. "C" SG had 23 leaking tubes in the hot leg side and one in the cold leg side.

These results are not conclusive because of the difficulty in determining which tubes and how many are leaking, but they will be used to determine where and what additional eddy current inspections are required.

Ultrasonic inspections have been performed on the "C" SG J tubes and the licensee reports no identified degradation. The eddy current inspection of the SGs is in progress. 100% of the tubes will be inspected with 20% receiving a full tube inspection. At present, the licensee has not received any results from Westinghouse concerning these inspections. A discussion on the sludge lancing activities is contained in the maintenance section, paragraph 7.

The inspectors conducted a tour of the Westinghouse trailer and witnessed eddy current inspection in progress on the "B" SG. The inspectors also observed the equipment used to perform repairs to the SG tube ends which were damaged a few years earlier due to control rod guide tube nuts found loose in the primary. These tube end repairs are necessary to allow the use of eddy current probes and other SG inspection and repair equipment to be placed in the tubes.

On April 22, 1987, while performing 1-PT-83.2, Simulated Blackout and SI-J Bus, Unit 1 experienced a loss of RHR flow. The licensee made a four-hour 10 CFR 50.72 report and will follow-up with a 10 CFR 50.73 LER. At the time of the loss of RHR, the unit was in Mode 5 with the Reactor Coolant System (RCS) temperature less than 140 degrees Fahrenheit. During the

performance of the test, a vital bus (1-III) inverter tripped causing loss of power to the suction valve (MOV-1701) for RHR. The operator recognized what happened and re-energized the vital bus (1-III) with the sola transformer and reopened the RHR suction valve. The loss of RHR was reported to be approximately six minutes with very little if any change in RCS temperature. The RHR pump continued to operate during the event recirculating discharge flow back to the suction of the pump. This recirculation flow path is normally used to warm up the RHR pump; therefore, the licensee informed the inspector that the RHR pump was not damaged. The inspector will review the LER when it is issued.

Following the feedwater pipe rupture event and subsequent feedwater piping inspection at the Surry Station, North Anna personnel developed an inspection plan for the Unit 1 condensate and feedwater piping inspection to be completed during this outage. The licensee has inspected 185 devices, approximately 90% complete, and has identified 25 devices which are required to be replaced. Seven of the devices are located in two phase flow systems and 18 are located in single phase flow systems. Of the 18 single phase systems, 17 are located in the feedwater pump discharge piping. The results of these ultrasonic inspections have not only identified thinned piping in single phase flow systems, but have confirmed that erosion/corrosion exists at the North Anna facility in both single and two phase flow systems. Along with the piping that has been identified as requiring replacement, the licensee has also identified piping exhibiting wall thinning that will need to be inspected again next outage.

No violations or deviations were identified.

#### 9. Operational Safety Verification (71707)

By observations during the inspection period, the inspectors verified that the control room manning requirements were being met. In addition, the inspectors observed shift turnover to verify that continuity of system status was maintained. The inspectors periodically questioned shift personnel relative to their awareness of plant conditions.

Through log review and plant tours, the inspectors verified compliance with selected Technical Specification (TS) and Limiting Conditions for Operations.

In the course of the monthly activities, the resident inspectors included review of the licensee's physical security program. The performance of various shifts of the security force was observed in the conduct of daily activities to include: protected and vital areas access controls, searching of personnel, packages and vehicles, badge issuance and retrieval, escorting of visitors, patrols and compensatory posts. In addition, the resident inspectors observed protected area lighting, protected and vital areas barrier integrity and verified an interface between the security organization and operations or maintenance.

On a regular basis, radiation work permits (RWP) were reviewed and the specific work activity was monitored to assure the activities were being conducted per the RWPs. Selected radiation protection instruments were periodically checked and equipment operability and calibration frequency was verified.

The inspectors kept informed, on a daily basis, of overall status of both units and of any significant safety matter related to plant operations. Discussions were held with plant management and various members of the operations staff on a regular basis. Selected portions of operating logs and data sheets were reviewed daily.

The inspectors conducted various plant tours and made frequent visits to the Control Room. Observations included: witnessing work activities in progress; verifying the status of operating and standby safety systems and equipment; confirming valve positions, instrument and recorder readings, annunciator alarms, and housekeeping.

The inspectors completed review of the auxiliary feedwater calculations provided by the licensee. The review assured them that the system will meet its design requirements without experiencing net positive suction head problems. An orifice installed in the discharge of the turbine driven auxiliary feed pump prevents runout of the pump on low steam generator pressure. The inspectors requested the licensee to provide the test results of the system to ensure that the system can deliver the design flow at the highest steam generator pressure. The present technical specification required surveillances only test the pumps on recirculation flow and verification that there is flow into the steam generators.

The licensee informed the inspectors that during an engineering review for a Technical Specification (TS) Change the corporate engineering department discovered that Stone and Webster (SW) used a Hi-Hi containment pressure setpoint for the accident analysis which was non-conservative. The pressure used by SW was 24.7 psia which was apparently used for analysis of other similar containments and not updated to the North Anna Containment design. The North Anna TS Hi-Hi containment allowable setpoint is 29.25 psia and the safety analysis limit is 30 psia. The inspectors were informed that an engineering analysis had been performed which determined that there is enough margin in the present analysis to ensure acceptable continued operation.

During a review of the information provided to the inspector documenting the situation the inspector determined that the corporate engineering department became aware of the non-conservative accident analysis on April 16, 1987. However, a Deviation Report (DR) documenting the problem was not transmitted to the site until April 27, 1987. The letter from SW stating that the present accident analysis is still acceptable was dated April 22, 1987. Therefore, when the DR 87-392 was presented to the site for operability and reportability determination, the response from SW had already been received.

The inspectors are concerned that the licensee allowed operation of both units of North Anna from April 16, 1987, to April 22, 1987, without reasonable assurances that their accidents analysis were still valid. Pending a review of the SW and licensee evaluation and a review of the licensee's immediate actions taken following the discovery of the potential unanalyzed condition, this will be identified as a Unresolved Item 338,339/87-10-02.

No violations or deviations were identified.

10. Environmental Qualification Problems (71707)

During a review of Deviation Report (DR) 87-336 and discussions with the licensee, the inspector became aware of a potential Environmental Qualification (EQ) problem with the Hydrogen Analyzers for both units. The licensee determined that a transformer located inside the analyzer's cabinet was qualified to only  $1.9 \times 10^5$  rads and the environmental zone in which the transformer is located has a 40 year plus DBE dose of  $2.5 \times 10^5$  rads. This would cause the transformer and therefore the hydrogen analyzers to be qualified for only 12.6 days following a LOCA.

The licensee declared the analyzers inoperable and entered Technical Specification (TS) action statement 3.6.4.1.b which allows for seven days to correct the problem or be in hot standby. The licensee then developed a Justification for Continued Operation (JCO) which allowed them to use both analyzers in series and be able to take credit for one operable analyzer. This allowed the licensee to enter TS action statement 3.4.6.1.a which allows thirty days to restore both analyzers to operability. Subsequent to the JCO, the corporate engineering department received a letter from Consip Corporation stating that the transformers and analyzers were qualified to the VEPCO EQ requirements. The engineering group then documented this information, after a review was performed, in a memorandum to the plant dated April 20, 1987. This memorandum from P. T. Knutsen to J. A. Stall stated that the transformers were fully qualified for the full 40 year life (plus LOCA) of the plants.

No violations or deviations were identified.