NRC FORM 195 (2-76)

U.S. NUCLEAR REGULATORY COMMISSION

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TO: Mr. Dennis L. Ziemann	FROM: Florida Power & Light Company, Miami, Florida, Mr. Robert E. Uhrig	DOCKET NUMBER 50-335
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REACTOR VESSEL OVERPRESSURIZATION
DISTRIBUTION PER G. ZECH 10-21-76

(1-P)

PLANT NAME: St. Lucie Unit No. 1

ENCLOSURE

Consists of response to NRC request for additional information regarding the Overpressurization issue.....

(8-P)

ACKNOWLEDGED

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NRC FORM 195 (2-76)

P. O. BOX 013100, MIAMI, FL 33101

FLORIDA POWER & LIGHT COMPANY

February 28, 1977
L-77-65

Office of Nuclear Reactor Regulation
Attention: Mr. Dennis L. Ziemann, Chief
Operating Reactors Branch #2
Division of Operating Reactors
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Ziemann:

Re: St. Lucie Unit 1
Docket No. 50-335
Overpressurization Issue

Your letter of January 10, 1977 requested that Florida Power & Light Company (1) identify the manner in which we plan to implement additional overpressure protection, and (2) supply additional information on interim measures being used to reduce the likelihood of overpressurization events.

We are now finalizing the hardware improvements we plan to make to preclude exceeding the limits of Appendix G to 10 CFR Part 50. We will identify these improvements to you, including a schedule for installation, by March 15, 1977.

Our response to your request for additional information is contained in the Attachment to this letter. The procedural and administrative measures described therein will be continued after long term hardware improvements have been made.

Very truly yours,

J. A. DeMastry
for
Robert E. Uhrig
Vice President

REU/MAS/cpc

Attachment

cc: Mr. Norman C. Moseley, Region II
Robert Lowenstein, Esquire

ATTACHMENT

Re: St. Lucie Unit 1 (PSL-1)
Docket No. 50-335
Overpressurization Issue

1. a. Training will be scheduled for all plant Operators to review the causes of past pressure transients that have occurred at other operating PWR facilities. A list of 31 occurrences which occurred between February 1972 and September 1976 has been distributed to all plant Operators for their review, which should be completed by the end of February, 1977. The scheduled training should be completed by April 8, 1977.

b. Training will be held as part of the normal Operator requalification program. Each shift will receive a formal 2 - 3 hour classroom lecture, including time for discussion, from the plant Training Staff. This lecture will cover the 31 occurrences about which we have information. One of the six shifts is in training each week, so it will take about 6 weeks, starting February 21, 1977, to complete the lectures. Thus, the training should be complete by April 8, 1977. We have no cold shutdowns planned before that date.

c. 1. Discharge of Safety Injection Tanks (accumulators)

The normal pressure in our SIT's is 220-225 psig with a maximum pressure (tank relief setpoint) of 250 psig. That pressure is below the pressure temperature curves for the life of the plant.

2. Isolation of RHR (Shutdown Cooling at PSL-1)

On some plants, isolation of RHR/SDC also isolates the letdown system thus causing a pressure transient. This is not true at PSL-1. Our letdown system is independent of SDC and is not isolated with SDC or as a result of SDC being isolated.

3. LPSI and CS Pumps

It should be noted that the discharge pressures of the Low Pressure Safety Injection pumps and the Containment Spray Pumps (FSAR Figure 6.3-3 & Table 6.2-8) are too low to create an overpressure condition at PSL-1.

d. The following procedure changes have been made in order to minimize the possibility of an overpressure transient exceeding Appendix G limits:

Operating Procedure 0120020 Fill and Vent of the Reactor Coolant System.

1. Section for filling RCS with LPSI pumps. Step added for establishing charging flow which prohibits third charging pump from starting. The second backup charging pump is in the OFF position to preclude auto start.

2. Section for filling RCS with charging pumps. Step added to prohibit starting a third charging pump by placing the second backup charging pump in the OFF position to preclude auto start.

   For both A and B above, this will minimize the fill rate of the RCS by the charging pumps.

3. Added steps to keep shutdown cooling system in service during fill of Reactor Coolant System with LPSI pumps and charging pumps.

4. Modified RCP start sequence so as to minimize period shutdown cooling is isolated. Previously, all venting done with shutdown cooling system isolated.

5. Modified procedure to differentiate between complete drain down and when pressurizer level is maintained, thereby eliminating unnecessary reactor coolant system venting operations and reactor coolant pump starts during solid plant conditions. This elimination of unnecessary RCP starts also minimizes the time required to have the plant in solid conditions.

6. Revised procedure to accommodate times during which the temperature distribution with the reactor coolant system is non-uniform. The revised procedures minimize pressure temperature differentials between the reactor vessel and steam generators prior to RCP starts.

7. Procedure revised to insure letdown flow path is established when solid prior to initiating charging flow.

2.a. Water solid conditions are addressed in the RCS heatup, RCS fill and vent, and RCS cooldown procedures.

HEATUP - Water solid conditions are assumed as initial conditions for the procedure to establish a steam bubble and, as such, cannot be considered as a procedure requiring water solid operation.

FILL AND VENT - RCS fill and vent is required only after the RCS has been drained for refueling or maintenance. The pressurizer is initially filled and vented to assure proper venting of air which may be trapped in the pressurizer during system fill. The RCP's are then started for short periods of time to sweep air from the steam generator U-tubes and other parts of the system not affected by SDC flow. Following each pump start, the entrained air is vented from the pressurizer, the RCP seal cavities, and the reactor vessel head.

COOLDOWN - The RCS is taken to a solid water condition at cold shutdown if it is necessary to cool the pressurizer and depressurize prior to opening the reactor coolant system.

The use of a nitrogen or air bubble during these operations is not preferred. Nitrogen and air are non-condensable gases and have compressibility characteristics much "harder" than that of steam. Large quantities of either gas would be required to provide significant mitigation of overpressure transients, particularly when operator action cannot be assumed for 10 minutes following initiation of the transient. Transition from gas to steam bubble would necessitate spending additional time in a condition with undesirable pressure control. Holdup and disposal of the required volume of gas is beyond the current capability of the plant.

b. FILL AND VENT - During the initial system fill, it is necessary to fill and vent the pressurizer to assure that all the entrapped air is removed. Concerns over the amount of dissolved oxygen in the pressurizer water following a fill and vent had precluded during a low pressure bubble. Recent discussion with the vendor has indicated that this is no longer a concern. Pump sweeps at present require solid water operation to safety equipment pressure limitations and tech spec requirements. A pressure of 305 psia is required to start one reactor coolant pump which the SDC isolation interlock setpoint is 267 psia. Current procedures require that the RCS pressure be raised above 305 psia prior to starting the RCP and then quickly lowered to below the SCD interlock pressure for system venting. This is done to permit adequate time to vent the system and satisfy the tech spec limit of 15 minutes without either the SDC system or an RCP in operation. The pressure response required to remain within this time limit would probably not be possible with a steam bubble and our pressurizer heatup rate.

It is our desire to perform the initial pump sweeps with a steam bubble in the pressurizer. To meet this objective, we have begun discussions with the vendor to reduce the required pressure for starting the reactor coolant pump to below the SPC isolation setpoint. This would permit system venting to proceed without interference with SPC operation.

<u>COOLDOWN</u> - The only time that the system is water solid at cold shutdown is if it is necessary to cool the pressurizer and depressurize prior to opening the reactor coolant system. There is no provision for depressurizing with a steam bubble in the pressurizer.

3. Based on our review of the 31 events of which we are aware, it appears that only 6 of these events were related / to SIS components. St. Lucie Unit 1 is not susceptible to 3 of these 6 events (SIT discharge - see 1.C.1 above).

The following fulfills your request for additional information.

a. FSAR Figures 6.3-1 & 6.3-2; Safety Injection System
FSAR Figure 9.3-4; CVCS (letdown)
FSAR Figure 9.3-5; CVCS (charging)

b. FSAR Figure 6.3-3; LPSI Pump Performance curves
FSAR Figure 6.3-4; HPSI Pump Performance curves

c. FSAR Figure 6.3-1; The A, B, & C HPSI pumps will be deenergized when the plant is solid.

FSAR Figure 6.3-2; Valves MV-3615, -3626, -3636, -3646 and MV-3617, -3627, -3637, -3647 are normally closed.

d. These changes will be implemented by March 31, 1977.

e. One HPSI pump may have to be made operable (i.e., breaker energized, but pump not started) to meet the requirements of Technical Specification 3.1.2.1 <u>if</u> all 3 charging pumps should fail (while solid). This will be a rare occurrence and the HPSI pump would be operated only if needed for Boron injection or RCS makeup. The header valves would be throttled to control flow and pressure. As noted, the probability is very low that all 3 charging pumps will fail during the limited time period of solid operations.

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f. 4160 volt vital switchgear 1A3 and 1B3 in the cable spreading room on elevation 43' of the Reactor Auxiliary Building (RAB), and 4160 volt vital switchgear 1AB by the Primary Sampling Station and Chemistry Laboratory on elevation 19.5' of the RAB. These breakers can be operated only locally when de-energized.

g. The only indication lost will be the HPSI pumps on/off status lights in the Control Room.

h. The heatup, RCS fill and vent and cooldown procedures will be revised (per 3.d above) to include de-energizing the HPSI pumps before taking the plant solid. Restoration from this status, once the plant is no longer solid, will also be included. Keys for key-operated components (key locker) and the equipment clearance (tag out) procedure are under the control of the Nuclear Plant Supervisor.

i. & j. Not applicable for PSL-1.

The SIT's will not overpressurize this plant as their maximum pressure, 250 psig, is below the Technical Specification pressure temperature curves for the life of the plant.

4. During cold shutdown we are required by our Technical Specifications to verify operability of charging pumps and HPSI pumps (at least one, once per month). For the condition of interest (cold, solid plant), at least one charging pump would be operating thus satisfying the requirement without any further operation of pumps.

For the HPSI pumps, we are changing the test procedure to require closing the motor-operated pump discharge valve. This is in addition to the normally closed header isolation valves isolating the system from the RCS. This change will be implemented by March 31, 1977.

Instrument channel testing of the Safety Injection Actuation Signal (SIAS) does occur (monthly) during cold shutdown. However, our procedures do not take this testing to the point of actual equipment operation. And, should the Technician make an error, it would actuate only one channel - we must have 2 channels (of 4) to receive a SIAS. Finally, the critical test switches are spring loaded to return to normal so the Technician could not inadvertently leave one channel tripped and cause an SIAS by proceeding to test a second channel.

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5. In view of the NRC position that no credit can be taken for Operator action until 10 minutes after he is aware of the transient, the requirement for an alarm appears to be contradictory.

   a. However, an alarm will be provided. It will use signals from the low range pressure indications (2 redundent channels) presently installed. It will provide annunciation at the Digital Data Processing System (DDPS) console and on the RTGB containing the Safety Injection System Controls.

      To provide proper signal isolation, I/I converters are required. We do not yet know exact delivery time but will install the alarm by the end of 1977.

   b. The I/I converters are being added to ensure isolation of the two redundent pressure instruments. Other than those, the only modifications involved are pulling cable to the DDPS and modifying its software (program).

   c. The alarm setpoint is variable (as are the pressure limits) and set by the Operators at the DDPS. The DDPS has a 5-second scan cycle and will initiate its own console alarm and the RTGB alarm annunciation as soon as it senses overpressure (maximum of 5 seconds after setpoint is reached). The sensors are two redundent (different vendor) safety and Seismic class instruments.

   d. Either or both of the two redundent instrument loops will initiate the alarm and clearing of the alarm condition in one loop will not remove the alarm signal, thus protecting against failure of one loop.

      Before and during solid operation the alarm will be tested by inserting setpoints below existing pressure and verifying alarm operability. The pressure instruments are and will continue to be surveilled for calibration and proper operation using the same methods followed for all safety-related instrumentation.

6. At PSL Unit #1, isolation of RHR (Shut Down Cooling) does not isolate letdown and does not initiate any overpressure transients. The SDC suction piping is designed for 300 psig and has relief protection set at 300 psig. It is automatically isolated at 267 psia sensed at the pressurizer. After correcting for the elevation difference between the piping low point and the pressurizer and instrument accuracy, this is equivalent to the design pressure.

The following fulfills your request for additional information:

a. SDS system design pressure is 300 psig.

b. Motor-operated valves, fail as is
Loop A
MV-3481 and MV-3480 in series (FSAR Fig. 6.3-2)
Loop B
MV-3651 and MV-3652.

c. Valves close upon high pressure in RCS at 267 psia.
Redundent Pressure Switches close the valves.
PIS-1103 closes MV-3481 and MV-3651
PIS-1104 closes MV-3480 and MV-3652.

Alarms - Annunciation is provided to indicate valves open (not fully closed) above 267 psia - one annunciator for each loop.

Also, annunciation is provided (one for each loop) to alert Operators that the valves are closing/closed and the SDC pump (A or B LPSI pump) is running.

d. 60 seconds.

e. V-3439 LPSI discharge relief 500 psig, 5 gpm, Figure 6.3-1.
V-3482 between MV-3480 and -3481, 2485 psig, 5 gpm, Figure 6.3-2.
V-3469 between MV-3651 and -3652, 2485 psig, 5 gpm, Figure 6.3-2.
V-3483 1A SDC pump suction, 300 psig, 155 gpm, Figure 6.3-2.
V-3468 1B SDC pump suction, 300 psig, 155 gpm, Figure 6.3-2.

f. Other than those in C above, the SI lines to RCS have high pressure alarms set at 1100 psig minimum PIA-3319, -3329, -3339, -3349, Figure 6.3-2.

7. a. The RCP's are started (jogged) for short periods of time to sweep air from the steam generator U-tubes and other parts of the system not affected by SDC flow.

The first time RCP's are run (all four, one at a time in each loop for 30 seconds, sequentially, not simultaneously), the minor temperature difference not already accounted for by the revised procedure (See 9a) is eliminated. (The system is vented between each run.)

Thus, the later runs (one minute for each pump as above and 3 pumps for 10 minutes, 2 in one loop and one in the other followed by a reversal of the "2 pump loop") are relatively risk free as the only known pressurizing driving head is the RX/SG ΔT. We have performed the modified procedure and demonstrated satisfactory performance.

b. & c. The note regarding the entrapped air was intended to point out a possible mitigating circumstance. As there is no way to quantify the amount of air (gas) present with any degree of assurance and since the effects would be minor, we do not plan to take any credit for it in any overpressure analysis.

8. Procedures for system venting and limitations for establishing a steam bubble during the operation are discussed in response to Questions 2.a and b.

9. a. Cooling is reduced thus allowing the reactor to heat up to within ± 50°F of the steam generators.

b. RX-SDC return temp, read on the RTGB in the control room. Two redundent sensors are available for the recorder. S/G blowdown temperature (A & B S/G's) available at the DDPS in the control room.

c. Operating procedures and administrative controls ensure the RCP's will not be started until temperatures are properly equalized.