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

Report No.: 50-395/88-15

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

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

Facility Name: Summer

Inspection Conducted: June 13-17, 1988

Inspector: R. H. Bernhard — 19 July 88, Date Signed

Approved by: F. Jape, Chief — 7/26/88, Date Signed
Test Programs Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope: This routine, unannounced inspection was conducted in the area of the Service Water System. A review was performed of the current system, its design basis and those plant actions taken to respond to current generic NRC service water concerns. A system walkdown was conducted, and surveillance test results were reviewed.

Results: This inspection showed the Service Water System to be maintained in accordance with the existing requirements of the technical specifications and the guidelines of ASME. The plant personnel are not in a mode of looking for problems related to Service Water. Problems are dealt with as they occur, instead of being anticipated. This approach is consistent with the observations made on Service Water Inspections of the programs at other licensee's facilities. Although IE Bulletin 81-03 "Flow Blockage of Cooling Water to Safety Related Components by Corbicula sp.", was issued in April of 1981, only relatively recently has the plant been actively seeking a solution to its clam problem. Degradation of service water performance has been noted in the past. Potential future problems include silting and microbiologically induced corrosion.

A system walkdown showed the system to have a well kept appearance. Performance testing on the active components shows them to be within the ASME Guidelines. The system engineer concept was recently instituted at the plant. The focus on the system as a whole resulted

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in Service Water flow balancing being performed recently at the request of the system engineer. This was beyond the minimum required testing.

Overall, the plant would rate average with other plants inspected with respect to its service water system programs. The system is better instrumented with respect to flow and temperature than most. The programs for assuring system performance are more reactive than proactive, however.

One violation, one deviation, and one unresolved item were identified. The violation was failure to provide an adequate procedure for Service Water operations during an extended equipment outage. This is discussed in Section 4 of the report. The deviation involved Reactor Building Cooling Units air flows at less than the FSAR design flows. This is discussed in Section 3 of the report. The unresolved item is a question of adequacy of the 'C' Service Water Pump. This is discussed in Section 3 of the report.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

L. C. Allen, Shift Supervisor, Operations
*W. R. Baehr, Manager, Chemistry and Health Physics
*O. S. Bradham, Director, Nuclear Plant Operations
*M. N. Browne, General Manager, Station Support
*W. R. Charleston, Independent Safety Engineering Group
*R. B. Clary, Manager, Design Engineering
A. J. Cribb, Jr., Plant Chemist
*B. T. Estes, Senior Mechanical Engineer, Design Engineering
*W. R. Higgins, Supervisor, Regulatory Compliance
*S. R. Hunt, Manager, Quality Systems
A. R. Koon, Jr., Manager, Nuclear Licensing
*G. V. Meyer, Design Engineering
*G. D. Mofatt, Manager, Maintenance Services
*D. R. Moore, General Manager, Engineering Services
*J. L. Skolds, General Manager, Station Operations
*G. G. Soult, Manager, Operations

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

Other Organizations

W. H. Carroll, Jr., BETZ Industrial

*Attended exit interview

2. System Description

A review of the V. C. Summer's Service Water System was performed June 13-17, 1988. The inspection consisted of review of selected parts of the system design, a plant system walkdown, a review of parts of the surveillance program for the Service Water equipment, and interviews with the system engineer and the plant chemist.

The V. C. Summer Service Water System consists of a dedicated Service Water Cooling Pond, three main Service Water Pumps and their support equipment, piping to the low pressure loads, two booster pumps, the piping to the higher pressure loads (the Reactor Building Cooling Units) and the return piping to the pond. The system's function is to provide cooling water to its loads. The system is safety related.

The piping, after leaving the main pumps discharge, separates the system into two independent trains, A and B. The C main Service Water Pump can provide water to either the A or B train. The system has instrumentation for monitoring flow to the major loads and temperature of the discharged coolant. The loads include the Component Cooling Water Heat Exchangers, the Diesel Generator Heat Exchangers, the HVAC chillers, the Service Water Pump bearings, the Diesel Generator Air Compressor After Coolers, the Service Water Pump House cooling coils; and during accidents, the Reactor Building Cooling units.

The Service Water cooling pond is interconnected with the Lake Monticello Reservoir and is filled with raw lake water. The water is not treated chemically prior to input into the Service Water piping.

The RBCUs are normally cooled by plant Industrial Cooling Water, a closed, treated, non safety-related water system. During an accident, the RBCUs change over to untreated Service Water. Mixing of the treated and untreated water occurs during the change over.

Potential problems for V. C. Summer's service water system can include almost the full spectrum of problems experienced at other plants. The raw water source is known to contain silt and clams. The conditions can lead to blockages, fouling and Microbiologically Induced Corrosion (MIC). Algae is also present as a source of possible blockage or fouling.

3. Review of System Design and Testing (61701)

During the inspection a review was performed of the current design of the Service Water System as represented in the FSAR, the Technical Specifications and the Design Basis Document for the system. Current flow diagrams of the system and interfacing systems were reviewed. Reviews were conducted of the System Operating Procedure (SOP), the Annunciator Response Procedures (ARPs), Surveillance Test Procedures (STPs) and a Mechanical Maintenance Procedure.

Past test results of component and system testing were reviewed. These results included some system startup tests, STP results, and recent testing performed by the system engineer.

Review of STP results showed the 'C' service water pump to have a lower output than either the 'A' or 'B' pump. The review of the startup results indicated the 'C' pump was marginally over the flow required for proper system operation. The five percent margin built into the purchase specification requirements for future pump degradation was not available in the 'C' pump as tested during startup. Current methods of testing for ASME requirements do not test the pumps at their design values, so it is difficult to determine adequacy in the pump as it exists today. Any degradations below the startup condition could make the 'C' pump less than fully operable.

During the time of the inspection, the 'C' pump was placed into service on the 'B' loop of Service Water while the 'B' pump was unavailable. This is the weakest configuration for the system. After about a day of operation, a drop in flow to below the FSAR requirements was noticed in the 'B' loop RBCUs. By varying the flow through the heat exchangers through valve manipulations, adequate flow was restored to the RBCU. The 'B' pump was brought back into service soon after the restoration. Unresolved Item 50-395/88-15-01, "Operability Determination of the C Service Water Pump" is identified to track this potential problem.

Another problem was noted in the review of the FSAR. The FSAR identifies in Table 6.2-1 the "General Containment Design Evaluation Parameters". The flow through the RBCUs was assumed to be 61,500 cfm/unit. Figure 6.2-15 of the "Design Reactor Building Cooling Unit Heat Removal Rate" and Figure 6.2-62 of the "Removal Rate Reactor Building Cooling Unit Atmosphere Heat," both assume design conditions of 61,500 actual cubic feet per minute air flow per unit. System testing to meet the requirements of Technical Specification 3/4-6.3, Particulate Iodine Cleanup System, tests the airflow rate through the RBCUs. Airflow was also tested in the system preoperational test. The May 5, 1987 STP test results show airflows as follows:

RBCU 1A	57,317 CFM
RBCU 1B	55,958,CFM
RBCU 2A	58,880 CFM
RBCU 2B	58,138 CFM

The preoperational test results also had flows less than 61,500 CFM.

The test results meet the flow requirements of T.S. 3/4.6.3 of 60,270 ± 10%, but do not address the higher required values of the FSAR for heat removal flows assumed in the containment analysis.

The condition has existed since startup. The plant entered an LCO based upon the lower than required airflows pending reanalysis. This low airflow is a deviation from the requirements of the FSAR. The deviation is 50-395/88-15-02, RBCU Airflow less than FSAR Design Requirements.

After the end of the inspection, analysis showed adequate heat removal would exist with the lower airflows in existence at the time of the inspection. However, a new problem was identified. The Technical Specifications allowed a 10% lower flow tolerance than was analyzed for iodine removal in the plant design. This new problem will be tracked as part of the same deviation.

The two problems involving the flow testing of the pumps and of the air units show an area that needs improvement. The ASME acceptance criteria for the pumps are not bounded by the system design requirements for the components. ASME test results show adequate pump performance with values that the FSAR defines as unacceptable to proper system operation. The STP acceptance criteria for the air units show a similar problem. If a parameter is measured as part of a surveillance test, efforts should be made to insure the acceptable band of performance, as defined by ASME or some other standard, does not include areas unacceptable to the system design requirements.

In addition, currently, the system engineers are not part of the review cycle for STP data acceptance or review. A review of data by the system engineers would provide an additional assurance that the components meet all requirements for system operation.

The documents reviewed included the following:

a. Final Design Description for Service Water System, July 17, 1986
b. Design Basis Document for Service Water System, Revision 1, SW3, March 4, 1988
c. FSAR, Chapter 9.2, Water Systems, Amendment 3, August 1987
d. FSAR, Chapter 6.2.2, Reactor Building Heat Removal Systems, Amendment 3, August 1987
e. V. C. Summer Technical Specifications
f. SOP-117, Service Water System, Revision 12
g. Annunciator Response Procedure, ARP-001-XCP-604, Revision 4, September 30, 1987
h. Annunciator Response Procedure, ARP-001-XCP-606, Revision 3, July 17, 1987
i. STP-123.001, Service Water System Valve Lineup Verification, Revision 4, March 10, 1988
j. STP-123.002, Service Water System Pump Test, Revision 9, September 23, 1987
k. SPT-123.003, Service Water System Valve Operability Test, Revision 7, May 14, 1987
l. STP-553.001, Reactor Building Cooling Units Performance Test, Revision 2, August 4, 1986, and Change A, April 29, 1987
m. MMP-460.022, Inspection, Cleaning, Lubrication Of Fan Coil Units, Revision 2, November 20, 1986
n. MRF No. 20992, SW Screen Wash Pump XPP-44A, March 21, 1986
o. SFR 4809, Service Water Pumps, September 3, 1981
p. SFR 3481, Service Water Pumps, November 10, 1980, May 18, 1981, January 5, 1981, and August 7, 1981
q. SFR 5549, Service Water Flow Diagrams, May 6, 1982
r. Technical Work Record, Serial 13867, April 28, 1987, Test Results 'A' SW, Tab 1B
s. Technical Work Record, Serial 13867, May 15, 1987, Test Summary PRP-026, Change A, Trains A and B
t. Technical Work Record, Serial 13867, April 30, 1987, Test Summary 'B' Train, Tab 1B
u. Technical Work Record, Serial 13867, June 1, 1988, Engineering Review of PTP-172.002, Test Results of May 27, 1988
v. Various Surveillance Test Procedure Results From Plant Records
w. Drawings:
x. B-208-101, SW04, Service Water Pump C, Channel B, Page A-D, Revision 8

y. B-208-101, SW01, Service Water Pump A, Channel A, Page A-D, Revision 7
z. B-208-101, SW02, Service Water Pump B, Channel B, Page A-D, Revision 7
aa. B-208-101, SW03, Service Water Pump C, Channel A, Page A-D, Revision 10
bb. B-208-002, Relay Internals Revision 2
cc. B-208-101, SW14A, and B Service Water Pump Speed Switch, Revision 6
dd. SW System Isometric Drawing, SH-10071-SR
ee. D-302-221, Service Water Cooling System Flow Diagram, Revision 14
ff. D-302-222, Service Water Cooling System Flow Diagram, Revision 23
gg. D-302-611, Component Cooling Flow Diagram, Revision 20
hh. D-302-612, Component Cooling Flow Diagram, Revision 17
ii. D-302-613, Component Cooling Flow Diagram, Revision 12
jj. D-302-614, Component Cooling To NSSS Pumps, Revision 9
kk. E-302-641, Residual Heat Removal Flow Diagram, Revision 4
ll. D-302-841, Chilled Water Flow Diagram, Revision 18
mm. D-302-842, Chilled Water Flow Diagram, Revision 11
nn. D-302-843, Chilled Water Flow Diagram, Revision 10
oo. Technical Work Record, Serial 13867, Globe Valve Orientation/ Configuration Review, June 22, 1988

4. System Walkdown (71710, 42700, 37700)

The system was walked down to check current configuration against the piping diagrams. The system was found to be in good general condition. The piping was painted outside to provide protection. No signs of rust damage were evident. Components checked showed proper identification tags were in place. The areas of the plant observed were free of debris and well maintained.

The service water pump house walkdown include the general area around the Service Water Pumps, are discharge valve pit, and the switchgear and ventilation areas. Observations made were:

The sump pump in the valve pit was not keeping the area free of water. A one inch accumulation of water was present on about one fourth of the pit floor.

One area of modification to the 'B' pump discharge piping had not yet been painted. Surface rust was present on this area. This was the only area of exterior rusting observed on the system piping.

The 'A' service water pump's screen wash pump was removed and the breaker was tagged out (the tag was hung February 17, 1986). The screen wash pump discharge MOV was tagged out (August 8, 1986). The valve was indicating the closed position. The 'A' traveling screen controls and the 'A' screen wash pump controls on the local panel were in the 'OFF' position. Lamps were missing from the 'screen stalled' and 'LOSS OF INSTRUMENT AIR' light sockets on the 'A' pump.

The traveling screens were free of debris, the pump pits of the operating pumps were showing a normal water level, indicating adequate flow through the screens, and general area condition was good.

A followup of the 'A' screen wash condition revealed SOP-117's Control Panel Lineup, and the steps in Section 2.1 involving operation of the traveling screen and screen wash pump, were not being complied with, and no procedure change or other formal administrative controls were in place. Interviews with the operations staff indicated the traveling screens and screen wash pump discharge valve were operated once per shift, without formal written direction, to keep the screens clear. Examination of the documents removing the screen wash pump did not reveal instructions as to the disposition of the controls or temporary operating considerations. This item is violation 50-395/88-15-03, "Failure to provide adequate procedure for controlling operation of 'A' Service Water Traveling Screen". The method followed by operations of rolling the screen every shift kept the screen clear of debris. The screens would automatically start on a SI actuation, so leaving them 'OFF' would not effect their safety function. No formal logging of the screen rotation was being kept.

The system walkdown continued where the pipe exited the ground elevation in the Diesel Generator Building. Piping to the Diesels, to the Fire Water interface, and to the Diesel Air Compressors was walked down. Normally flow is not present in the Fire Water Header. This is a potential location for MIC or clam problems. The Diesel Air Compressor's line was very small bore piping and could be susceptible to plugging by shells. This load is not considered safety related. All pipe appeared in good general condition.

A walkdown was performed of the Component Cooling Water Heat Exchangers, the HVAC chillers, and the lines to the Emergency Feedwater Pumps. The piping and components appeared to be in good condition.

While examining the piping configuration at the Service Water Booster Pumps, the inspector noted the gate valves used as isolation valves for the test flow lines for the booster pumps were not installed in the correct orientation for the flow that would exist when the test line was in service. Examination showed the installation isometrics did not provide a flow direction for fluid in the test line. The gate valves were installed with the same configuration in both the 'A' and 'B' Service Water Loops. The licensee could not find documentation directing installation counter to normal industry practice. The orientation will not effect the valves ability to perform its safety function, as it is not used in a throttling application. An evaluation was provided to the inspector (see item 24 in the previous section) to indicate the problem was an isolated occurrence, and not a programmatic error. The results of the evaluation appear to address the issue adequately.

The piping from the booster pumps to the containment penetration for the RBCU supply was walked down. The return line was followed until it went below grade. At the time of the walkdown, the 'B' line was in service supplying water to the 'B' loop RBCUs. Noises in the return line to the service water pond indicated possible cavitation. The vertical distances from the outlet of the RBCUs to the pond is over 100 feet. Back pressure to prevent cavitation is maintained through use of flow orifices at the discharge. The sizing of the orifices determines flow through the RBCUs by determining the operating point of the Booster Pumps and also provides the amount of back pressure in the return line. Sizing was changed in the preoperational test program to allow for greater RBCU flow. The accident analysis shows the return water from the RBCUs reaching a temperature of 214°F. Cavitation and flashing at the flow orifices, in the cooler or in the piping might result from these elevated temperatures. Discussion of this was not provided in the Service Water Design Basis Description.

After the walkdown, STP 123.002 and STP 123.001 on pump testing were reviewed. The recirculation path used while testing the Service Water Booster Pumps is relatively small in volume. Calculations performed by the inspector show the water could heat up at rates of 5-7°F per minute of pump operation while in recirc. The procedure currently does not include a caution on the water heatup, or a time limit for pump operation in recirc. STP 123.001, performed to verify valve lineup for Technical Specification operability of service water, did not list the Booster Pump recirculation isolation valves as valves checked for proper position. The valves left open would cause lower than required flows to the RBCUs in an emergency and could impact system operability.

The inspector also performed a walkdown of the control room panels that dealt with Service Water. Operators were interviewed and were familiar with system operation. Monitoring of system flows and temperatures is conducted on a regular basis from the control room panels controls of the throttled system valves were discussed with operations. The service water throttle valves are manipulated to maintain component flow within limits prescribed by the system engineer based upon recent system flow balances. No maximum or minimum valve positions are specified for the throttle valves. Throttle valves position could be an indicator of heat exchanger fouling. If operations must open the valve more it could indicate increased resistance in the heat exchanger. In addition, operating throttle valve position and heat exchanger resistance will effect flows to the RBCUs loads when they are added as loads during an emergency. Throttle valve limits would insure some loads are not starved for water during off normal events. Currently, no engineering evaluation of these limits to provide guidance to operations is available.

5. Review of Plant Programs (61700)

An interview was conducted with the Plant Chemist on Chemistry's Service Water initiatives. The individual with primary responsibility for the chemistry programs on Service Water was unavailable, but the Plant Chemist provided an overview of the initiatives.

V. C. Summer has been aware of the clams in The Service Water pond since 1984. Clams were known to be present in quantity in the Lake Monticello Reservoir prior to that date. No active plan for water treatment is yet in place at the plant to reduce the potential impact of the clams. Chemistry currently provides a monitoring function. Chemistry documents the condition of the heat exchangers when they are opened up for inspection. The pump bays for Service Water and Circulating Water are inspected each outage. The last inspection performed for Service Water found several inches of shell debris in the pit, all located away from the immediate vicinity of the pump. Water velocities may keep the area around the pump clear.

Chemistry is experimenting with different chemistry controls through use of side stream test chambers with Service Water running through them. The effect of different chemicals on the growth rate of the organics is measured. The plant chemist indicated recommendations on treatment may be available later in the year.

A brief talk was held with a representative from a major chemical supplier on the latest treatments available. Some of these methods are under evaluation at V. C. Summer.

The licensee has recently instituted the system engineer concept at the plant. Engineering responsibility for a system is given to an individual. This allows a central focus for system problems. A sense of ownership of the system by the system engineer can lead to enhanced performance. The Service Water System engineer accompanied the inspector on the walkdowns, provided the historical perspective of the system problems and proved a good source of knowledge on the system. The system engineer had not, at the time of the inspection, had prior opportunity to perform a system walkdown. With time and support from management, proper application of this system engineer concept will lead to self identification of problems of the sort found during this inspection.

A review was also performed of some mechanical maintenance procedures for inspection and cleaning of the airside of the RBCUs. Regular inspection and cleaning are scheduled for each unit. These should insure the air side of the coolers stay clean and heat transfer is maximized.

6. Exit Interview

The inspection scope and results were summarized on June 17, 1988, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results listed below. Dissenting comments were not received from the licensee.

Item Number	Type	Description and Reference
88-15-01	UNR	Operability Determination of the 'C' Service Water Pump
88-15-02	DEV	RBCU Airflow less than then FSAR requirements
88-15-03	VIO	Failure to provide adequate procedures to control the 'A' service water traveling screen