UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report No.: 50-302/94-26

Licensee: Florida Power Corporation
3201 -34th Street, South
St. Petersburg, FL 33733

Docket No.: 50-302 License No.: DPR-72

Facility Name: Crystal River Nuclear Plant Unit 3

Inspection Conducted: November 7-10, 1994

Inspector: *Walt Rogers* *12/16/94*
Walter G. Rogers, Team Leader Date Signed

Accompanying Personnel: L. Mellen
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NRC Consultant: D. Prevatte

Approved by: *T A Peebles* *12/16/94*
Thomas A. Peebles, Chief Date Signed
Operations Branch
Division of Reactor Safety

SUMMARY

Scope:

A Service Water System Self-Assessment Inspection was conducted on November 7-10, 1994, according to NRC inspection module 40501. Temporary Instruction 2515/118 for service water inspections was also used as the reference to determine the adequacy of the licensee's self-assessment of service water systems.

Results:

The NRC Temporary Instruction (TI) for Service Water Inspections (Safety Issues Management System item TI 2515/118), was not closed since further NRC inspection will be necessary to assure the licensee has taken adequate actions to respond to Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment."

Enclosure

The licensee's collective service water system self-assessment efforts, during 1994, including their Service Water System Operational Performance Assessment (SWSOPA), identified substantial weaknesses in numerous areas including heat exchanger performance monitoring, the implementation of Generic Letter actions, and service water system flow balancing. However, the licensee's initial response to some of the SWSOPA findings did not have the appropriate sensitivity to findings or conditions that clearly indicated questionable operability. The licensee stated that their subsequent operability evaluations found the systems operable. An unresolved item has been identified pending a NRC review of your past operability determinations covering the SWS.

The licensee's SWSOPA identified a design weakness within the service water/raw water system that may render that system incapable of performing its safety function through the failure of only one component. This design weakness concerns the vulnerability of the system to one non-safety related check valve, which is a passive component and was considered a part of their licensing basis.

REPORT DETAILS

1. Inspection Background & Objectives

   Numerous problems identified at various operating plants in the country have called into question the ability of the SWSs to perform their design function. These problems have included inadequate heat removal capability, biofouling, silting, single failure concerns, erosion, corrosion, insufficient original design margin, lapses in configuration control or improper 10 CFR 50.59 safety evaluations, and inadequate testing. NRC management concluded that an in-depth examination of SWSs was warranted based on the identified deficiencies. Consequently, TI 2515/118, "Service Water System Operational Performance Inspection (SWSOPI)," was issued to perform a SWS team inspection of select facilities. Subsequently, a pilot program was initiated by the NRC to conduct a limited-scope, in-depth inspection as an alternative to the full-scope TI inspection. Use of the reduced scope inspection allows the NRC to minimize regulatory impact upon the licensee and more efficiently use NRC resources. The reduced scope inspection is contingent upon a number of factors including past licensee performance and the licensee conducting a SWS self-assessment which would encompass all the inspection elements of TI 2515/118.

   In a letter dated June 2, 1994, the licensee requested the NRC conduct a reduced scope SWS inspection at their Crystal River 3 facility. In a letter dated July 8, 1994, the NRC granted the licensee's request. This inspection's primary objectives were to;

   * review the qualifications of the individuals assigned to the licensee's SWSOPA to ensure there was the necessary credentials and experience to perform a technically creditable self-assessment,

   * review the scope of the SWSOPA plan to ensure its scope and depth was at least equivalent to those specified in TI 2515/118,

   * witness the last onsite week of the SWSOPA and determine whether the self-assessment team was adhering to the SWSOPA plan, and

   * independently evaluate the licensee's capability to response to the SWSOPA findings.

   The inspectors' observations and concerns are described in paragraphs 3 through 5 of this report. Personnel contacted and those who attended the exit on November 10, 1994, are identified in Attachment A. Acronyms and abbreviations are identified in Attachment B.

2. General Description of SWSs

   The SWSs at Crystal River 3 encompassed two systems. As described in the FSAR these are the DH/RW system and the SW/RW system. The DH/RW system rejects the heat acquired by the DH system which includes the DH/RW pump

motors, DH pumps and motors, reactor building spray pumps and motors, and makeup and purification pumps and motors. The SW/RW system rejects the heat acquired by the SW system which includes spent fuel coolers and pumps, reactor coolant pump and motors, reactor building fan assembly cooling cuils, motor-driven emergency feedwater pump lube oil cooler and motor cooler, and chilled water system chillers.

Seawater is drawn from the intake canal (from the Gulf of Mexico) and conveyed to a pump pit by two redundant 48-inch intake conduits. One intake conduit shares a common intake structure, bar racks, and traveling screens with the circulating water system. The other intake conduit is supplied with a bar rack and separate traveling screen. A closed sluice joins the two compartments. A normal nonsafety-related SW/RW pump, a safety-related SW/RW, and a safety-related DH/RW pump take suction from the compartment connected with the circulating water system. The other compartment contains a safety-related DH/RW and SW/RW pump.

Seawater circulates from each of the DH/RW seawater pumps through separate supply lines and DH closed cycle heat exchangers and discharge through two 48-inch discharge pipes. Seawater circulates from each of the SW/RW pumps to a common header and then separates to four SW closed cycle heat exchangers in parallel. After passage through the heat exchangers, the discharge line merges with the DH/RW discharge lines leading to the discharge canal.

3. Self-Assessment Team Qualifications

The inspectors reviewed the qualifications and composition of the self-assessment team. All team members' resumes were reviewed. All team members were interviewed during the SWSOPA and collectively after their exit with licensee management. Emphasis was placed on whether the design reviewers had sufficient hands-on design experience. Also, the team's composition was evaluated as to whether there was diversity in backgrounds and independence from decisions affecting the present SWS design. The findings were as follows:

a. This team was composed of members from FPC, various consulting companies, and one team member from another licensee, GPU Nuclear. This team composition met the standards set forth in TI 2515/118.

b. Professional qualifications and experience level met the standards set forth in TI 2515/118. The team members were generally knowledgeable of their assessment area as determined through interview. One area of weakness was noted with the licensee's team members' understanding of process instrument bias when relating test data to design requirements.

4. Scope and Implementation of the SWSOPA

The inspectors reviewed the assessment plan prepared by the licensee. Also, the inspectors evaluated the implementation of the SWSOPA by reviewing select assessor observation write-ups, interviewing the assessors before and after their exit, observing assessor interactions with each other at the licensee's team meetings, observing interactions between the assessors and other licensee personnel, and attending the SWSOPA exit. Select SWS equipment was independently walked down by the inspectors. Also, the inspectors performed independent reviews of select licensing and technical materials. The inspector's observations were as follows:

a. The SWSOPA was planned and directed by FPC employees and was conducted at two locations, the plant site and FPC's engineering offices in St. Petersburg. At the plant site, areas assessed included training, operations, maintenance, chemistry, quality programs, system engineering, procurement engineering, and inservice inspection. Safety analysis, I&C engineering, mechanical engineering, configuration management, and licensing were assessed at the St. Petersburg office.

   The stated scope of the licensee's inspection included three elements;

   - Verification of the plan and actions taken in response to GL 89-13,

   - Verification that the raw water system, the decay heat closed cycle cooling system, and the nuclear services closed cycle cooling system were capable of fulfilling their thermal and hydraulic performance requirements and were being operated in accordance with the design, and

   - Verification of the operational, maintenance, surveillance, testing, and personnel training to ensure the above systems were operated and maintained to be able to perform their safety-related functions.

   The stated scope was consistent with the TI guidance.

b. In preparation for the assessment, the licensee generated 120 questions addressing the various assessment topics. These were divided between the assessors who were required to produce written answers as a minimum assessment deliverable.

   The licensee's team implementation plan appeared to be too prescriptive to provide optimum effectiveness. The attention of some of the team seemed to be focused primarily on getting the questions answered rather than using them as a guide, as is generally the approach used in NRC SWSOPIs. This seemed to discourage the more free

thinking environment which has historically been more productive. The more structured, check list approach dictated similar levels of resources be applied to questions producing favorable answers as to exploring areas with unfavorable answers.

c. As a result of paragraphs 4a and 4b above, few observations appeared to be outside the confines of the questions. The licensee offered two reasons for their approach; it provided better guidance for less experienced team members, and it assured more complete documentation of what was covered, allowing the license to better answer future NRC questions about the assessment. An adequate level of synergy was evident in discussions with assessment team members collectively after their exit.

d. The SWSOPA exit presentation logically and clearly portrayed the team findings. The more safety significant issues were emphasized. However, the presentation did not draw an overall conclusion as to the present operability of the SWS. In discussions with the team after the exit, the team leader indicated that an overall conclusion had been drawn and would be shared with senior licensee management later in the day. The team indicated that they could not confirm system operability. Subsequent licensee evaluations concluded the systems were operable. The specific issues addressing operability are discussed in section e.

e. Notwithstanding the perceived weaknesses discussed above, the licensee's collective efforts identified numerous substantive weaknesses in activities associated with the SWS. These included:

(1) In preparation for the SWSOPA, the licensee's QA organization performed an audit of GL 89-13 actions. The audit identified that the licensee had not implemented a number of GL commitments. These included deviations in the frequency of biofouling inspection of the heat exchangers, not pursuing design changes allowing heat exchanger testing and not inspecting/cleaning the SWS pump pits during a refueling outage. These findings resulted in the licensee submitting a letter dated July 8, 1994, to the NRC indicating revisions to their original GL commitments.

(2) There were weaknesses in the present biofouling controls. Routinely, whenever the DH/RW pumps were started for surveillance testing, the DH heat exchanger would immediately plug with shells, in some cases by as much as 75 percent. The licensee indicated that fouling was heavier on one of these trains than the other. Routinely, whenever the surveillance testing was performed on the SW/RW pumps, all four of the heat exchangers would have to be placed in service in order for the system to achieve the design flow. This was also due to sea shell plugging in the heat exchangers.

(3) Failure of the normal SW/RW pump's discharge check valve (RWV-36) in the open direction may render the safety related SW/RW system inoperable by recirculating a considerable amount of RW flow back to the intake pit. The resulting flow to the heat exchangers could be less than that required, and the turbulence of the flow in the pit could result in excessive biofouling of the heat exchangers.

(4) The most current SWS flow balancing test from 1992 had unreconciled inconsistencies which potentially impacted whether all safety related equipment would receive design flow.

(5) There was no quantitative acceptance criteria for pit inspections and no technical basis for cleaning heat exchangers at a given discharge pressure.

f. The SWSOPA also identified strengths in training, procurement, the technical bases for ASME Section XI testing, and maintenance.

5. Organizational Response to Significant Findings

The inspectors selected a sample of SWSOPA findings to evaluate how the licensee was responding to the findings. The inspector's observations were as follows.

(a) The licensee had organized a response team whose function was to address questions and concerns identified by the assessment team. This response team began its preparations long before the start of the assessment by performing its own evaluations of the systems. Many discrepancies were identified by this team, and steps had already been initiated to correct these before the inspection began.

(b) The licensee's organization did not appear to have the appropriate sensitivity to findings or conditions that clearly indicated questionable operability. Examples included:

- In the cases of DH heat exchanger plugging with shells, the TS action statement would be entered for that division while the heat exchanger was cleaned. Upon completion of cleaning, that division would be restored to service and successfully tested. Then the same process would be repeated on the opposite division. No consideration appeared to have been given to the indeterminate period prior to the first test attempt, when both divisions of the system would not have been capable of performing their safety function if called upon, and the entire system was inoperable. Also, the overall viability of this testing/cleaning process was not questioned. Even when Problem Report 94-0269 was initiated by the licensee on heat exchanger clogging, an operability evaluation was not initially performed.

- In the cases when an additional SW heat exchanger had to placed into service for the SW/RW pumps to achieve design flow, the tests were routinely accepted without question of system operability (Problem Report 94-0322).

- When Problem Report 94-0320 was initiated by the licensee on the SWS flow balance inconsistencies in 1992, an operability evaluation was not initially performed.

- When Problem Report 94-0268 was initiated by the licensee on the SWS urethane pipe liner failures, an operability evaluation was not initially performed.

(c) Following inspector involvement, operability evaluations were performed by the licensee in accordance with their administrative procedures. Subsequently, the licensee concluded the SW systems were operable. The operability evaluation associated with heat exchanger clogging referenced an unverified calculation which did not accompany the operability evaluation. The NRC independent review of the licensee's past operability evaluations is URI 50-302/ 94-26-01, "Past Operability Evaluations."

6. Exit Interview

The team conducted an exit meeting on November 10, 1994, at the Crystal River 3 Nuclear Power Station to discuss the major areas reviewed during the inspection, the strengths and weaknesses observed, and the inspection results. Licensee representatives and NRC personnel attending at this exit meeting are documented in Attachment A of this report. The team also discussed the likely informational content of the inspection report. The licensee did not identify any documents or processes as proprietary. There were no dissenting comments at the exit meeting.

Persons Contacted

*L. Armstrong, Assessment Team Member
*T. Austin, Assessment Team Member
*K. Baker, Nuclear Configuration Management Manager
*D. Black, Senior Nuclear Results Engineer
*G. Boldt, Nuclear Production Vice-President
*K. Campbell, Senior Nuclear Mechanical Engineer
*D. Culpepper, Chief Engineer - Assurance (Florida Power and Light)
*R. Davis, Nuclear Plant Maintenance Manager
*C. Doyel, Senior Nuclear I&C Engineer
*T. Eckart, Assessment Team Member
*E. Froats, Senior Nuclear Licensing Engineer
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*R. Long, Project Engineer
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*W. Rogers, Team Leader

* Indicates those present at the exit meeting on November 10, 1994.

ACRONYM LIST

ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulation
DH	decay heat
FPC	Florida Power Company
FSAR	final safety analysis report
GL	Generic Letter
GPU	General Public Utilities Corp.
I&C	instrumentation and control
NRC	Nuclear Regulatory Commission
QA	Quality Assurance
RW	raw water
RWV	raw water valve
SW	service water
SWS	service water system
SWSOPA	Service Water System Operational Performance Assessment
SWSOPI	Service Water System Operational Performance Inspection
TI	Temporary Instruction
TS	Technical Specification