September 29, 1987

Docket Nos. 50-335
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MEMORANDUM FOR: Herbert N. Berkow, Director
Project Directorate II-2
Division of Reactor Projects-I/II

FROM: E. G. Tourigny, Project Manager
Project Directorate II-2
Division of Reactor Projects-I/II

SUBJECT: ST. LUCIE TRIP REPORT, SEPTEMBER 15-18, 1987

I visited the St. Lucie plant site from September 15 through 18, 1987. During the visit I reviewed the June 1987 reactor trip event at Unit 1, external missile protection measures, mangrove restoration efforts, 10 CFR 50.59 plant change/modification package documentation, and I also conducted various plant tours. The enclosure provides the summary of my activities. An advanced copy was provided to the Senior Resident Inspector for his use in his monthly inspection report.

E. G. Tourigny, Project Manager
Project Directorate II-2
Division of Reactor Projects-I/II

Enclosure:
As stated

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9/28/87	9/29/87	9/29/87

ENCLOSURE

SUMMARY OF ACTIVITIES DURING PLANT VISIT

TO THE ST. LUCIE PLANT, UNIT NOS. 1 AND 2

SEPTEMBER 15 - 18, 1987

Reactor Trip Event

The project manager (PM) reviewed the circumstances associated with the Unit No. 1 reactor trip of June 14, 1987. The 1B main feedwater pump tripped and the reactor subsequently tripped on high pressurizer pressure. The PM reviewed the licensee event report (LER) submitted to the staff by letter dated July 10, 1987; the monthly report submitted to the staff by letter dated July 15, 1987; and the post-trip review report (completed Operating Procedure No. 0030119, Revision 4, dated June 14, 1987). The PM also discussed the event with licensee personnel.

The PM reviewed the event because it was felt that the reactor should have tripped on low steam generator water level, versus high pressurizer pressure, and there appeared to be a discrepancy on whether the power-operated relief valves (PORV's) opened.

The major sequence of events, as recorded by the sequence of events recorder, showed the 1B main feed pump tripping at 2350:03. This initiated a partial loss of main feedwater and a turbine runback. Although the turbine was in a runback condition, and therefore requiring less reactor power, the reactor was still producing full power. The control rods were not being inserted because the rod control system was in manual. The operators started to manually insert rods late into the event. Pressurizer pressure started increasing, and the reactor subsequently tripped at 2350:25 on high pressurizer pressure. The low steam generator water level trip occurred five (5) seconds later. It should be noted that the 1B main feedwater pump was restarted by the operator eleven (11) seconds after it tripped. In addition, the auxiliary feedwater system responded accordingly. Thus, during the event, the pressurizer pressure increase was dominant and loss of steam generator level was not dominant, and the reactor tripped on high pressurizer pressure.

There was also a discrepancy on whether the PORV's opened. The PORV's are set to open at 2400 psi, the same setpoint as the high pressurizer pressure reactor trip. The LER stated that they did open, yet the monthly report stated that there were no PORV challenges during June. In addition, the post-trip report stated in one section that they opened, but stated in another section that they did not open. The PM discussed the discrepancies with licensee personnel. Some licensee personnel believe that the PORV's opened and some licensee personnel believe that they did not open. As a result of discussions with licensee personnel, it was determined that the time difference between the signal to open the PORV's and the signal to close the PORV's was less than two seconds. Therefore, it would be difficult to determine if they opened under these conditions. However, the discrepancies in the reported information remains. The licensee agreed to resolve the discrepancy by either supplementing the LER or correcting the monthly report. This proposal was acceptable to the PM.

External Missile Protection

The PM noted that a few pieces of safety-related equipment, located outdoors, were not fully protected from postulated tornado/hurricane-generated external missiles. The postulated scenario involves a severe weather condition at the site, a missile being generated and propelled toward the safety-related equipment, the missile breaking the boundary of the equipment, and the subsequent failure of the equipment to fulfill its function. The objective is to bring the unit to cold shutdown. Additional assumptions include no onsite electrical power and multiple missiles. The pieces of equipment that are not fully protected the are the Unit 1 condensate storage tank (1); the Unit 1 diesel fuel oil storage tanks (2); the Unit 1 component cooling water system heat exchanger (2); and the refueling water tank (1) for each unit.

The top of the condensate storage tank (CST) for Unit 1 has a steel beam framework with chain link overlay. The top of the CST is vulnerable to a potential incoming vertical missile. This vulnerability was discussed with licensee personnel. The licensee personnel felt that the probability of this event occurring and completely disabling the tank was extremely low. In addition, if the event did occur and disable the tank, there is another method available to the Unit 1 auxiliary feedwater pumps. There is an underground cross-tie between the Unit 1 CST and the Unit 2 CST. The valves associated with the cross-tie are normally locked closed. In addition, the Unit 2 CST is completely missile-protected. A procedure (1-0700022) is in place to use the cross-tie, if necessary, and water can be supplied to the Unit 1 auxiliary feedwater pumps if the Unit 1 CST is disabled. The PM was satisfied with the licensee's response.

The refueling water tank (RWT) for each unit is vulnerable to a potential incoming vertical missile. The upper portion of the Unit 1 RWT is vulnerable to a potential incoming horizontal missile from the northeast and the upper portion of the Unit 2 RWT is vulnerable to a potential incoming horizontal missile from the southeast through a very small "window" between adjacent buildings. These vulnerabilities were discussed with licensee personnel. The licensee personnel felt that the probability of disabling the RWT's due to a missile was extremely low. In addition, if the RWT was disabled, the unit could be shut down using water sources within the plant (safety injection tanks and boric acid makeup tanks). Procedures (1-0030140/2-0030140) are in place to transfer these water sources and shut down the plant. The PM was satisfied with the licensee's response.

The two Unit 1 diesel fuel oil storage tanks are vulnerable to a potential incoming vertical missile and the upper parts of the tanks are vulnerable to a potential incoming horizontal missile from the northeast. These vulnerabilities were discussed with licensee personnel. The licensee personnel felt that the disabling of one or both of these tanks using this scenario was a very low probability event. In addition, if the event did occur and disable both tanks, there is another method to supply fuel oil to the Unit 1 diesel generators. There is an underground cross-tie line between the Unit 1 fuel oil tanks and the Unit 2 fuel oil tanks. The valves associated with the cross-tie are normally locked closed. In addition, the Unit 2 tanks are completely missile-protected.

There is general knowledge onsite about the existence of the cross-tie line; however, there is no procedure in place to use it under the scenario of loss of both Unit 1 fuel oil tanks. Because the probability of disabling both tanks is extremely low, the PM did not recommend that a procedure be written to address this potential event. The PM was satisfied with the licensee's response.

The two Unit 1 component cooling water (CCW) system heat exchangers are vulnerable to a potential incoming vertical missile and the eastern side end bells are vulnerable to a potential incoming horizontal missile. CCW flows through the shell side of the heat exchanger, and intake cooling water (ICW) flows through the tube side via the end bells. Thus, the relationship of what type of water lost (CCW, ICW, or both) depends upon where the heat exchanger is hit and how deep the missile penetrates.

These vulnerabilities were discussed with the licensee. The licensee has in place procedures (1-0310030/2-0030030) that address unit operation if there is a problem with the CCW system. One of the elements of the procedure calls for isolation of a CCW heat exchanger if there is a problem with it. The PM was satisfied with the licensee's response addressing the loss of one CCW heat exchanger.

Current procedures do not address the loss of both heat exchangers. This would be a very critical event, because the CCW system is used to bring the plant to a cold shutdown condition. It would be difficult to write procedures because one would have to address loss of heat exchanger ICW, loss of heat exchanger CCW, and loss of both CCW and ICW, and this is a function on where the missile hits the heat exchanger and the depth of penetration.

The PM discussed the potential loss of both heat exchangers with the licensee. The licensee pointed out that missile protection of the CCW heat exchangers has been evaluated in great depth in Appendix 3F of the Unit 1 FSAR. The licensee analyzed the Florida tornado and potential tornado-generated missiles. The licensee also evaluated the missile penetration resistance of the CCW heat exchangers. This consisted of identifying missile types (wood plank, steel rod, steel pipe, utility pole) and calculating the missile velocity that would result in penetration. Thus, the licensee feels that the probability of both heat exchangers being disabled is an extremely low probability event. In addition, it was pointed out that this is a beyond design basis event for Unit 1.

The PM reviewed the licensee's engineering analysis contained in the FSAR and toured the heat exchanger location. The orientation of the heat exchangers is from east to west. Their vulnerability to an incoming horizontal missile from the east is extremely low for the following reasons. The heat exchanger itself is a massive component and very resistant to missile damage. The target area for the incoming horizontal missile from the east is approximately 30 ft^2 per heat exchanger; thus, the target area is very small. The heat exchangers are on the east side of the plant and close to the ocean. The ocean lies a few hundred yards to the east. The limited land space between the ocean and the heat exchanger has minimal vegetation and there are no major items such as large trees that could become the missile. Similar arguments can be made for the incoming vertical missile. The PM was satisfied with the licensee's response.

Mangrove Restoration Efforts

The technical specifications for both units require the licensee to conduct a beach survey and mangrove photographic survey at least once per year. These surveys are associated with flood protection measures for the site. The results of the beach survey were submitted to the staff by letter dated July 7, 1987. The results indicated that the present dune condition is acceptable. The results of the mangrove survey were submitted to the staff by letters dated March 2, 1987 and July 1, 1987. The results indicated that there has been some deterioration of the mangroves. As a result, the licensee performed an engineering evaluation. The licensee concluded that the mangroves are not required to maintain the design basis of the St. Lucie site to protect safety-related structures and equipment from probable maximum hurricane surge and erosion damage. Thus, the licensee determined that the deterioration did not create a condition of any safety significance.

The PM discussed the deterioration of the mangroves with licensee personnel and the discussion centered not only on safety significance, but also on the environmental significance. The mangroves cover about 900 acres around the St. Lucie plant site. The PM reviewed a recent infrared photograph and concluded that the deterioration is associated with an approximate 50 acre tract bounded by the intake canal (south of the tract), the discharge canal (north of the tract), the ocean (east of the tract), and route A1A (west of the tract). About 40% of this tract is in a deteriorated condition. Deterioration encompasses mangroves that need to be completely replaced to mangroves that need to be rejuvenated. Thus, only about two (2) percent of the mangroves are in a deteriorated condition. The deterioration does not appear to create a condition of any safety or environmental significance.

Although the licensee believes the deterioration does not present a condition of any safety significance, the licensee has embarked on a program to rejuvenate the 50 acre mangrove tract. The licensee has installed a piping system to water the tract. The piping system draws water from the intake canal and pumps it through PVC pipe to the northern edge of the 50 acre tract, where the water releases along the whole edge of the tract. Pooled water in the tract is eventually released back to the intake canal. The licensee believes that much of the 50 acre tract that is deteriorated will be restored in a few years. The PM believes that the licensee is acting in a responsible manner to restore the tract, since there is no requirement to do so.

Plant Change/Modification Packages

A number of Unit 1 plant change/modification packages were reviewed by the PM. Emphasis was placed on the safety evaluation conducted by the licensee. These were St. Lucie Unit 1/Unit 2 security systems (141-81); electrical penetration E-4 nozzle (003-184); steam line radiation monitor weather enclosure (024-184); and environmental qualification update (077-186). Unit 2 plant change/modification packages were reviewed during a prior 1987 site visit. All safety

evaluations were adequate. It should be noted that the security system plant change/modification package contained safeguards information and it was stored in a locked file cabinet, as required. In addition, the environmental qualification update plant change/modification package is a good example of a change made under 10 CFR 50.59 that is not hardware-orientated. It demonstrates that the licensee envelopes all changes described in the FSAR into their change program, not just hardware changes.

Tours

The PM conducted various tours. Particular emphasis was placed on the reactor auxiliary building (RAB) for each unit. The PM toured all levels inside the RAB's and the ground level outside the RAB's and fuel handling buildings. All outside doors to the RAB's were closed as required. All outside doors to the fuel handling buildings were closed as required, except for one door on the Unit 2 fuel handling building, which was open because new fuel was just received onsite and was just moved into the building. A guard was posted since the door was open, and personnel were working in the immediate area.

The licensee has had difficulties in the past in keeping all the RAB doors closed. The reason for keeping the doors closed is if an airborne radiological release occurred in the RAB, an open door would represent an unmonitored and unfiltered escape pathway and partially defeat the purpose of the RAB ventilation cleanup and filtration system. Significant improvement has been noted. Housekeeping was also excellent in both RAB's.

The PM noted a possible discrepancy in the shield building wall penetration (No. 57) associated with the containment mini-purge system line (Unit 2). The PM noted that the piping run went through the penetration, but the area between the outside of the line and the inside of the penetration was not sealed. The PM could not determine if the unsealed area went through the entire depth of the shield building wall. The concern would be a leak pathway between the containment annulus and the reactor auxiliary building, thereby partially prohibiting the shield building ventilation system from fulfilling its design function of purging the annulus area and filtering the purged air prior to release to the atmosphere. This discrepancy was discussed with the licensee. The licensee personnel showed the PM by way of drawings that the seal between the outside of the pipe and the inside of the penetration was made at the inside of the shield building wall. The licensee also stated that the leak tightness of the annulus area is periodically checked to ensure that there is no unacceptable leakage. The explanation afforded by the licensee resolved the PM's concern.