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

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Report Nos.: 50-338/88-28; 50-339/88-28;
50-280/88-40; and 50-281/88-40

Licensee: Virginia Electric and Power Company
Richmond, VA 23261

Docket Nos.: 50-338 and 50-339
50-280 and 50-281

License Nos.: NPF-4 and NPF-7
DPR-32 and DPR-37

Facility Name: North Anna 1 and 2
Surry 1 and 2

Inspection Conducted: September 26-30, 1988

Inspectors: W. B. Gloersen — 10/26/88 Date Signed

R. R. Marston — 10/21/88 Date Signed

Accompanying Personnel: C. R. Nichols (NRR)

Approved by: J. B. Kahle, Section Chief — 10/26/88 Date Signed
Division of Radiation Safety and Safeguards

SUMMARY

Scope: This routine, announced inspection was conducted in the area of control room habitability and inspector followup items.

Results: In the areas inspected, violations or deviations were not identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*R. L. Boehling, Performance Engineer
*M. L. Bowling, Assistant Station Manager
*G. H. Flowers, Supervisor - Surveillance and Test Engineering
+B. Foster, Project Engineer, Surry
*G. E. Kane, Station Manager
*J. H. Leberstein, Engineer
P. Prendergast, Assistant Engineer
*F. T. Terminella, Supervisor - Quality

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

NRC Resident Inspector

*J. L. Caldwell

*Attended exit interview
+Licensee Representative, Surry

2. Summary

During the period of December 1-5, 1986, a control room habitability survey was conducted at the North Anna Power Station by members of the Region II and NRR staff, together with NRC consultants from the Argonne National Laboratory. The purpose of the survey was to evaluate: (1) the operation of the control room ventilation system and its ability to maintain the North Anna control room habitable and (2) the adequacy of the plant's technical specifications and procedures to demonstrate system operability and system capability consistent with the assumptions made in the plant's TMI Action Item III.D.3.4, "Control Room Habitability" analysis, FSAR Section 6.4, and the NRC staff's associated safety evaluations. The survey team gathered flow rate data in various portions of the control room ventilation system with the system operating in its normal mode of operation. Data were also gathered with the ventilation system operating in its emergency radiological operating mode. The survey team's findings covered system operation and design, plant technical specifications and procedures, and NUREG-0737 III.D.3.4 analysis.

The control room habitability survey resulted in three findings requiring prompt attention by the licensee and eleven additional findings. The survey report and findings were transmitted to the licensee by letter dated May 4, 1987, L. Engle (NRC) to W. Stewart (VEPCO). In that letter, the NRC requested the licensee to respond to the findings requiring prompt

attention within 30 days of receipt of the May 4, 1987, letter and the other findings within 60 days of receipt of the letter. The licensee transmitted a response to the three items requiring prompt attention in a letter to the NRC dated June 8, 1987, and transmitted a second response to the other findings in a letter dated September 11, 1987. The licensee had notified the NRC in a letter dated July 30, 1987, that additional time would be required to respond to the other findings of the control room habitability survey report. A subsequent conversation between L. Engle (NRC) and G. Panel (VEPCO) established a submittal date of September 11, 1987.

The purpose of this inspection was to review the licensee's responses to the findings of the control room habitability survey report. Most of the findings in the survey report were identified as inspector followup items (IFIs) in Inspection Report Nos. 50-338/87-19 and 50-339/87-19. The inspectors and an NRC/NRR representative reviewed the inspector followup item responses for completeness and the initiatives taken by the licensee to resolve the technical issues.

3. Licensee Action on Previously Identified Inspector Followup Items (92701)

   a. (Closed) IFI 50-338, 339/87-19-04: Ductwork inleakage from chiller room. The finding indicated that flow data for the ductwork which passed from the Unit 2 switchgear and relay room air handling area through the Unit 2 chiller room and then back into the relay room at the instrument rack showed a considerable amount of inleakage as it passed through the chiller room. Since the chiller room communicated with the turbine building and was not part of the control room envelope, it provided a potentially contaminated path into the envelope. The licensee was requested to make flow rate measurements and/or differential pressure measurements of the ductwork with respect to the chiller room to determine whether there was inleakage.

      The licensee installed new test taps which were better suited for uniform flow characteristics into the aforementioned ductwork. The original test taps used during the control room habitability survey were apparently not ideally located and the spacings of the sample holes were not uniform. The original test taps were located such that with backflow through leaking dampers and the effect of upstream obstructions, reliable information could not be obtained. The licensee's flow rate measurements indicated that no inleakage existed. Additionally, the licensee made differential pressure measurements of the ductwork with respect to the Unit 2 chiller room. In order for eduction to take place, the static pressure inside the duct must be less than the static pressure outside the duct. Static pressure measurements were obtained within the duct at two locations and in the chiller room. Additional measurements were taken at the most probable location for reduced pressure, which was downstream of the elbow in the ductwork (in accordance with survey team recommendations). All measurements indicated that the pressure inside the duct was greater than that of the chiller room. Based on these data, it appeared that no eduction could occur. In order to

further reduce the pressure in the chiller room, the licensee reversed the flow direction of the fan in the chiller room so that the static pressure would be less than the static pressure in the control room envelope. The chiller room fan then discharged directly into the Turbine Building. As another measure to ensure that the control room envelope would remain at a positive pressure with respect to the chiller room, the block wall between the switchgear/relay room and the fan room was removed. The inspectors reviewed Engineering Work Requests 87-070, 87-070A, 87-070B, 87-070C, 87-070D and 87-070E which provided a safety evaluation regarding the removal of the block wall between the switchgear/relay room and the fan room. The safety evaluation concluded that the removal of the entire block wall would not: (1) affect the seismic capacity of the Instrument Rack Room, Fan Room, or Control Room; (2) adversely affect 10 CFR 50, Appendix R (fire protection) equipment; (3) increase the probability of the fire or explosion which could affect redundant safety equipment; and (4) add combustible material. The block wall was not a fire barrier. In the engineering work request, the licensee stated that the problem was due to the differential pressure that existed between the Unit 1 and 2 Fan Rooms, the adjoining instrument rack rooms, within the control room envelope, and the chiller rooms (bottled air storage). The area of lowest pressure was the Fan Room. The ventilation return to each fan room was through a doorway in the block wall between the Fan Room and Instrument Rack Room. The engineering solution was to remove the block wall to minimize restriction of the return air flow to the fan rooms.

Differential pressure measurements were made and it was found that the control room envelope was at a positive pressure relative to the chiller room. The licensee performed similar engineering modifications to the Unit 1 control room envelope and chiller room. Based upon the flow rate and differential pressure measurement data provided by the licensee, it appeared that no inleakage existed. This item is considered closed.

b. (Closed) IFI 50-338, 339/87-19-05: Control room ventilation system gauges. This finding indicated that control room ventilation system equipment should be instrumented with gauges capable of reading the operating parameters of the system, such that the instruments would not be pegged, off-scale, or in need of repair. The survey team noted that although the instruments were on-scale during normal operation, the instrumentation would not be capable of providing the status during the emergency mode of operation.

The licensee had various pressure gauges which measured the pressure of the control room envelope relative to the surrounding areas. The instruments served two purposes. First, the instruments were used for surveillance testing and needed to be accurate over the pressure range required by the surveillance test acceptance criteria (0.05 inches water gauge). Second, the pressure gauges were used to confirm that the control room envelope was being maintained at a

positive pressure during the various emergency modes of operation of the control room habitability system. The installed pressure gauges covered a range from 0 to 0.5 inches water gauge and were considered suitable for satisfying both of the purposes described above. The licensee reviewed the requirements for control room ventilation system instruments and concluded that the existing instruments were adequate for their intended purposes. Additionally, the licensee periodically checked the instruments for proper calibration under the station's instrument calibration program. The licensee indicated that none of the pressure gauge instruments were in need of repair. This item is considered closed.

c. (Closed) IFI 50-338, 339/87-19-06: Mark control room pressure boundary doors. In this finding, the NRR/ANL survey team noted that all pressure boundary doors within the envelope should be marked as such. On two separate occasions, the survey team observed control room envelope doors which had been left opened, thus breaking envelope integrity. The survey team also noted that it was not obvious that some of the control room envelope doors were actually pressure boundary doors.

The licensee took positive action by replacing certain boundary doors as part of an upgrade program. Following the door replacement, the licensee marked each door as a "Pressure Boundary Door." Doors which were not replaced have been marked as "Pressure Boundary Door." This item is considered closed.

d. (Open) IFI 50-338, 339/87-19-07: Adequacy of procedure for access control of control room. In this finding, the survey team questioned the feasibility of an administrative procedure which was designed to limit access to the control room envelope through the use of a security guard during the first hour after initiation of the bottled air system. The survey team estimated that at least eight or nine security guards would be required to limit access to all pressure boundary doors of the control room envelope. Additionally, the survey team noted that several entrances and exits from the control room would be a necessity during an accident situation. It appeared that the licensee would need to reevaluate the post-accident operation of the control room bottled air and ventilation systems. The licensee was made aware that a new control room dose evaluation could be required if control room access were not limited. If access were limited, the present procedure would need to be modified to ensure limited access consistent with the present evaluation. It was indicated to the licensee that NRC/NRR would address the revised control room dose evaluation (if applicable).

The licensee stated that an engineering evaluation was being performed to determine the best method for limiting access to the control room following an accident so the control room could be maintained at a positive pressure with the bottled air system. The licensee was also considering in the evaluation, a scenario involving

several entries into the control room envelope. Additionally, the licensee was evaluating the control room habitability during a fuel handling accident (see Paragraph 3.k). The licensee was using a consultant to work on both the engineering evaluation and the control room dose reevaluation. During the exit meeting, the licensee made a commitment to complete the evaluation by February 28, 1989, and to send the results of the evaluation to the NRC Region II. This item remains open.

e. (Closed) IFI 50-338, 339/87-19-08: Absence of fire dampers in ductwork. This finding indicated that Drawing 11715-FB-24E-12, Ventilation and Air Conditioning Service Building SH-5, showed fire dampers in the duct work passing from the Unit 2 chiller room to the Unit 2 instrument rack room. The survey team did not observe fire dampers in the subject ductwork which passed from the Unit 2 switchgear air conditioning room to the Unit 2 chiller room. The survey team indicated that fire dampers would appear to be appropriate in both locations.

The licensee's review of Drawing 11715-FB-24E-12 concluded that there were no dampers shown in the ductwork between the Unit 2 air chiller room to the Unit 2 instrument rack room and therefore no drawing revision was considered necessary. Additionally, the licensee had previously applied for an Appendix R exemption requesting a waiver from having fire dampers in the ductwork passing from the Unit 2 chiller room to the Unit 2 emergency switchgear air conditioning room (emergency ventilation system). This condition was evaluated by the NRC in a letter dated November 6, 1986, and it was concluded that the subject penetration was acceptable for use in the fire boundary as described. It should be pointed out that the duct itself provided a barrier to prevent smoke from entering either room. Additionally, the licensee measured the pressure in the ductwork and determined that it was higher than the pressure outside the ductwork. Therefore, unfiltered air or smoke would not be able to infiltrate into the ductwork. This item is considered closed.

f. (Closed) IFI 50-338, 339/87-19-09: System descriptions and station procedures should reflect actual acceptable operational configuraticns. In this finding, the survey team reviewed the updated FSAR and system and operating procedures and determined that there were approximately 96 different combinations of control room and switchgear and relay room air handling units and their respective emergency filtration units. From discussions with control room operators, it was revealed that under certain configurations, chilled water could not be supplied to the air handling units without the chillers tripping frequently. The tripping was caused by partial loading of the chillers. The system description and station procedures were not specific regarding this problem.

The licensee reviewed and revised operating procedure 1-OP-21.6, Main Control and Relay Room Air Conditioning, Revision 9, May 26, 1988, so that it would indicate acceptable operating configurations for the control room ventilation system. The licensee reviewed operating

procedures 1-OP-21.7, Main Control and Relay Room Emergency Ventilation and 1-OP-21.9, Control Room Bottled Air Pressurization System and determined that no revisions were necessary. The inspector reviewed Training Module NCRODP-36, Secondary Plant Ventilation Systems, which was part of the Nuclear Control Room Operator Program and noted that the module adequately described ventilation system operation and lineups. This item is considered closed.

g. (Closed) IFI 50-338, 339/87-19-10: Emergency filter unit leakage. This finding indicated that the measurements of flow in the control room and switchgear ventilation system showed that the Units 1 and 2 control room emergency filter units had more flow exhausting than was supplied, which indicated an inleakage problem. In some cases, the survey team noted that exhaust was 50% greater than supply. For the switchgear and relay room emergency filter units, similar problems were observed. However, in the case of Unit 2, supply was less than design. All other cases for emergency ventilation filter showed that supply was greater than design. During normal operation, the switchgear room Unit 1 filter showed outleakage. In all operating conditions, the Unit 2 switchgear air handling units demonstrated backflow. The Unit 1 damper on the emergency ventilation filter train D for the switchgear room leaked about 140-200 cfm during normal operation.

Licensee Event Report (LER) 86-19, Control Room Emergency Ventilation System High Flow Rates Due to Inadequate Post Maintenance Testing, was submitted on January 9, 1987, to describe the event regarding the control room and switchgear and relay room emergency filter units flow rates exceeding the Technical Specification limit of 1000 cfm ±10%. The flow rates were brought back into the Technical Specification limits by adjusting the modulating damper installed in the filter inlet ductwork. This condition occurred after maintenance was performed consisting of cleaning the inlet filters on the control room emergency ventilation systems. After the filters were cleaned, flow through the system increased. This maintenance activity was performed without a maintenance procedure or the performance of a post-maintenance test. For further information regarding LER 86-19, the reader is referred to Inspection Report Nos. 50-338/87-01 and 50-339/87-01.

The licensee installed new test taps in the suction ductwork upstream of the filter housing for all filter units in order to measure more adequately the supply flow to the filter units. The licensee indicated that the excess flow measurements at the exhaust were attributed to minor inleakage downstream of the filters and to errors inherent in the measuring method due to the inconsistent nature of flow at the exhaust plenum. The licensee stated that the minor inleakage downstream of the filters was of no radiological concern since infiltration was from within the control room envelope. This item is considered closed.

h. (Closed) IFI 50-338, 339/87-19-11: Air handling units and emergency filtration unit not operating as designed. The NRR survey team made the observation that the air handling units and the emergency filtration units did not appear to be operating with the efficiency assumed in their design and that system flows were also outside the design basis.

The licensee had tested the air handing units and the emergency filtration units in accordance with the technical specifications. The licensee's results indicated that these systems were operating within their operating limits. LER 86-19, Control Room Emergency Ventilation System High Flow Rates Due to Inadequate Post Maintenance Testing, further describes the observation made above. The LER indicated that flow rates were found to be outside the technical specification limits. The flow rates were brought back into the technical specification limits by adjusting the modulating damper installed in the filter inlet ductwork. This item is considered closed.

i. (Closed) IFI 50-338, 339/87-19-12: Additional makeup air entering control room envelope to produce high pressures. In the May 4, 1987, letter to the licensee transmitting the results and findings of the control room habitability survey to the licensee, it was indicated that this finding would be addressed by NRC/NRR. During this inspection, an NRR representative accompanied the inspectors and discussed with the licensee the response to this finding.

The licensee evaluated the observed data collected by the survey team and concluded that the increase in pressure was not indicative of additional air entering the control room envelope. The observed data were to be expected, given that velocity flow is proportional to the square root of the differential pressure (Bernoulli's Law). The licensee's response to this finding was similar to the response tracked by IFI 50-338, 339/87-19-04. In that response, the licensee concluded that no additional makeup air was entering the control room envelope during the radiological mode of operation. This item is considered closed.

j. (Closed) IFI 50-338, 339/87-19-13: Differential pressure should be measured with respect to the two air chiller rooms and all differential pressure gauges should be labeled as to the specific area that is being monitored.

As a measure to ensure that the control room envelope remains at a positive pressure with respect to the chiller rooms, the licensee took positive steps by removing the block walls between the switchgear/relay room and the fan rooms. Differential pressure measurements were obtained after removal of the block walls and the data indicated that the control room envelope was at a positive pressure relative to the chiller rooms. Additionally, the licensee reversed the normal room ventilation fan in each chiller room to

further reduce the pressure in the chiller rooms. The licensee indicated that there was no advantage to be gained by adding the differential pressure gauges to monitor the chiller rooms with respect to the control room envelope. The licensee conducted various tests to ensure that the control room envelope was at a positive pressure with respect to the chiller rooms. With the removal of the block walls mentioned above, the cause for the low pressures in the rooms was eliminated and the switchgear room instrumentation would accurately represent the pressure in the fan rooms. Additionally, the chiller room freely communicated with the turbine building and was represented by existing turbine building differential pressure instruments. This item is considered closed.

k. (Closed) IFI 50-338, 339/87-19-14: Modify technical specifications. In this finding the NRR survey team identified the following technical specifications that should be modified:

(1) 30°C laboratory test of charcoal using ASTM D 3803-1979 test method.

(2) Acceptance criteria for laboratory test based upon Regulatory Guide 1.52 formula.

(3) In-place DOP and freon leakage and bypass tests acceptance criteria set at 0.05%.

(4) Equipment qualification temperature based upon the most sensitive equipment or instrumentation within the control room envelope necessary to shut the reactor down and measured at that location.

(5) Demonstration of a positive pressure appropriate for 1000 cfm of makeup flow through the filter unit if the bottled air must demonstrate a positive pressure of 0.05 inches water gauge at a flow rate of 340 cfm.

(6) The technical specification needs to address modes 5 and 6 since the system should be operable during these modes to protect control room operators in the event of a fuel handling accident.

In the May 4, 1987, letter to the licensee transmitting the results and findings of the control room habitability survey, it was indicated that this finding would be addressed by NRC/NRR. During this inspection, an NRR representative accompanied the inspectors and discussed with the licensee the responses to this finding.

With regard to findings (1), (2), and (3), the technical specifications required testing of charcoal in accordance with Regulatory Guide 1.52, Revision 2, March 1978. The licensee's procedure required a representative sample of charcoal adsorber to be tested at 60°C at a relative humidity of 70%. The acceptance

criterion for methyl iodide penetration was less than or equal to 1%. In-place leak testing of HEPA filters and charcoal adsorbers was also required to be in accordance with Regulatory Guide 1.52, except that a removal efficiency of greater than or equal to 99% was specified. The proposed revision to the technical specifications would require testing the charcoal adsorber samples at 30°C and 70% relative humidity with an acceptance criterion of greater than or equal to 99% removal efficiency. Additionally, in-place leak testing of the HEPA filters and charcoal adsorbers would specify an acceptance criterion of greater than or equal to 99.95% efficiency. The licensee stated that in order to comply with the proposed changes, it would necessitate a major redesign of the control room emergency filtration system, use of different filter media, and more frequent system maintenance. The licensee stated that the proposed changes would not substantially increase the overall protection of the public health and safety. The inspectors indicated to the licensee that control room habitability systems were designed to protect the control room operators running the plant. Additionally, the inspectors indicated that the purpose of testing the charcoal adsorber samp'es at the lower temperatures was to provide a realistic test of the charcoal at temperatures and humidities similar to the influent temperatures and humidities of the air stream that would be expected during an accident. The licensee planned to continue performing surveillance testing in accordance with the criteria established in the technical specification due to the cost of upgrading the system to comply with the proposed test criteria.

In response to findings (4), the licensee stated that since the control room ventilation system consisted of four one hundred percent capacity air handlers and a total of six mechanical chillers capable of providing chilled water to the air handlers, it would be highly improbable that a complete loss of control room ventilation/cooling would occur.

According to the licensee, a complete loss of ventilation or cooling capacity has never occurred. In the unlikely event that four out of four air handlers and six out of six chillers were to fail, air circulation would stop and temperature would rise. The control room temperature sensor was located behind the back boards in the computer room. The location of this instrument, in the upper regions of the control room envelope, was considered by the licensee to be a representative location. In contrast, the relay room, which would be the area most sensitive to safe shutdown, was in the lowest elevation of the envelope and would most likely be at the coolest ambient temperature. Technical specifications currently required unit shutdown should ventilation and/or cooling be lost or should air temperature exceed 120°F. According to the licensee, these requirements are sufficient to protect the temperature-sensitive equipment from extended periods above 120°F. The inspectors questioned the habitability of the control room at ambient temperatures around 120°F. The licensee acknowledged the inspectors

comment, but believed that the existing temperature monitoring and controls were adequate.

In response to finding (5), the licensee reviewed the surveillance requirements in Technical Specifications 4.7.7.1(d)(3) and 4.7.7.2(b) and concluded that the requirements were appropriate and sufficient for demonstrating capability of the systems to perform their intended functions. The surveillance requirements were intended to demonstrate both the integrity of the control room envelope and the operability of each system (that is, the ability of the system to provide a rated flow at a specific differential pressure between the envelope and the outside environment). The licensee considered the bottled air pressurization system test as the more rigorous test in that a greater positive pressure must be demonstrated with a lower pressurization flow. The licensee stated that if the bottled air pressurization test was acceptable, the control room envelope was intact, then the emergency filtration system with its greater flow capacity would also be capable of maintaining a positive envelope pressure. Regarding the demonstration of system operability, the licensee considered the tests adequate for demonstrating that the systems were capable of supplying adequate pressurization flow, and for detecting degradations in system performance as a result of improper system lineups and equipment failures. The licensee saw no need to modify the subject technical specification surveillance requirements.

Regarding finding (6), the licensee was reevaluating the response made in a letter dated September 11, 1987, to the NRC. In that response the licensee stated that the technical specifications for control room habitability systems did not address modes 5 and 6 because the systems were not required to protect the control room operators in the event of a fuel handling accident. The licensee hired a consultant to evaluate control room habitability during a fuel handling accident. The fuel handling accident scenario was one of the issues being evaluated in IFI 50-338, 339/87-19-07.

Although this IFI will be administratively closed, its closure does not imply that the NRC concurs with the responses provided by the licensee.

i. (Closed) IFI 50-338, 339/87-19-15: Resolve comments on procedures. The inspector reviewed the procedures listed below and noted the incorporation of the enhancements identified by the NRR survey team.

- 1-OP-21.7, Main Control and Relay Room Emergency Ventilation, Revision 7, July 31, 1987.
- 1-OP-21.9, Control Room Bottled Air Pressurization System, Revision 10, July 29, 1988.

- 1-PT-76.4, Control Room Bottled Air Pressurization System Test, Revision 3, July 29, 1987.

- 1-PT-76.10(A), Control Room Emergency Ventilation System - Laboratory Analysis for 1-HV-FL-8, Revision 2, February 12, 1987.

- 1-PT-76.12(A), Control Room Emergency Ventilation System (Post Maintenance Test on HEPA Filter for 1-HV-FL-8), Revision 2, October 15, 1987.

- 1-PT-76.13(A), Control Room Emergency Ventilation System (Post Maintenance Test on Charcoal Filters for 1-HV-FL-8), Revision 2, October 15, 1987.

This item is considered closed.

4. Surry (84724)

An inspector travelled to the Surry Power Station to observe plant personnel conducting Special Test Procedure ST-220, "Control Room Envelope Air Conditioning System," dated September 27, 1988. The inspector reviewed the procedure and appropriate drawings, and discussed the procedure with a licensee representative (see Paragraph 1). The test was delayed indefinitely, however, when a chiller condenser service water pump motor burned out.

No violations or deviations were identified.

5. Exit Interview

The inspection scope and results were summarized on September 30, 1988, with those persons indicated in Paragraph 1. The inspectors summarized the scope and findings of the inspection and also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents or processes as proprietary. During the exit meeting, the licensee made a commitment to complete the review of the ingress/egress into the control room envelope issue during the one hour isolation mode by February 28, 1989 (see Paragraph 3.d). No dissenting comments were received from the licensee.