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

Report No.: 50-395/85-37

Licensee: South Carolina Electric and Gas Company
Columbia, SC 29218

Docket No.: 50-395 License No.: NPF-12

Facility Name: V. C. Summer

Inspection Conducted: September 7 - 30, 1985

Inspector: A. J. Johnson for 10/29/85
C. W. Hehl Date Signed

A. J. Johnson for 10/29/85
Perry C. Hopkins Date Signed

Approved by: F. S. Cantrell 10/29/85
F. S. Cantrell, Section Chief Date Signed
Division of Reactor Projects

SUMMARY

Scope: This routine, unannounced inspection entailed 385 inspector-hours onsite in the areas of plant tours; operational safety verifications; monthly surveillance observations; monthly maintenance observations; a review of the licensee program for maintenance modifications and design changes; and a review of operating events.

Results: One violation was identified - with the unit at power, a feedwater isolation valve was rendered inoperable for a period of approximately ten days.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*O. Bradham, Director, Nuclear Plant Operations
*K. Woodward, Manager, Operations
B. Williams, Supervisor of Operations
*M. Quinton, Manager, Maintenance
*M. Browne, Manager, Technical Support
*B. Croley, Group Manager, Technical and Support Services
*A. Paglia, Manager, Nuclear Licensing
*H. Sefick, Associate Manager, Station Security
*P. LaCoe, Nuclear Licensing
*G. Putt, Manager, Scheduling and Maintenance
*R. Campbell, Engineer, ISEG
*H. Donnelly, Senior Licensing Engineer, Licensing Engineering
*A. Koon, Associate Manager, Regulatory Compliance
*M. Fowlkes, Engineer, Regulatory Compliance
*S. Hunt, Quality Assurance

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

*Attended exit interview

2. Exit Interview

The inspection scope and findings was summarized on September 27, 1985, with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed the inspection findings. One violation was identified:

> Violation 50-395/85-37-01: With the unit at power, a feedwater isolation valve was rendered inoperable by isolation of its instrument air supply for a period of approximately ten days.

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

During the exit interview, the licensee did state that they were concerned with a Trip Report discussing the results and findings from a site visit on July 22 and 23, 1985, by two NRR persons and one Region II inspector conducting a review of limited aspects of the licensee's training program. The licensee expressed a concern that this report had been placed in the Public Document Room without the licensee being forwarded a copy. The inspectors acknowledged the licensee's comment.

3. Operational Safety Verification (71707, 71710)

The inspector observed control room operations, reviewed applicable logs and conducted discussions with control room operators during the report period. The inspector verified the operability of selected emergency systems, reviewed removal and restoration logs, and tagout records, and verified proper return to service of affected components. Tours of the control, auxiliary, intermediate, diesel generation, service water and turbine buildings were conducted to observe plant equipment conditions including potential fire hazards, fluid leaks, and excessive vibrations, and to verify that maintenance requests had been initiated for equipment in need of maintenance. The inspector, by observation and direct interview, verified that the physical security plan was being implemented in accordance with the Station Security plan.

Within the areas inspected, no violations or deviations were identified.

4. Surveillance Observation (61726)

During the inspection period, the inspector verified by observation/review that selected surveillances of safety-related systems or components was conducted in accordance with adequate procedures, test instrumentation was calibrated, limiting conditions for operation were met, removal and restoration of the affected components were accomplished, test results met requirements and were reviewed by personnel other than the individual directing the test, and that any test deficiencies identified during the testing were properly reviewed and resolved by appropriate management personnel.

Within the areas inspected, no violations or deviations were identified.

5. Maintenance Observation (62703)

Station maintenance activities of selected safety-related systems and components were observed/reviewed to ascertain that they were conducted in accordance with regulatory requirements. The following items were considered in this review: the limiting conditions for operations were met; activities were accomplished using approved procedures; functional testing and/or calibrations were performed prior to returning components or systems to service; quality control record were maintained; activities were accomplished by qualified personnel; parts and materials used were properly certified; and radiological controls were implemented as required. Maintenance Work Requests were reviewed to determine status of outstanding jobs to assure that priority was assigned to safety-related equipment which might affect system performance.

Within the areas inspected, no violations or deviations were identified.

6. Maintenance/Modifications and Design Changes (37700)

The inspectors reviewed four design changes and modifications, not previously approved by NRR, (along with four that had been approved by NRR) to ascertain that the changes had been appropriately reviewed and approved by the licensee in accordance with section 6 of the Technical Specifications (TS), and 10CFR50.59.

Item	Area	Modification No.	Subject
1	Reactor Control	MRF 20208	Reactor Trip Switch-gear
2	Reactor Coolant System	MRF 20249	Overpressure Protection Modification
3	Plant Electrical	MRF 20448	Diesel Generator (DG) Control and Relay Panel Relocation
4	Radwaste	MRF 20172	Mixer Added to Waste Monitor Tank
5	Nuclear Blowdown System	MRF 20571	Nuclear Blowdown Holdup Tank Stabilizer Supports
6	Protection System (startup)	MRF 20354-A	Design Review, Westing-house CAB Drawing Review
7	Reactor Heat Removal	MRF 20435	Reactor Heat Removal Calibrations Set Point
8	Electrical	MRF 20560	Electrical Fire Carrier Certification

During the review, the inspectors verified (1) that the design changes were reviewed and approved in accordance with TS and established QA/QC controls, (2) that design changes were controlled by established procedures, (3) that the licensee conducted a review and evaluation of test results, that these test results were within previously established acceptance criteria, that any test deviations were resolved and necessary retesting was accomplished as appropriate, (4) that operating procedure modifications were made and approved in accordance with Technical Specifications (TS), and (5) that as-built drawings were changed to reflect the modifications. For modifications, the inspectors observed (1) that change activities were conducted in accordance with the appropriate specifications, drawings, and other requirements, (2) that acceptance and startup testing of modifications were conducted in accordance with technically adequate and approved procedures, and (3) the implementation of appropriate controls (e.g.,

firewatch, portable fire fighting equipment, welding and cutting permit, etc.). Additionally, the inspectors reviewed the outstanding facility change requests (FCR) and determined that an excessive backlog was not developing.

The following Technical Services Procedures and Station Administration Procedures were reviewed:

Station Administration Procedure SAP 133, Design Control/Implementation, Revision 3, April 25, 1985

Technical Services TS 128, Initiation, Evaluation, and Approval of Design/ Modification Requests, March 1, 1984

Technical Services TS 129, Design Development/Design Package, March 1, 1984

Technical Services TS 130, Design Analyses and Calculations, March 1, 1984

Technical Services TS 131, Design Verification, March 1, 1984

Technical Services TS 132, Technical Services Disposition of Modification Change Notices, March 1, 1984

Technical Services TS 133, Preparation of Interim Drawings/Sketches, March 1, 1984

Technical Services TS 134, Temporary Bypass, Jumper, and Lifted Lead Review, October 12, 1984

Technical Services TS 135, Station Design Change Interface and Implementation, March 1, 1984

A review was conducted of the Engineering Project Printouts to include technical services tracking system.

It appears that the licensee has established and scheduled training and familiarization with current and past changes/modifications etc., affecting plant conditions and training for appropriate licensee personnel prior to these personnel assuming responsibilities in the plant.

Based upon interviews with licensee personnel in engineering, licensing, regulatory compliance, maintenance and operations, interfaces appear to be functioning adequately. Generally, engineering had a good handle on the total design/modification process.

Further, a review/sampling of records reflect adequate control at all levels.

Within the areas inspected no violations or deviations were identified.

7. On-site Followup of Operating Events (93702)

During this inspection period, the inspectors reviewed operating events which occurred at the facility. The focus of this review was to ascertain the safety significance of the event; evaluate performance of safety systems and actions taken by the licensee; confirm that proper notifications of the event, if required, had been made in accordance with 10CFR50.72; and evaluate the need for further or continued NRC response to the event.

a. Loss of Instrument Air Event

On September 8, 1985, the licensee reported to the NRC that, at 4:40 p.m. on September 8, 1985, the Turbine Driven Emergency Feedwater Pump, (TDEFW) was determined to be rolling at approximately 200 - 250 revolutions per minute (RPM) with no TDEFW start signal present and the steam inlet valve (XVG-2030) indicating closed. The main steam header supply valves to TDEFW pumps A and B, from B and C steam generators respectively, were closed and the TDEFW speed was reduced to zero. The determination that the TDEFW pump was rolling was made by the control operators following problems with the instrument air (IA) compressors which resulted in a short term reduction in IA header pressure.

At 4:40 with the unit at 100 percent power "B" instrument air compressor tripped on an indicated high vibration, high temperature and high lube oil temperature. Upon indication that the "B" IA compressor trips, the operator started "A" IA compressor. "A" IA compressor started, but apparently failed to supply air as the IA header pressure continued to decrease. The operator then attempted to place a third, supplemental air compressor, in service. The supplemental air compressor started, but tripped almost immediately on high discharge pressure. At 4:47 "B" air compressor auto started on low header pressure, control was transferred by the operators local manual control, and IA header pressure was restored to a near normal valve of 95 PSIG. Normal IA header pressure is approximately 110 PSIG. Subsequent to the restoration of "B" IA compressor, a mobile diesel driven air compressor was hooked up to the IA header, but would not start due to a dead battery. Following stabilization of IA header pressure, the TDEFW pump was declared inoperable at 5:30 p.m. on September 8, 1985 based on apparent excessive seat leakage through the steam inlet valve PVG-2030 allowing the turbine to roll at low RPM. The low RPM makes the turbine unreliable due to concerns with poor bearing lubrication and pressurizing the Woodward governor, with the potential for an overspeed trip following receipt of an automatic start signal. During subsequent trouble shooting by operations to determine the scope of the TDEFW pump problems, the pump was observed to roll even with the trip throttle valve closed.

Subsequent evaluation and trouble shooting determined that steam inlet valve PVG-2030 had experienced steam cutting of the valve seat allowing excessive seat leakage. The valve seat was subsequently repaired and the valve returned to service. The observed phenomenon of the TDEFW

pump rolling with the trip throttle valve closed was determined to have resulted from the "normal" valve alignment of maintaining the XVT-2803 A and B, TDEFW pump turbine throttle valves drain valves open two turns to allow draining of moisture collecting in the above and below seat areas of this valve. The maintaining of these drain valves two turns open effectively short circuited the steam around the trip throttle valve. The licensee's valve alignment procedures have been changed to require the XVT-2803 B below seat drain to be maintained fully closed, with any moisture collecting in this area now being drained through the turbine casing drains. The TDEFW pump was successfully tested and returned to service at 10:10 a.m. on September 11, 1985.

Although the above problems with the TDEFW pump were identified following the September 8, 1985 partial loss of instrument air, the licensee has not been able to definitively determine whether the TDEFW pump was rolling at low RPM prior to the event. The steam inlet valve, PVG-2030, fails open on loss of IA, but the air system for this valve has an accumulator to allow limited operation of the valve following a loss of IA. Since the as found testing of the leak tightness of this accumulator and associated piping was not performed prior to its being disturbed during repair of valve PVG-2030, a determination of the effect of the partial loss of IA on September 8, 1985 cannot be made. Post maintenance testing of the PVG-2030 valve included testing of the valve's ability to function upon isolation of the IA supply; excessive leakage in the IA system was not identified during these tests. Review of the performance of Surveillance Test Procedure (STP) 120.002, TDEFW Pump Test, a monthly STP requiring the running of the TDEFW pump and includes operator verification that the TDEFW turbine rolls to a stop following closure of valve PVG-2030, indicates that on August 26, 1985 the turbine rolled to a stop following closure of PVG-2030. Aside from the performance of STP 120.002, routine periodic determination that the TDEFW pump is not rolling, is not performed.

With regard to the TDEFW pump reliability concerns associated with the turbine rolling at low RPM, prior to declaring the TDEFW operable on September 11, 1985, the licensee's engineering organization evaluated the bearing lubrication concern and determined that no adverse affect on system reliability was expected. The licensee engineering organization was pursuing but had not completed their evaluation of the potential for a turbine trip on overspeed occurring as a result of the TDEFW pump rolling at low RPM supplying oil to the governor speed setting cylinder. The potential reliability concern associated the governor's ability to control turbine speed during a start when previous shaft motion was present (as was the case on September 8, 1985) is potentially generic concern identified following a December 1984 event at Crystal River Unit 3 and discussed in IE Report 50-302/85-04.

As identified above, following the initial trip of the running IA compressor "B" on September 8, 1985, apparent multiple sequential failures prevented the installed standby and the supplemental air

compressor from performing their intended function. The plant instrument air systems, although not a safety related system, are of concern in their potential affect on the safety related components served. By design, the plant instrument air systems are not required to function to mitigate the consequences of an accident in that all valves are either designed to fail to the required accident mitigation position or are provided with air accumulators. A loss of instrument air should not affect the ability of safety systems to perform their safety functions. Unfortunately, instrument air systems that are not properly maintained have been known to precipitate corrosion and fouling related failures in safety related systems. Thus maintenance and reliability related problems in IA systems must be examined closely to ascertain if they are indicative of a lack of adequate preventative maintenance on the IA system which could precipitate safety system failures. A review of the V.C. Summer program to assure quality of IA determined that the IA systems were periodically monitored only by the Health Physics organization to assure the air met breathing air requirements. The amount of moisture (dewpoint) in the IA system is not periodically monitored to assure proper air dryer operation. A review of the maintenance performed on the IA compressors following the September 8, 1985 event did not identify any failure mechanisms directly attributed to IA quality. Despite the absence of a program for monitoring the quality of instrument air, no apparent degradation of safety related components has resulted.

b. September 20, 1985 Reactor Trip

On September 20, 1985, the licensee notified the NRC that at 8:58 p.m. a reactor trip from 100 percent power had occurred in response to a turbine trip initiated by a trip of all main feedwater (MFW) pumps. The MFW pump trip initiated during the conducted of a special test to determine condensate pump net positive suction head (NPSH) in preparation for a planned modification to convert these pumps from variable speed to constant speed units. Following the reactor trip, the plant responded as expected with the exception that the MFW isolation valve XVG-1611B failed to close in response to the expected automatic feedwater isolation on low reactor coolant average temperature coincident with P-4 (reactor trip breakers open), and intermediate range nuclear instrumentation channel (NI) 36 failed downscale. The feedwater isolation valve and NI-36 were repaired and tested and the unit was returned to power on September 22, 1985.

The condensate pump test in progress which resulted in the reactor trip was conducted to determine the NPSH of the condensate pumps at design pump speed and maximum pump speed by taking manual speed control of each pump and increasing pump speed while monitoring pump parameters. To avert a trip of the condensate pumps on high discharge pressure during the testing, the pressure transmitter in the common condensate pump discharge header was isolated. The isolation valve for this transmitter apparently allowed sufficient leakage to allow the

transmitter to sense the elevated header pressure expected during the testing and initiate a trip of the condensate pumps.

Subsequent evaluation of the above identified failure of NI-36 downscale, following the reactor trip, was determined to have resulted from excessive detector compensating voltage. The compensating voltage was adjusted, the channel tested and was returned to an operable status prior to plant restart.

During plant startup following this reactor trip, a misaligned instrument block equalizing valve for flow transmitter IFT 3571 rendered the emergency feedwater (EFW) flow control valve IFV 3546 incapable of automatically isolating EFW flow from the TDEFW pump. This finding and a discussion of the failure of the main feedwater valve XVG-1611 B to close as identified above are discussed in detail below.

c. Misaligned Equalizing Valve

On September 20, 1985, the licensee found emergency feedwater header flow transmitter IFT 03571 inoperable because of an open equalizing valve on the transmitter manifold. With this transmitter inoperable isolation of emergency feedwater to steam generator B on high flow was also inoperable.

The licensee identified the discrepancy and took immediate action to rectify the situation. The design analysis descriptions mitigate the consequences of such an event. That the licensee's Emergency Procedure further mitigates the situation, and by review of related documents indicate that this is a highly isolated case with minimum consequences. There appears to be no programmatic deficiencies, relative to this occurrence, therefore, no notice of violation will be issued.

d. Failure of MFW Isolation Valve to Close

Following the reactor trip on September 20, 1985, MFW isolation valve (FWIV) XVG-1611B failed to close in response to a feedwater isolation signal on low reactor coolant average temperature coincident with permissive reactor trip breakers open. Subsequent licensee evaluation determined that the manually operated instrument air supply valve to valve XVG-1611B had been isolated and the associated air receivers had bled down to a pressure insufficient to allow valve closure. The instrument air supply valve was determined to have been closed on September 10, 1985, in conjunction with the disposition of a previously identified problem in a portion of the valve hydraulic circuit not required for FWIV 1611B to close in performance of its accident mitigation function.

The FWIV at V.C. Summer use hydraulic pressure to open and close the valve. Instrument air pressure is necessary to position a 4-way valve that directs the hydraulic pressure to the under or above valve actuating piston area. The 4-way valve does not move and the FWIV fails as is on loss of instrument air. The valve operator has two redundant air/hydraulic circuits labeled active and stand-by. The active side circuit alone receives signals from the Engineering Safety Features (ESF) system to provide FWIV functions required for safe shutdown and accident mitigation. The inactive side receives signals for waterhammer and steam generator baffle bolting protection as well as a permissive for forward flushing (feedwaterline warming) opening. Thus the accident mitigation functions are performed by the active side alone. This particular design, the valve receiving only a train "A" ESF signal, is an accepted configuration in that the feedwater regulating valves receive both train "A" and train "B" ESF signals and the main feedwater pumps receive a train "B" ESF (safety injection) trip signal. The use of non-safety related components (feedwater regulating valves and the main feedwater pumps) for redundant accident mitigation in a steam break senario has been accepted by the NRC as discussed in NUREG 0138, page 1 - 11.

The previous problem with the FWIV noted above which resulted in the isolation of IA to valve XVG-1611 B involved a defective 4-way valve in the stand-by hydraulic circuit. Pending replacement of this defective component at the next shutdown the licensee performed an engineering evaluation in accordance with 10CFR50.59 and determined that since the active side of the hydraulic circuit was unaffected by the defect, the valve remained operable. The 10CFR50.59 evaluation, attached to Non-conformance Notice (NCN) 2032, determined that the FWIV would meet its functional requirements if the active side (train "A") hydraulic accumulator is pressurized to at least 4800 psig.

Although not addressed in the disposition of the inactive side problem, the defective 4-way valve caused the inactive hydraulic circuit to be at a reduced pressure resulting in the air driven hydraulic pump running constantly in an attempt to change this side. To reduce unnecessary wear on this pump, on September 10, 1985, a decision was made to isolate IA air to the pump and establish a twice per shift surveillance of the pressure in the hydraulic accumulator in the active side to ensure pressure was maintained via the hydraulic accumulator check valves. The IA supply isolation valve was subsequently closed. Review of the IA isolation aspect of this event and the decision process was indeterminate in that documentation was not available to be examined. The IA valve was not removed from service under the tag out program. Its closure was not addressed on the disposition of NCN 2032. Thus apparently no formal evaluation was performed or deemed necessary

at the time. Concern over the bleed down of the air accumulators was apparently not considered. It is noteworthy to mention that currently there is no installed instrumentation to monitor air reservoir pressure.

By design, a loss of IA (a non-safety system) should not preclude the ability of this valve to perform its accident mitigation function. Air reservoirs (accumulators) with associated check valves are provided to maintain the required approximately 75 psig air pressure necessary to position the 4-way valves to allow valve closure. With IA isolated, either leakage through the IA reservoir check valves or other FWIV components allowed the IA pressure to bleed down to a pressure that was insufficient to close valve XVG-1611B. No data is available to determine the actual cause of this air bleed down as the licensee performed no leakage testing on valve XVG-1611B's air circuits prior to replacement of the defective inactive side 4-way valve. Subsequent "snooping" of the IA circuits on September 24, 1985, did not identify any leakage.

Technical Specification (TS) 3.7.1.6 requires that with the plant in Modes 1, 2 or 3, each feedwater isolation valve be operable. For a component to be considered operable, TS definition 1.18 specifies that it must be capable of performing its specified functions. One of the safety functions of the FWIV is to close and isolate feedwater in response to an ESF signal calling for feedwater isolation.

As identified above, during the period from about September 10, 1985, until September 20, 1985, FWIV XVG-1611B was rendered inoperable for performance of its safety functions by isolation of its instrument air supply. During this period, the unit was operated at 100% power and when called upon to function to limit cooldown of the reactor coolant system subsequent to the September 20, 1985 reactor trip, it did not function. This is a violation (50-395/85-37-01).

On April 30, 1985, the NRC issued Information Notice (IEN) 85-35, Failure of Air Check Valves to Seat". IEN 85-35 discussed a potentially significant problem concerning Parker-Hannifin check valves supplied as part of the valve operators on Anchor/Darling Main Steam Isolation Valves (MSIV) and FWIV. These check valves, which are installed on the IA supply line to the air reservoirs, have been demonstrated to fail to seat during a slow depressurization of the IA supply line. As a result the MSIV or FWIV air reservoir would bleed down rendering the valve incapable of being closed. IEN 85-35, Attachment 2, identified V.C. Summer Station as a plant with FWIV supplied by Anchor/Darling Company with these Parker-Hennifin air check valves.

Inspection review of the licensee's evaluation and actions associated with this IEN determined that the licensee's Nuclear Engineering Group had determined that FWIV-1611A, B and C had been supplied with these type check valve as identified in their August 21, 1985 letter to the

plant and recommended that these check valves be replaced at the "earliest opportunity". This initial evaluation of IEN 85-35 by Nuclear Engineering did not address or put forward any justification for continued operation of the facility pending replacement of these check valves. In light of the above bleed down of the air reservoirs for valve XVG-1611B, and the lack of data to exclude failure of the check valve to seat as a cause, the licensee on September 25, 1985 completed an engineering evaluation to justify continued operation until the valves are replaced. NRC review of this evaluation was still in progress. Replacement of these valves is scheduled during the October - November 1985 refueling outage. Completion of NRC review of this justification and replacement of valves is an Inspector Followup Item 50-395/85-37-02.