UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

# SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

# REQUEST FOR AUTHORIZATION OF ALTERNATIVE REFUELING WATER TANK BOTTOM DESIGN

# FOR

# FLORIDA POWER AND LIGHT COMPANY

# ST. LUCIE PLANT, UNIT 1

# DOCKET NO. 50-335

## 1.0 BACKGROUND

By letter dated January 6, 1997, Florida Power and Light (the licensee) requested approval for an alternative refueling water tank (RWT) bottom design due to the development of a small leak in the bottom. The licensee submitted Relief Request 13 (1-93-190) dated July 30, 1993, which requested approval for a temporary non-Code repair for the RWT bottom until the next Unit 1 refueling outage. Relief Request 13 was approved by Nuclear Regulatory Commission (NRC) letter dated October 21, 1993. The licensee determined that the RWT bottom Code repair was not practical during the fall 1994 refueling outage. The licensee requested approval of an alternative non-Code repair to correct the through wall leakage of the Unit 1 RWT bottom by letter dated November 16, 1994. NRC approved the alternative, non-Code repair by letter dated November 25, 1994. The non-Code repair consisted of adding a reinforced vinyl ester liner to the bottom of the RWT. As part of the approval, the NRC requested that the licensee complete ongoing laboratory testing and in-situ inspections to confirm the ultimate capabilities of the lining. The licensee has completed the laboratory testing and in-situ inspections of the vinyl ester liner and has confirmed that the lining meets the manufacture's specifications for physical and chemical properties and is performing as expected. Therefore, the licensee has requested approval of the use of the reinforced vinyl ester liner for the remainder of the second interval and for the third interval.

The RWT is an above ground aluminum tank sitting on a sand bed and supported by a concrete ring foundation. The RWT is a Quality Group B, American Society of Mechanical Engineers (ASME) Class 2 Structure constructed in accordance with American National Standards Institute B96.1-1967. A copper ground grid is below the tank and the licensee has reported that the tank bottom has come in contact with the ground grid.

ENCLOSURE

The licensee has committed to an augmented inspection program for the reinforced vinyl ester RWT bottom liner during the remaining life of the plant. The program for the remainder of the second 10-year inservice inspection (ISI) interval and the third 10-year ISI interval consists of remote visual examination during refueling outages SL1-15, SL1-16, SL1-18, SL1-19, and SL1-21. A full hands-on examination would be conducted during refueling outages SL1-17 and SL1-20. The program for the fourth 10-year ISI interval will be submitted as part of the ISI plan for that interval. In addition, the caulking material between the RWT bottom and the concrete foundation ring wall will be inspected on an annual basis.

The licensee conducted a root cause evaluation of the as-found condition to determine the failure mechanism for the RWT bottom. The licensee conducted soil resistivity tests, determined the level of chemicals in the soil, and evaluated DC potential measurements on the RWT bottom. The soil resistivity was high which is indicative of non-corrosive soil. The levels of chloride, nitrate, and sulfate in the soil were also low, again indicative of non-corrosive soil. The licensee did not find indications of oil in the soil.

The tank-to-soil potentials measured around the tank were more noble than potentials for aluminum alloys in sea water. The licensee stated that the exterior surfaces of the floor plates were in an active state of corrosion. The licensee hypothesized that the noble potentials were caused by contact of the floor plates with the copper grid. However, the licensee stated that the non-corrosive nature of the soil should not have produced the observed corrosion. The licensee reported that the joint sealing compound at the interface between the tank floor and the concrete foundation wall was missing. This would permit water to enter the sand bed in contact with the tank bottom and this water could decrease the resistivity of the sand bed making it more corrosive.

The licensee concluded that the root cause for the failure of the tank bottom was galvanic corrosion as a result of the galvanic couple between the tank bottom and the surrounding copper ground grid. The licensee proposed that the lack of joint sealing compound at the interface between the tank floor and the concrete wall permitted the intrusion of water into the sand bed that accelerated the galvanic corrosion. The corrective action taken by the licensee was to place joint sealing compound between the tank bottom plates and the concrete ring wall and to regrade the area around the RWT to prevent standing water from rising to a level above the top of the ring wall foundation.

Prior to the spring 1996 refueling outage, the licensee performed an evaluation which addressed the following: 1) procedures and acceptance criteria for the inspection of the liner; 2) contingencies for minor repairs; and, 3) a 10 CFR 50.59 evaluation showing that no unreviewed safety questions or changes to the Technical Specifications result from the use of the liner.

During the Spring 1996 refueling outage, the RWT was completely drained to conduct a hands-on inspection of the liner to evaluate the performance of the installed liner and to obtain sufficient data to support the request for approval of the liner as a permanent repair to the tank bottom. The liner was

inspected to determine the acceptability of liner hardness, delamination, adhesion, peeling, flaking, undercutting, blistering, cracking, discoloration, holidays, and pinholes, using non-destructive tests. A small hole, 1/32 inch diameter and 1/16 inch deep, was detected that did not penetrate through the liner. The affected area was cleaned and repaired using Duromar SAR-SU. A small amount of duct tape was found on the RWT wall. The liner was cut open, the tape removed, and the liner was repaired with Duromar SAR-UW epoxy coating. All of the remaining properties were satisfactory and verified the manufacturer's published information on the physical properties of the Dudick Protecto-Line 800 system. Furthermore, the chemical properties of the coating were determined to conform with Dudick's published information by an independent test laboratory. The repairs to the liner followed the Dudick specifications.

## 2.0 DISCUSSION

In the November 25, 1994 safety evaluation, the NRC staff determined that the tank bottom is continuously supported by the sand bed. The tank bottom is a fluid boundary and carries the static compressive load from the hydrostatic head of the fluid level. The height of this tank results in a maximum compressive load of approximately 16 psig for a full tank.

Seismic loads were considered in the November 25, 1994 evaluation. The loads resulting from a seismic event tend to slide the tank sideways or tip the tank over. There are 45 anchor bolts distributed around the tank that restrain it from sliding or tipping over.

The licensee has proposed an augmented inspection program that involves a visual or hands-on inspection during each of the refueling outages for the remainder of the second inspection interval and for the third inspection interval. These inspections are expected to identify any degradation of the liner. The inspection of the caulking material between the RWT bottom and the concrete ring wall will identify degradation of this seal such that corrective measures can be taken to ensure that the sand bed will remain dry and that galvanic corrosion effects will not be significant.

The inspection and hands-on testing of the liner indicate that it is performing as expected. The independent laboratory test results on the liner material confirm that the correct lining material was used.

## 3.0 STAFF EVALUATION AND CONCLUSIONS

The staff finds that the fiberglass reinforced vinyl ester liner in the RWT is performing as expected and is structurally acceptable for continued service. The licensee has committed to perform a visual or hands-on inspection during each refueling outage for the remainder of the second interval. The lining is a coatings industry standard with demonstrated capability for the intended application. Consequently, the staff finds the proposed alternative to an ASME Code repair for the RWT bottom would provide an acceptable level of quality and safety.

In accordance with the provisions of 10 CFR 50.55a(a)(3)(i), the alternative to continue with the use of the tank lining along with the proposed

inspections, in lieu of a Code repair or replacement, for the remainder of the second 10-year interval is authorized. The request for relief from the Code requirements for the continued use of the tank lining for the third interval is denied. The licensee must submit a separate relief request for the third 10-year interval which addresses the requirements applicable to the RWT for the edition of the Code applicable to the third interval that is scheduled to start in March of 1998.

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