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ACCESSION NBR: 8701130163 DOC. DATE: 87/01/09 NOTARIZED: NO DOCKET #
 FACIL: 50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co. 05000389
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 WOODY, C. O. Florida Power & Light Co.
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SUBJECT: Forwards confirmatory analysis per 861016 Amend 16 to
 License NPF-16 re low temp overpressure protection.
 Confirmatory analysis, "Possible Low Temp Overpressure
 Protection Sys Alignments... included in 861016 ltr.

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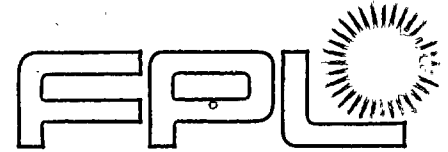
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JANUARY 09 1987

L-87-4

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

Gentlemen:


Re: St. Lucie Unit 2
Docket No. 50-389
Confirmatory Analyses for
Low Temperature Overpressure Protection

By letter dated October 16, 1986 (E. G. Tourigny to C. O. Woody) the NRC issued Amendment No. 16 to Facility Operating License No. NPF-16 for St. Lucie Unit 2. This amendment consisted of changes requested by Florida Power & Light Company (FPL) to the reactor coolant system pressure/temperature limit figures. The amendment also added the shutdown cooling system (SDCS) relief valves as Low Temperature Overpressure Protection (LTOP) devices.

In the Safety Evaluation issued with Amendment No. 16, the staff required FPL to submit confirmatory analyses by January 15, 1987. The confirmatory analyses, entitled "Possible LTOP System Alignments and the Required Supporting Analyses" were included as an attachment to the staff's October 16, 1986 letter. Attached to this letter are the above required confirmatory analyses.

Please contact us if you have any question about these analyses.

Very truly yours,


C. O. Woody
Group Vice President
Nuclear Energy

COW/EJW/gp

Attachment

cc: Dr. J. Nelson Grace, Region II, USNRC
Mr. Alan Schubert, Florida Dept. of Health and Rehabilitative Services
Harold F. Reis, Esquire

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ATTACHMENT

CONFIRMATORY ANALYSES REQUIRED
PER ST. LUCIE UNIT 2
AMENDMENT No. 16 TO FACILITY OPERATING LICENSE NPF-16

Response to 1.a.

A mass addition transient due to simultaneous operation of two High Pressure Safety Injection (HPSI) and three charging pumps was considered as one of the two most limiting pressure transients which provided a basis for the original St. Lucie Unit 2 Low Temperature Overpressure Protection (LTOP) system. (See Reference (1), Subsection 5.2.6.2.1). The original LTOP system was also based on the Pressure/ Temperature (P/T) limits for 0 to 2 years and included two Power Operated Relief Valves (PORVs) with the LTOP setpoints of 460 psia and 490 psia which were designated for transient mitigation over the entire LTOP temperature range.

To preclude violation of the P/T limits for 5 Effective Full Power Years (EFPY), 10 EFPY, etc., in the case of a pressure transient at the lower Reactor Coolant System (RCS) temperatures, a lower relief valve setpoint was required. It was determined that reducing the setpoint would not, by itself, preclude violation of new P/T limits if the limiting pressure transients previously assumed were also used as a basis for a new LTOP analysis.

As a result, less severe overpressurization events were assumed for the new St. Lucie Unit 2 LTOP system. (See Reference (2), Response to Question 1). These assumptions, although less conservative than those used previously, meet the requirements for LTOP systems, specified in Reference (3), and the Limiting Conditions for Operation (LCOs) of Reference (4), paragraphs 3.1.2.3, 3.1.2.4, 3.5.2, and 3.5.3.

1. The first of these is the fact that the Commission has not yet received any information from the Government of the United Kingdom regarding the proposed changes to the law. This is a serious matter, as the Commission is unable to carry out its duties without such information.

[illegible]

1. The first step in the process of identifying a problem is to define the problem. This involves identifying the symptoms of the problem and determining the scope of the problem. Once the problem has been defined, the next step is to identify the causes of the problem. This involves identifying the factors that are contributing to the problem and determining the underlying causes. Once the causes have been identified, the next step is to develop a plan of action. This involves identifying the steps that need to be taken to solve the problem and determining the resources that will be needed to implement the plan. Once a plan of action has been developed, the next step is to implement the plan. This involves carrying out the steps that have been identified in the plan and monitoring the progress of the implementation. Finally, the last step in the process is to evaluate the results of the implementation. This involves determining whether the problem has been solved and whether the resources have been used effectively.

Journal of Management Education 30(6)

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In the most recent LTOP evaluation, no HPSI pumps were assumed to be operable at $T_c = 200^\circ\text{F}$. However, a mass addition transient due to simultaneous operation of one HPSI and three charging pumps at these temperatures was analyzed. The peak RCS pressure in this transient, if mitigated by one Shutdown Cooling System (SDCS) relief valve, was calculated to be 345 psia.

An analysis was performed to determine if one HPSI pump can be operable to $T_c = 185^\circ\text{F}$ if the RCS is depressurized with a vent of greater than or equal to 3.58 square inches. The analysis confirmed that one HPSI pump can be operable under the above conditions. As a result Technical Specifications 3.1.2.1 and 3.1.2.3 requiring HPSI pump operation were satisfied.

An additional evaluation revealed a marginal difference between the peak pressure of 345 psia discussed above and the controlling pressure of 343 psia which was used to identify heatup and cooldown rates. (This controlling pressure was assumed to equal the rounded off peak pressure in the Reactor Coolant Pump (RCP) start transient with one SDCS relief valve.) Using $P_{\text{cont}} = 345$ psia instead of $P_{\text{cont}} = 343$ psia does not significantly change the identified heatup and cooldown rates.

Consequently, it was concluded that, based on LTOP considerations, one HPSI pump can be aligned to the RCS during the entire LTOP mode including the RCS temperatures below 185°F .

Response to I.c.

Following are the sequences of events during the most limiting pressure transients which were used as a basis for the St. Lucie Unit 2 LTOP analysis.

1. The first part of the report deals with the general situation of the country and the progress of the work during the year. It also mentions the results of the various investigations and the conclusions drawn from them.

2. The second part of the report deals with the results of the various investigations and the conclusions drawn from them. It also mentions the progress of the work during the year and the general situation of the country.

3. The third part of the report deals with the results of the various investigations and the conclusions drawn from them. It also mentions the progress of the work during the year and the general situation of the country.

4. The fourth part of the report deals with the results of the various investigations and the conclusions drawn from them. It also mentions the progress of the work during the year and the general situation of the country.

5. The fifth part of the report deals with the results of the various investigations and the conclusions drawn from them. It also mentions the progress of the work during the year and the general situation of the country.

I. RCP Start in Water-Solid RCS
With Secondary-to-Primary T = 40°F

IA. With a PORV

<u>Time (sec)</u>	<u>Event</u>	<u>Analysis Setpoint or Value (psia)</u>
0.0	Operator starts a RCP. RCS pressure begins to rise from the initial value	300
6.4	PORV opens at the specified setpoint	470
6.5	RCS pressure reaches a peak (at the PORV inlet) and starts decreasing	473.3
7.1	PORV closes at the reseal pressure and RCS pressure begins to rise	462
6.4 - 600	PORV cycles open and closed. Peak pressures at the PORV inlet	471.0 to 474.5

IB. With a SDCSRV Relief Valve (SDCSRVR)

<u>Time (sec)</u>	<u>Event</u>	<u>Analysis Setpoint or Value (psia)</u>
0.0	Operator starts a RCP. RCS pressure begins to rise from the initial value	300
3.0	SDCSRVR starts opening at 3% accumulation	360
3.1	RCS pressure reaches a peak (at the SDCSRVR inlet) and starts decreasing	362.1
3.7	RCS pressure reaches a minimum, and starts increasing	359.8
9.0	RCS pressure reaches a maximum (at the SDCSRVR inlet) and starts decreasing slowly	362.1
9.0-600 ⁽¹⁾	RCS pressure continues to decrease with the SDCSRVR partially open, or until the valve closes at 10% blowdown	316.5

(1) The transient was not analyzed up to t = 600 sec. However, in either case, the peak pressure of 362.1 psia will not be exceeded, because the intensity of the transient diminishes with time.

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II. Mass Addition Due to One HPSI and Three Charging Pump Operation
in Water-Solid RCS, with a PORV

<u>Time (sec)</u>	<u>Event</u>	<u>Analysis Setpoint or Value (psia)</u>
0.0	Inadvertent safety injection actuation. RCS pressure begins to rise from the initial value	300
3.3*	PORV opens at the specified setpoint and RCS pressure starts decreasing	470
4.0*	PORV closes at the reseal pressure and RCS pressure begins to rise	462
3.3 - 600	PORV cycles open and closed. Peak pressures at the PORV inlet	470**

* Estimated

** Based on comparison between the setpoint and the equilibrium pressure of 375 psia which was calculated for this transient.

1. The first part of the report is a general introduction to the subject of the study.

2. The second part of the report is a detailed description of the methods used in the study.

3. The third part of the report is a detailed description of the results of the study.

4. The fourth part of the report is a detailed description of the conclusions of the study.

5. The fifth part of the report is a detailed description of the recommendations of the study.

6. The sixth part of the report is a detailed description of the appendixes of the study.

7. The seventh part of the report is a detailed description of the bibliography of the study.

Response to I.d

Three overpressurization events were chosen and analyzed, as indicated in Reference (2), Response I. These are:

- RCP Start
- Two charging pump operation
- Inadvertent actuation of a HPSI pump, with simultaneous operation of three charging pumps.

These events were assumed to be mitigated by either one PORV, with a setpoint of 470 psia, or one SDCS relief valve, with a setpoint of 350 psia. The pressure transient analyses result in the peak (maximum) RCS pressures in each transient. These pressures are provided below:

	<u>w/PORV</u> <u>(psia)</u>	<u>w/SDCS Relief</u> <u>Valve (psia)</u>
(1) RCP Start	535	342.7
(2) Two Charging Pumps	473	341.0
(3) 1 HPSIs and 3 Charging Pumps	492	345.0

The identified controlling pressures (i.e. the most limiting pressures) were as follows:

$P_{cont} = 535$ psia, when LTOP is provided by the PORVs.

$P_{cont} = 343$ psia, when LTOP is provided by the SDCS relief valves.

It should be noted that a controlling pressure generally identifies an RCS pressure limit which will not be exceeded during any overpressurization event that could occur in the corresponding temperature region while being mitigated by an applicable relief valve. When applied to 10 CFR 50 Appendix G P/T limit curves, a controlling pressure also provides a lower bound pressure limit for these curves. In other words, a controlling pressure is generally more limiting than the P/T limits above it. Therefore, no P/T limits above the controlling pressure will be exceeded during normal operation or an overpressurization event.

SECRET

It is the policy of the United States to support the people of the Republic of China in their struggle to maintain their freedom and independence.

The United States will continue to provide the Republic of China with the military and economic assistance it needs to defend itself against the aggression of the People's Republic of China.

The United States will also continue to support the Republic of China in its efforts to achieve a peaceful and unified China.

Very truly yours,
John F. Kennedy

Mr. Tamm
Mr. Boardman
Mr. Nichols
Mr. Belmont
Mr. Mohr
Mr. Casper
Mr. Callahan
Mr. Conrad
Mr. DeLoach
Mr. Evans
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The United States will continue to support the Republic of China in its efforts to achieve a peaceful and unified China.

SECRET

P/T limits below the controlling pressure are considered theoretical since restrictions on heatup and cooldown rates (which are a part of LTOP requirements) prevent operation based on these limits.

REFERENCES

- 1) St. Lucie Unit 2 Final Safety Analysis Report
- 2) FPL Letter L-86-353 dated September 4, 1986
- 3) NRC Branch Technical Position RSB 5-2, Overpressurization Protection of Pressurized Water Reactors While Operating at Low Temperatures
- 4) St. Lucie Unit 2 Technical Specifications

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