Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

December 31, 2009

L-2009-305
10 CFR 50.4

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: St. Lucie Unit 1
Docket No. 50-335
Preliminary Insights for CCW System Air Intrusion Events

This letter provides additional information and preliminary conclusions to support the evaluation of the St. Lucie Unit 1 component cooling water (CCW) air intrusion events in October 2008 and November 2009. The information was derived from ongoing evaluations being performed by Florida Power & Light (FPL), consultants, vendors and industry experts.

On October 16, 2008 and November 6, 2009, St. Lucie Unit 1 was at 100% power when the unit experienced air intrusion from the containment instrument air system into the CCW system. The intrusion pathway was through the CCW makeup line to the seal water tank of a stand-by containment instrument air compressor. Air intrusion into the CCW system was terminated in approximately 18 hours and 8 hours after the start of the October 16, 2008 and November 6, 2009 events, respectively. These events were captured in the St. Lucie Corrective Action Program.

The air in-leakage source has been isolated to both instrument air compressors via closure of manual valves pending implementation of permanent corrective actions.

Although analysis of these events continues, the following insights and preliminary conclusions are provided to assist in the NRC's evaluation of the air intrusion events and the vulnerability of the CCW system to gas intrusion in general:

1. The CCW system is instrumented to detect and annunciate degraded flow. During the 2008 event, Operations received alarms for low CCW flow to CCW radiation monitors and the high/low flow to the CCW headers. The system includes additional alarms such as CCW flow to containment fan coolers that would have also provided control room annunciation had flow further decreased.

2. Based upon computer modeling of the air intrusion events, CCW system flow indication changes would be observable to operators at a void fraction of approximately 2% at the suction of the CCW pumps. Modeling indicates that at a 2% void fraction, entrained air would begin to transport through the CCW heat exchangers and affect indicated flow.

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3. Based upon consultant and pump vendor input, CCW air entrainment of up to approximately 10% could be accommodated by the CCW pumps and motors without interruption of flow to CCW system loads. Studies indicate that with 10% air entrainment, CCW flow would decrease by approximately 20% with concurrent pressure reductions but the CCW pumps would continue to provide cooling flow to system loads. The CCW pumps and motors are of a robust design and would continue to operate.

4. Considering 10% CCW air entrainment, flow to the reactor coolant pump (RCP) seal coolers would decrease by approximately 20%. At this lower flow, seal performance would not degrade based on flow and temperature margins. Significant decreases in CCW flow would result in control room alarms prior to degradation of RCP seal performance.

5. The RCP seal design provides redundancy through a four-stage design. Any one of the four seals within the assembly is capable of operating with full RCS pressure across it. Furthermore, the seals have been tested to demonstrate that they are capable of maintaining reactor coolant system (RCS) pressure during a station blackout event when CCW is not supplied to the RCPs. The test duration was for 8 hours under conditions simulating RCS pressure and temperature with an idle pump with the controlled bleed off isolated. The seal remained operable with only minimal changes detected in the upper seal.

6. An evaluation of a postulated CCW flow reduction of 20% for the normal CCW operating alignment determined that this flow reduction would not result in degradation of components cooled by CCW. This conclusion is supported by consideration of the low system heat loads during the normal operating configuration.

7. The design deficiency associated with the containment instrument air compressors is an original Unit 1 plant design feature and is therefore a legacy issue. Current St. Lucie Engineering Quality Instructions contain guidance for evaluation of designs to ensure adverse interactions are precluded. Specifically, guidance is provided to assure that new designs do not create "a new potential gas intrusion pathway that could result in pump gas binding." No program weaknesses were identified that would allow an adverse system interaction to be overlooked in a new design.

Summarizing the above insights and preliminary analysis, the St. Lucie Unit 1 CCW system is able to support normal operation with air ingress levels significantly beyond what has been experienced at St. Lucie. Specifically, adequate cooling would be provided to RCP seals and based upon design margins, RCP seal degradation is not anticipated.

Although action has been taken to preclude further air intrusion events, the CCW system design provides sufficient instrumentation and alarms to provide operators with early indication of such an event. Experience with these events proves that operators are capable of detecting, diagnosing and mitigating gas intrusion events in advance of degradation to components serviced by the CCW system. Based on the risk-influencing factors considered in the evaluations, the probability of an air intrusion event leading to a loss of CCW is low. The probability of a design basis event including a large LOCA or LOCA with concurrent LOOP during an air intrusion event is expected to be smaller than that of loss of CCW due to the short fault exposure times.

FPL continues to evaluate these events and will share additional insights and conclusions as they become available. Should you have any questions or desire additional information please contact Mr. Eric Katzman, St. Lucie Licensing Manager, at (772) 467-7734.

Very truly yours,

FOR RLA

Richard L. Anderson
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