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SUBJECT: Forwards response to 970404 RAI re small break loss of coolant accident info submitted in 961220 license amend request.

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CATEGORY 1 DOCUMENT

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

April 17, 1997

L-97-109
10 CFR 50.46
10 CFR 50.90

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

Re: St. Lucie Unit 1
Docket No. 50-335
Proposed License Amendment for Reactor Core Safety Limit (TAC No. M97471);
Request for Additional Information - Small Break Loss of Coolant Accident

Ref: (1) FPL Letter L-96-333, J.A. Stall to NRC (DCD), Request for License Amendment, St. Lucie Unit 1 Core Safety Limit, December 20, 1996.

(2) NRC Letter, L.A. Wiens (NRC) to T.F. Plunkett (FPL): REQUEST FOR ADDITIONAL INFORMATION - SMALL BREAK LOSS OF COOLANT ACCIDENT - ST. LUCIE, UNIT 1 (TAC NO. M97471); April 4, 1997.

Reference (1) is a proposed license amendment containing an analysis of small break loss of coolant accidents (SBLOCA) for St. Lucie Unit 1, considering up to 30 % steam generator tube plugging. Reference (2) forwarded a request for additional information (RAI) which is needed by the NRC to complete its assessment of the proposed license amendment. The RAI includes concerns about certain SBLOCA phenomena such as reactor coolant loop-seal clearing and break orientation, and their impact on long term cooling capabilities. FPL has evaluated these concerns and determined that St. Lucie Unit 1 will continue to operate in compliance with 10 CFR 50.46.

The attachment to this letter contains FPL's responses to the subject RAI. Please contact us if there are any questions.

Very truly yours,

J. A. Stall
Vice President
St. Lucie Plant

JAS/RLD

Attachment

A001

cc:
Regional Administrator, Region II, USNRC.
Senior Resident Inspector, USNRC, St. Lucie Plant.
Mr. W.A. Passetti, Florida Department of Health and Rehabilitative Services.

Concern: The small break loss of coolant accident (SBLOCA) scenario involving the principal safety concern entails long term cooling conditions in which the break size and orientation would be such that the primary system would not depressurize, limiting the emergency core cooling system injection flow rate to that only capable of matching the core boiloff rate due to decay heat. Also, in this scenario, a column of water in the reactor coolant system pump suction loop seal would inhibit the vent path to the break and exert enough additional pressure to the steam space above the core such that the level in the core would be depressed below the top of the core. Should this condition exist as an equilibrium condition, core uncovery would be indefinite, since the attendant decay heat rate would be small and virtually constant. Under these circumstances the cladding oxidation criteria of 10 CFR 50.46 could be violated.

NRC Request No. 1. **In the near term the licensee should provide information to assure that St. Lucie plant, in its present configuration (including plant design, technical specifications, procedures, analyses), will operate such that the criteria of 10 CFR 50.46 will not be violated for its SBLOCA analyses in consideration of the scenario(s) of concern.**

FPL Response:

The thermal hydraulic behavior of loop seals is important in the SBLOCA scenario as it determines the availability of the vent path to the break. To accurately simulate and quantify the scenario described above, the evaluation model should have the capability to model two phase loop seal phenomena under the prevailing conditions. This would include the appropriate noding, break orientation, and two phase correlations to simulate the loop seal behavior, and valid flooding correlations for the anticipated two-phase flow regimes. The SBLOCA evaluation model used to perform the Reference (1) analysis predicted loop seal clearing, but did not explicitly simulate the long-term cooling conditions discussed in Reference (2). However, the following additional information demonstrates that this scenario is not a concern for St. Lucie Unit 1 and that the Reference (1) SBLOCA analysis remains valid.

The present plant configuration at St. Lucie Unit 1 would not sustain the conditions described in the scenario where the core is uncovered for an indefinite period of time. The elevation of the top of the active core is > 60 inches below the cold leg centerline, and the spill under elevation of the loop seal (top of the horizontal run of loop seal) is 57 inches below the cold leg centerline. The elevation of the top of the active core is, therefore, below the spill under elevation of the loop seal. Since the maximum elevation head in the loop seal is less than that in the core-downcomer region corresponding to the top of the active core, the pressure which would be required to depress the RCS level below the top of the core would be more than that needed to blow the loop seal clear of water. Once the loop seal clears, the vent path established through the loop seal would depressurize the RCS, increasing the injection flow rate. This increased injection flow rate would exceed the core boil-off rate and refill the core.

Technical Specifications: Two independent emergency core cooling system (ECCS) subsystems are required to be operable during operational MODES 1, 2, and 3 (above 1750 psia) which assures redundancy in providing sufficient emergency core cooling capability in the event of a LOCA assuming the loss of one subsystem through any single failure consideration. Each subsystem consists of an operable high-pressure safety injection (HPSI) pump, one operable low-pressure safety injection (LPSI) pump, and an independent flow path capable of taking suction from the refueling water tank (RWT) and automatically transferring suction to the containment sump on a Recirculation Actuation Signal (RAS). This latter requirement assures that each ECCS subsystem can provide long-term core cooling capability in the recirculation mode during the accident recovery period. In addition, at least two of the three available coolant charging pumps are required to be operable in these same operational modes.

Emergency Operating Procedures (EOP): The St. Lucie plant EOPs provide operator actions that are required to be accomplished in the event of a LOCA with or without a concurrent loss of off-site power condition. These actions are designed to ensure the plant is placed in a stable, safe condition, and includes those actions necessary to establish long term core cooling using either the Safety Injection (SI) system or the Shutdown Cooling (SDC) system. SI and charging flow to the RCS is maximized and verified by comparison to specified acceptance criteria throughout the event.

The EOP for loss of coolant accidents emphasizes the importance of steam generator (SG) heat removal for SBLOCA mitigation. Acceptable SG water levels are required to be maintained and at least one SG must be used to perform a rapid cooldown while controlling primary pressure to maintain RCS subcooling. The EOPs contain instructions for forced circulation cooling, single-phase natural circulation cooling, and, if single-phase cooling cannot be maintained, use of two-phase natural circulation and break flow to maintain the heat removal process. The EOPs also contain contingency actions for depressurizing the RCS in the event that depressurization is hindered by steam voiding in either the reactor vessel (RV) head or the SG U-tubes. If accident conditions prevent using the normal SDC system for long term core cooling, such cooling is provided by the SI system aligned for both hot and cold leg RCS injection.

An equilibrium condition during the SBLOCA event that would result in core uncovery for an indefinite period of time is precluded by the EOP requirement to verify, at least every 15 minutes throughout the event, that all safety function acceptance criteria are satisfied. The status of RV head voiding and core uncovery is monitored by the redundant channel Reactor Vessel Level Monitoring System (RVLMS) and the temperatures measured by Core Exit Thermocouples (CET), and specific acceptance criteria for these parameters are provided in the safety function status check sheets. Failure to meet any safety function acceptance criteria requires immediate corrective action. Specifically, failure to satisfy the RCS Pressure Control or RCS and Core Heat Removal safety functions using normal methods would ultimately lead to initiation of once-through-cooling, which uses the Power Operated Relief Valves to provide an alternate (in addition to the break) vent path for steam voids in the RCS while simultaneously injecting subcooled water into the RCS with the SI system.

Conclusion

An equilibrium condition creating an indefinite period of core uncovery as described in the scenario of concern is not feasible in the present St. Lucie Unit 1 design configuration. In addition, the technical specification requirements for ECCS equipment operability in conjunction with plant EOPs provide assurance that the plant can be properly depressurized in the event of a SBLOCA, that unacceptable periods of core uncovery will not occur, and that long term core cooling capability can be implemented. Therefore, the St. Lucie plant, in its present configuration, will operate such that the criteria of 10 CFR 50.46 will not be violated for its SBLOCA analyses.

NRC Request No. 2. **To address longer term concerns associated with this SBLOCA scenario, and the capability to quantify the scenario of concern for ongoing operation and future configurations, the licensee should describe its action plan to update its licensing basis SBLOCA model with noding and correlations to explicitly simulate the phenomena for the scenario and plant configurations of concern as required by 10 CFR 50.46.**

FPL Response:

Asea Brown Boveri - Combustion Engineering (ABB-CE) will be the fuel vendor for St. Lucie Unit 1 beginning Cycle 16. ABB-CE has a model under NRC review which would be capable of simulating the SBLOCA scenario of concern. Although not needed for the present configuration at St. Lucie Unit 1, the ABB-CE model will be available for FPL's future use.