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

Report No.: 50-424/88-24

Licensee: Georgia Power Company
P. O. Box 4545
Atlanta, GA 30302

Docket No.: 50-424 License No.: NPF-68

Facility Name: Vogtle 1

Inspection Conducted: June 7-9, 1988

Inspector: C. A. Patterson for P. M. Madden, Reactor Engineer — 6/27/88 Date Signed

Approved by: C. R. Herdt for T. E. Conlon, Chief, Division of Reactor Safety — 6/27/88 Date Signed

SUMMARY

Scope: This special announced inspection was in response to an Operational Event on June 3, 1988 in the area of fire protection.

Results: As a result of the event, a major weakness was found in the licensee's penetration seal design with respect to the seals ability to provide a water tight barrier between redundant safe shutdown trains, paragraph 2. This condition resulted in a safety issue which had not been reviewed.

Within the areas inspected, the following violation was identified:

Failure to adequately design and install water tight penetration seals and perform an analysis which evaluates their failure as required by License Condition 2.G, and 10 CFR 50, Appendix B, Criteria III Design Control, paragraph 2.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*G. Blockhold, General Manager
*W. Davis, Engineering Supervisor
*G. Fredrick, QA-Site Manager
T. Green, Plant Support Manager
*R. Lide, Engineering Support Superintendent
*J. Maddry, Unit 2 fire Protection Manager
*A. Mosbaugh, Assistant Plant Support Manager
*W. Nicklin, Regulatory Compliance Supervisor
*R. Pinson, Vice President
*W. Ramsey, Unit 2 Project Engineering Manager
*P. Rice, Vice President and Project Director
*T. Richardson, Project Engineering Manager
*H. Varnadoe, Engineering Supervisor

Bechtel Employee

*R. Kies, Engineering Supervisor

Insulation Consultant & Management Service Employee

NRC Resident Inspectors

*J. Rogge
*R. Schepens

*Attended exit interview

2. Followup on Fire Protection/Operational Event (Modules 64704, 92701, & 92720)

On June 3, 1988, at 0909 hours, Central Standard Time, a fire alarm was received in the control room for fire alarm zone 120.1. This zone is for the B train cable spreading room on level 2 of the control building. Immediately following the receipt of the fire alarm for the "B" train cable spreading room a fire alarm was received, at 0910 hours, in the control room for fire alarm zone 179. This fire alarm zone provides protection for the electrical equipment room on level 3 of the control building. Shortly after the receipt of the alarm condition in fire alarm zone 179 the licensee's control room operators noted that both the diesel and the electric fire pumps started. At this time the control room operators requested the plant fire team, shift support operators, and

building and grounds personnel to report to level 2 and 3 of the control building to investigate the actuation of the fire detection/protection system. Upon arrival of the licensee's personnel in corridor 230 on level 2 of the control building outside the "B" train cable spreading room, it was identified that the preaction sprinkler system (Fire Protection System) valves for systems 078 and 081 had tripped, thus charging the headers associated with the sprinkler system protecting the "B" train cable spreading room. None of the sprinkler heads installed in the cable spreading room sprinkler system fused by the pending condition and discharged water. However, the solenoid pilot valve associated with the preaction sprinkler valve trip mechanism actuated as a result of a signal from the cable spreading room smoke detection system. The pilot valve upon actuation remains open and discharges water until the system is reset. Thus, upon actuation of the sprinkler system 078 and 081 pilot valves opened and water was discharged onto the floor of room 230 through 3/8 inch diameter tubing downstream of the pilot valve. During the event the plant floor drain system associated with Room 230 and the "B" train cable spreading room removed the majority of the inadvertent water discharge. However, the water discharge from these valves seeped under the "B" train cable spreading room door and about a 1/4 to 1/2 inch of water accumulated over approximately 1/3 of the cable spreading floor area. Upon entering the "B" train cable spreading room licensee personnel identified a faint odor of smoke. The licensee's staff performed an investigation of the cable spreading room and found no evidence of fire. The licensee also sent personnel to level 3 of the control building to conduct further investigations. On level 3 an odor of smoke was present in electrical equipment room 322 and upon further investigation the licensee's staff determined that there was no evidence of fire. Upon completion of the licensee's investigation on levels 2 and 3 and the fact that no fire was present, the licensee reset the fire protection systems to stop the flow of water at 0934 hours.

At 0954 hours, during the clean up operations, the control room received a pressurizer high level deviation alarm and the pressurizer backup heaters began to cycle on and off and pressurizer power operated relief valve (PORV) PV-456A opened. The pressurizer PORV opened for approximately 5 seconds, and system pressure in the reactor coolant system dropped to approximately 2200 PSIG. The licensee's operations staff took prompt action and manually shut the PORV and block valve. In addition, the operations staff placed the backup pressurizer heaters in manual control. At 1010 hours, licensee personnel reported water leaking into the control room from the cable spreading room above. Based on the licensee's investigation it was determined that small amounts of water infiltrated the process monitoring panels directly underneath the cable spreading room.

The licensee's post event investigation revealed that Unit 2 personnel where performing a flow balance test on the control building cable spreading room level 2 and 3 HVAC system at the time of the event. In performing the test the licensee's personnel opened the outside air intake damper (AHV-12910) to make an adjustment and the inrush of cooler outside air activated the thermostat on electric duct heater (A-1539-H7-001). This energized the heater coils and the initial burnoff of dust caused a smoke odor which was carried through the ductwork and distributed into

levels 2 and 3 of the common Unit 1 and 2 control building. This condition appears to have actuated the smoke detectors which tripped preaction sprinkler systems 078 and 081.

In response to the event the licensee took the following immediate corrective actions:

*The Fire Protection Systems involved were reset to stop water flow.

*The control room process panels were covered to prevent further wetting, and the panel doors were opened to prevent overheating.

*The PORV PV-456A was declared inoperable and the LCO was initiated.

*A fire watch was established for the level 2 and 3 fire detection zones that alarmed.

*The Pressurizer backup heaters were placed in manual control.

*Sand bags were placed inside the Unit 1 "B" cable spreading room door.

*All wetted plant areas were mopped and/or toweled dry.

In addition to the above corrective actions, the licensee took the following actions to ensure that the safety systems affected by the event were functional and to further prevent water from entering the cable spreading/control room:

*The licensee initiated a work request to install RTV-732 silicone caulk between the damming angle and the concrete floor around all penetration seal assemblies in the cable spreading room.

*The licensee's engineering staff wrote a special test procedure to test the affected pressurizer pressure and level channel.

*The licensee tested the affected pressurized pressure and level channel on June 5, 1988 and the PORV was placed back in service.

*The licensee placed the fire protection sprinkler system 078, 080, and 081 out of service on 6-5-88 and established a continuous fire watch in the affected areas.

In response to the event, on June 7, 1988, the NRC Region II Office dispatched an inspector to the site to evaluate the event and the licensee's interim corrective actions. The inspector performed a walkdown of the Unit 1 "B" train cable spreading room and the control room and inspected the area which was affected by the June 3, 1988 event. During this walkdown the inspector concentrated his efforts on inspecting the cable spreading room fire/water penetration seals which were identified as

being degraded with respect to being water tight and ensuring that the licensee's interim corrective actions were appropriate.

During the event, cable spreading room penetrations seals 347, 355, 325, and 357 allowed water to leak into the control room and the ceramic damming board on the control room side of penetration seals 311, 312, 344, and 345 showed discoloration from water seepage through these seal. The licensee as a result of their post event investigation determined that water entered the control room by leaking under the steel penetration damming angle, which is seal welded to the penetration embed plate, then seeping down through the concrete voids behind the concrete and the penetration blockout steel embed plate. The licensee to preclude this type event from occurring in the future applied RTV-732 silicone sealant around the perimeter of all the floor penetrations in the Unit 1 "B" train cable spreading room. The inspector indicated that this configuration should be tested to demonstrate that this modification would correct the design error. In addition, the inspector was concerned about water impingment to the top of the seals from the overhead Fire Protection System in the cable spreading room and water infiltration into the control room. The inspector indicated that according to the licensee's design criteria DC-1003, "Flooding", Section 3.2.J, states that flooding caused by activation of the Fire Protection System shall not result in failure of a safety-related system to perform its function and therefore, the permanent seal modifications, in response to this event, should take this into consideration. The licensee indicated that they had test documentation which demonstrated that the silicone penetration sealant material was water tight. In addition, as a result of the inspector's concern the licensee performed smoke tests on seven "B" train cable spreading room penetration seal assemblies (317, 318, 319, 320, 347, 355, & 357). As a result of these tests, it was determined that penetration seals 318 and 347 had leakage through the cable bundles penetrating the silicone sealant material.

The licensee provided their test documentation, test report HT-E01-08, Hydrostrahc Test For Electrical Blockouts, which the licensee claims to qualify the Vogtle penetration seal design as being water tight. The inspector reviewed the documentation and determined that the as tested configuration did not represent the worst case "as-built" configuration which is currently installed in the floor of the Unit 1 "B" train cable spreading room. The licensee's test report documented the test of a 24 inch by 24 inch penetration seal with five conductors and a 12 inch aluminum open back cable tray penetrating the seal. The seal was installed in a steel open bottom box with a removable lid, then two inches of water was applied to the top of the seal along with 3 PSIG (Nitrogen) hydrostatic pressure for 24 hours. This seal configuration did not allow any leakage during the specified test duration. However, based on the inspector's review of this test, it appears that the only conclusion that can be made from the results of this test is that the silicone foam (RTV 3-6548) material is water resistant and that the test configuration in no manner represents the in plant penetration seal installations. In addition, the test configuration did not address the silicone to concrete interface, or the cable configuration (i.e., 100 or more cables routed through a penetration blockout) of the in plant installations.

The licensee, on June 8, 1988 and June 9, 1988, in an effort to determine the degree of the penetration seal leakage problem and to qualify the RTV-732 caulk modification to the Unit 1 upper cable spreading room penetration seals as being water tight, ran a series of water leakage tests on Unit 2 upper cable spreading room seals. It should be noted that the seal design for Unit 2 is the same as those seals which were installed on Unit 1. The inspector witnessed these tests and the following is a summary of the results:

Test No. 1

The purpose of this test was to demonstrate the licensee's theory on how the water leaked into the control room the cable spreading room.

The licensee constructed a water dam assembly around the penetrations 1060 (33" by 11 1/2" penetration opening) and 1061 (17" by 11 1/2" penetration opening) in the Unit 2 upper cable spreading room. The penetration design of penetrations 1060 and 1061 were in conformance with the typical design details as noted on the licensee's design detail AX7G11-85-2 except penetration seal 1060 had not been filled with the silicone foam seal material. With the seal material not yet installed in penetration 1060 direct observations during the test of the water leak path could be made. The water dam area around penetrations 1060 and 1061 was filled with approximately 1/2 inch of water on June 8, 1988 and approximately 5 minutes into the test, seepage was observed in penetration 1060 and the water appeared to be seeping through the concrete voids which were present behind the blockout embed plate. At 10 minutes into the test both penetration assemblies showed visible signs of leakage in the control room below.

The licensee's theory on how the water got into the control room appears to be correct.

Test No. 2

The purpose of this test was to qualify the licensee's Unit 1 silicone caulk modification.

On June 9, 1988, penetration 1060 and 1061 were tested to demonstrate that the licensee's modification which installed silicone RTV-732 caulk around the penetration steel damming angle where it interfaces with the concrete floor is water tight. The water dam around the penetration assemblies was then filled with four inches of water. This condition was to be held for 1 hour. Approximately 4 minutes into the test leakage from penetration 1061 into the Unit 2 control room was observed.

The leakage appeared to be concentrated in the corners of the penetration assembly. The water leakage through seal 1061 was at the rate of about 1 drop of water every 10 seconds. The four inch water level was held around penetration seal assembly 1060 for approximately 1 hour without any signs of leakage. The licensee's analysis of the leakage through seal 1061

indicated that the silicone RTV-732 did not cure properly due to moisture under the steel damming angle. The moisture under the angle was directly attributed to the test conducted on June 8, 1988.

Test Nos. 3 & 4

The purpose of this test was to demonstrate that the licensee's silicone caulk modification was water tight and to demonstrate that their overall penetration seal design/assemblies were water tight.

On June 9, 1988, penetration assembly 1117 (11" by 23" penetration opening), which was a completed assembly with greater than 100 conductors penetrating the silicone penetration sealant material, was tested with respect to it's water tight properties. The water dam which, was constructed around the penetration assembly, was initially filled with four inches of water and held for 30 minutes to verify that the caulk modification was water tight. This portion of the test (Test No. 3) was successful and no water leakage was identified in the control room during the duration of the test. At the end of the 30 minutes the water level in the water dam was raised to a level of two inches above the seal. Approximately, two minutes into this test (Test No. 4) significant leakage was identified in the control room below. The major portion of the leakage into the control room appeared to be down through the cable bundles. To avoid any damage to the control room components the licensee terminated this portion of the test promptly once the leakage path was established and identified.

Test No. 5

The purpose of this test was to demonstrate that the licensee's penetration seal design with limited conductors penetrating the sealant material was water tight.

On June 9, 1988, penetration seal 1107 (11" by 15" penetration opening), which was a completed seal with only two conductors penetrating and had the silicone caulk material installed, was tested to demonstrate that a penetration seal with limited conductors penetrating the silicone seal material was water tight. The water dam around the penetration seal assembly 1107 was filled with water until a level of two inches of water above the seal was achieved. Approximately 20 minutes into the 30 minute test leakage of water on the control room side of the seal was identified. The leakage which was identified appeared to be originating and seeping through the northwest corner of the assembly where the silicone sealant material came in contact with the steel damming angle. In order to preclude any damage to control room equipment/components this test was terminated by the licensee once the leakage path was identified.

As a result of the June 3, 1988 event, the failure of Unit 1 "B" train cable spreading room penetration seals to pass the smoke test, and the failures associated with the Unit 2 penetration seal tests as documented above, the licensee's penetration seal design and installation failed to

meet Vogtle Unit 1 license condition 2.G. License condition 2.G., requires that the licensee implement and maintain in effect all the provisions of the approved fire protection program as described in the final safety analysis report for the facility, as approved in the NRC's Safety Evaluation Report (SER NUREG-1137) through Supplement 5. In the Vogtle Unit 1 SER dated June 1985, Section 9.5.1.1, "Fire Protection Requirements", states that 10 CFR 50, Appendix A, General Design criteria (GDC) 3 requires that fire fighting systems be designed to ensure that rupture or inadvertent operation does not significantly impair the safety capability of structure, systems, and components important to safety. The licensee by letter dated February 22, 1985 stated the components required for hot shutdown are designed so that rupture or inadvertent operation of the fire suppression systems will not adversely affect the operability of these components. In addition, the licensee stated that redundant trains of components that are susceptible to damage from water spray are physically separated so that manual fire fighting activities will not adversely affect the operability of the components not involved in the postulated fire.

Contrary to the above, prior to the June 3, 1988 event, a postulated fire in the Unit 1 "B" train cable spreading room with either automatic actuation of the cable spreading room sprinkler system and/or manual fire suppression activities, could have rendered the "B" train of safe shutdown equipment inoperable. In addition, as demonstrated by the June 3, 1988 event, the condition of the cable spreading room penetration seals with respect to their ability to preclude water from entering the control room, "A" train safe shutdown components could have been rendered inoperable or could have spuriously operated in an adverse manner. The auxiliary shutdown panel under this postulated fire condition would not be available for shutdown since this panel is associated with the "B" train. Thus, the postulated fire in the "B" train cable spreading room causes a loss of the "B" train safe shutdown functions, the auxiliary shutdown panel, and due to the water leakage into the control room from the fire suppression activities in the cable spreading room above, "A" train safe shutdown process monitoring functions, since these circuits are not isolated from the control room, could have been rendered inoperable. Failure to perform a complete analysis of the impact of the above postulated event is contrary to license condition 2.G., and 10 CFR 50, Appendix B, Criteria III requirements and is identified as violation 424/88-24-01.

The inspector reviewed the licensee's interim corrective actions as previously described above and found them to be acceptable. In addition, the licensee has established a continuous fire watch in the Unit 1 "B" train cable spreading room as a compensatory measure and the licensee will maintain it in effect until an acceptable water tight penetration seal design can be tested and installed. The inspector found the licensee's compensatory measures (which exceeded the associated fire protection action statements) and interim actions to provide adequate justification with respect to continued plant operation.

3. Exit Interview

The inspection scope and findings were summarized on June 9, 1988, with those person identified in paragraph 1 above. The inspection findings identified in this report were originally identified as a Unresolved Item pending NRC management review. Based on NRC's management's review of the issues a subsequent telephone exit interview was held with the licensee on June 16, 1988 and the unresolved item was identified as a violation. The inspector described the areas inspected and discussed in detail the results of the inspection and the finding listed below. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during this inspection. Dissenting comments were not received from the licensee.

Item Number	Description and Reference
424/88-24-01	Violation - Failure to adequately design and install water tight penetration seals and perform an analysis which evaluates their failure as required by License Condition 2.G and 10 CFR 50, Appendix B, Criteria III Design Control, paragraph 2.