



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

Report Nos.: 50-280/87-01 and 50-281/87-01

Licensee: Virginia Electric and Power Company
Richmond, VA 23261

Docket Nos.: 50-280 and 50-281

License Nos.: DPR-32 and DPR-37

Facility Name: Surry 1 and 2

Inspection Conducted: January 12-15, 1987

Inspector: *P. M. Madden* 2-3-87
P. M. Madden Date Signed

Approved by: *T. E. Conlon* 2-4-87
T. E. Conlon, Section Chief Date Signed
Plant Systems Section
Division of Reactor Safety

SUMMARY

Scope: This special, announced inspection was conducted in the areas of Fire Protection System interaction events associated with the December 9, 1986, feedwater pipe rupture and followup on previously identified inspection items.

Results: No violations or deviations were identified.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *W. Benthall, Nuclear Safety and Licensing Staff
- *T. Carlisle, Staff Engineer Corporate Loss Prevention
- *W. Craft, Licensing Coordinator
- *L. Farinholt, Site Loss Prevention Supervisor

Other licensee employees contacted included construction craftsmen, engineers, technicians, operators, mechanics, security force members, and office personnel.

NRC Resident Inspector

- *B. Holland

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on January 15, 1987, with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspector during this inspection.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. Fire Protection System Spurious Activations and Main Control Room Habitability

On December 9, 1986, at approximately 14:20 hours the Surry Nuclear Power Station experienced a feedwater pipe failure in the Unit 2 Turbine Building.

Within minutes of the feedwater pipe rupture event in the Unit 2 Turbine Building, portions of the Unit 2 turbine building sprinkler system actuated. Sixty-two sprinkler heads opened in the immediate area of the feedwater pipe

rupture due to the high heat levels associated with the event. These sprinkler heads as they opened began immediately discharging water to cool the turbine building atmosphere.

As a result of the sprinkler water and feedwater discharge due to the event the carbon dioxide (CO₂) and the Halon Fire Suppression System Control panels were affected. The CO₂ fire suppression system control panels for both the Units 1 and 2 cable tray rooms are located near the Unit 2 cable tray room access door along the column line 9 wall on elevation 45'-0". The sprinkler water discharge from the sprinkler heads directly over and adjacent to these panels intruded into the CO₂ fire suppression system control panels through multiple open conduits ends which extend from the panels to the cable tray raceway above. Therefore, the water intrusion into these panels caused the time limit switches to short in the closed position. Upon closure of these switches, the CO₂ fire suppression systems, at approximately 14:32 hours (12 minutes into the event) the Robert Shaw fire protection panel/printer in the main control room recorded the discharge of CO₂ into the Unit 2 cable tray rooms. In addition, at approximately 14:34 hours (14 minutes into the event) the Robert Shaw panel recorded the second discharge of CO₂ into the Unit 2 cable tray room. It should be noted that the bulk of CO₂ discharge, which was noticed by the licensee's loss prevention staff who conducted the personnel search and initiated the venting of CO₂ from the cable tray rooms, was in the Unit 1 cable tray room. The Robert Shaw fire protection panel/printer did not register a Unit 1 discharge throughout the duration of the pipe rupture event. Thus, as a result of the water affecting the time limit switches in the CO₂ control panels, the discharge timers did not function as designed. This allowed a total of 17 tons of CO₂ to be discharged into the cable tray rooms.

In addition, the Halon Fire Suppression System protecting Units 1 and 2 emergency switchgear rooms on elevation 9' 6" actuated at approximately 15:02 hours (42 minutes into the event as documented by the Robert Shaw panel printer). The Halon system actuation was caused by sprinkler water discharge and feedwater runoff which flowed under the elevation 27'-0" fire door (30) installed in the column line 9 wall. The water runoff cascaded down the column line 9 wall, which separates the Units 1 and 2 turbine buildings, on the Unit 1 side, entered a Halon system conduit through a conduit fitting which had the fitting cover plate removed at the time of the event. The specific conduit fitting is located directly below the open grating floor on the Unit 1 side of the elevation 27'-0" column line 9 wall fire door (30). The runoff water which entered in the subject conduit flowed through the conduit and intruded Halon control panel 1-FPH-CP-1 located on the Unit 1 side of the column line 9 wall on elevation 9'-6". The water intrusion caused the time limit, battery charger and the dual zone modules to short. Therefore, upon shorting the dual zone modules, which are associated with the manual remote actuation circuit located in the control room, the system actuated discharging 7 to 10% Halon concentration into the emergency switchgear rooms.

Since Halon extinguishing agent is heavier than air, the Halon discharge into the emergency switchgear rooms on elevation 9' 6" had basically no effect on the habitability of the main control room. Upon the initial discharge of the emergency switchgear Halon fire suppression system some leakage of Halon into the main control room through floor penetrations in the Unit 1 computer room and through the control room emergency air bottle discharge piping was noticed. However, it should be noted that the concentrations of Halon as a result of the emergency switchgear room discharge would not have created a life hazard to personnel in the control room.

Upon verification of CO₂ system discharge by the main control room, two members of the licensee's loss prevention staff responded to the cable tray rooms with self-contained breathing apparatus to conduct a personnel search of these rooms. As a part of this search, measures were taken to vent the CO₂ from the cable tray rooms by opening the doors to Units 1 and 2 mechanical equipment rooms and the respective cable tray room access doors located on elevation 45'-0" of Units 1 and 2 turbine buildings. In addition, at the time the CO₂ was being vented from the cable tray rooms the main control room annex door in the turbine building/control room complex wall and the main control room door separating the annex from the main control room were blocked open. Thus, CO₂ being heavier than air flowed down from elevation 45'-0" to the 27'-0" elevation and into the main control room annex and the main control room through the open door. In addition, during the time the CO₂ was being vented from the cable tray rooms, the main control room exhaust fan (1-VS-F-15) was operating. The operation of this fan created a negative pressure in the main control room and the main control room annex thus, causing the vented CO₂ to be drawn into the control room complex.

Presence of CO₂ in the control room can also be attributed to the fact that at the time of the event control room ventilation unit 1-VS-AC4 was out of service for design modifications and that a temporary unit which obtained its makeup air from mechanical equipment room 1 was in service. Therefore, upon venting the CO₂ from the respective cable tray room into the mechanical equipment room, this allowed the temporary control room HVAC fan unit to draw CO₂ into the control room ventilation system.

Control room personnel in the main control room annex and near the main control room door experienced shortness of breath, dizziness and nausea.

It should be noted that once it was recognized that CO₂ was present in the control room, the control room operators took the appropriate corrective actions and initiated control room emergency air supply fans 1-VSF-41 and 2-VSF-41. The starting of these fans placed the main control room at a higher pressure than the turbine building. This action assisted in diluting and exhausting the existing CO₂ levels and precluded any additional CO₂ from infiltrating into the main control room.

The licensee, as a result of the spurious fire protection system actuations associated with the feedwater pipe break event, has proposed the following CO₂/Halon fire protection system modifications:

1. Seal the open ends of all conduits leading to the CO₂ system control panels throughout the plant.
2. Replace all components within both Units 1 and 2 Cable Tray Room CO₂ control panels that show visible signs of corrosion.
3. Fully test both systems to confirm proper system operation.
4. Seal the Unit 1 control panel. A 1½" hole and a 1" hole exist in the right side wall near the bottom of the panel.
5. Replace missing 2" conduit cover under the elevation 27'-0" turbine building column line 9 wall platform and walk down all other conduits to ensure that covers to conduit, pull boxes, and junction boxes are in place and properly sealed.
6. Repair door seal on the Halon control panel and relocate identification sign.
7. Replace all existing Halon panel modules and upgrade modules to CP35 Series.
8. Perform functional tests of the Halon System for both Units 1 and 2 emergency switchgear rooms to ensure proper operation.
9. Replace Halon System check valves in discharge lines or replace rubber seals.
10. Have Halon cylinder heads replaced or reworked to ensure bottles will not leak and that seals are in good condition.
11. Have Halon bottles filled and placed in discharge header.
12. Have Halon pressure switch and solenoid covers removed and inspect for corrosion or water damage.

Based on our review of the above modifications, it appears that upon their completion the probabilities of spurious cable tray room CO₂ and emergency switchgear room fire suppression system actuations due to water/ steam intrusion will be greatly reduced. However, it is our recommendation that the licensee in addition to implementing the above proposed modifications, consider the following with respect to ensuring control room habitability and personnel safety:

1. The installation of a wintergreen odorized on Units 1 and 2 cable tray room CO₂ system,
2. The installation of a permanent O₂ analyzer with a control room audible alarm in the main control room annex,
3. The development of a procedure which will require the control room operators to pressurize the control room in the event of a gaseous fire suppression system actuation in either the cable tray rooms or the emergency switchgear rooms, and
4. The installation of predischarge visual and audible warning devices near Units 1 and 2 cable tray room doors and inside the cable tray rooms which will activate to alert personnel prior to a CO₂ system discharge.

The licensee's proposed fire protection system modifications and their evaluation and implementation of the above recommendations will be reviewed during a subsequent NRC inspection.

6. Inspector Followup Items (IFI)

- a. (OPEN) IFI (280 and 281/85-37-01), Firefighting preplans lack brigade guidance in smoke control, fire damage control and fire suppression water runoff control.

Currently, the preplans are being revised by the licensee. Currently the licensee's site loss prevention staff anticipates issuing the revised preplans by April 1, 1987.

- b. (CLOSED) IFI (280 and 281/85-37-02), Annual Fire Pump Test not being conducted following the guidance of NFPA-20. The licensee has revised periodic test (PT) procedure 24.12, fire pump flow rate test to reflect the intent of the fire pump flow test guidance of NFPA-20.
- c. (CLOSED) IFI (280 and 281/85-37-03), Review of Appendix R Fire Barrier Upgrade Program. The licensee has revised surveillance procedure PT-24.11, Fire Barriers, to incorporate the required Appendix R Fire Barrier into the Surveillance Program.
- d. (CLOSED) IFI (280 and 281/85-37-04), Review of Fire Protection Valve Cycle Test Program to verify all testable valves are being tested. The licensee has completed their valve review and has incorporated the dry pipe hose station and sprinkler system valves for Units 1 and 2 cable tunnels into surveillance procedure PT-24.1A, Fire Protection System - Testable Valves.

- e. (CLOSED) IFI (280 and 281/85-37-05), Failure to Review FPSEER Commitment Regarding Replacement of Foam Cart by Fire Truck. The fire truck's fighting equipment exceeds the equipment which was carried by the foam cart. The site loss prevention staff had advised their corporate staff by memorandum dated December 26, 1985, to request the NRC to revise their Safety Evaluation Report commitment with respect to the foam cart replacement.