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SUBJECT: Application for amend to license DPR-67, incorporating recent evaluation of postulated inadvertent opening of MSSV into current licensing basis.

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July 22, 1997

L-97-158  
10 CFR 50.59  
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  
UFSAR Evaluation of MSSV Inadvertent Opening

Pursuant to 10 CFR 50.90, Florida Power & Light Company (FPL) requests to amend Facility Operating License DPR-67 to incorporate a recent evaluation of a postulated inadvertent opening of a Main Steam Safety Valve (MSSV) into the current licensing basis for St. Lucie Unit 1. An assessment of the potential consequences of this specific transient is not presently contained in the Updated Final Safety Analysis Report (UFSAR). This request for license amendment is required by 10 CFR 50.59(c).

Attachment 1 is the subject evaluation. Attachment 2 is the "Determination of No Significant Hazards Consideration." It is requested that the proposed amendment, if approved, be issued by April 30, 1998.

The proposed amendment has been reviewed by the St. Lucie Facility Review Group and the Florida Power & Light Company Nuclear Review Board. In accordance with 10 CFR 50.91 (b)(1), a copy of the proposed amendment is being forwarded to the State Designee for the State of Florida.

Please contact us if there are any questions about this submittal.

Very truly yours,

J. A. Stall  
Vice President  
St. Lucie Plant

A00111

JAS/RLD

Attachments

280057



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



St. Lucie Unit 1  
Docket No. 50-335  
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UFSAR Evaluation of MSSV Inadvertent Opening

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STATE OF FLORIDA            )  
  )  
COUNTY OF ST. LUCIE        )        ss.

J. A. Stall being first duly sworn, deposes and says:

That he is Vice President, St. Lucie Plant, for the Nuclear Division of Florida Power & Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information and belief, and that he is authorized to execute the document on behalf of said Licensee.

  
\_\_\_\_\_  
J. A. Stall

STATE OF FLORIDA  
COUNTY OF St. Lucie

Sworn to and subscribed before me  
this 22nd day of July, 19 97  
by J. A. Stall, who is personally known to me.

  
\_\_\_\_\_  
Signature of Notary Public-State of Florida



Leslie J. Whitwell  
MY COMMISSION # CC646183 EXPIRES  
May 12, 2001  
BONDED THRU TROY FAIN INSURANCE, INC.

\_\_\_\_\_  
Name of Notary Public (Print, Type, or Stamp)

St. Lucie Unit 1  
Docket No. 50-335  
Proposed License Amendment  
UESAR Evaluation of MSSV Inadvertent Opening

L-97-158, ATTACHMENT 1

EVALUATION  
OF  
INADVERTENT OPENING OF A MAIN STEAM SAFETY VALVE

## Introduction

A conservative assessment of the potential consequences associated with the inadvertent opening of a St. Lucie Unit 1 (PSL1) Main Steam Safety Valve (MSSV) was performed by Florida Power and Light Company (FPL) in conjunction with the NSSS vendor, Combustion Engineering (ABB/CE). The evaluation is based on a comparison of PSL1 transient analysis key input parameters for an Excess Load event to those of an explicit analysis performed to assess the postulated inadvertent opening of an MSSV reported in the St. Lucie Unit 2 (PSL2) Updated Final Safety Analysis Report (UFSAR). The impact of parameter differences between the two St. Lucie units was then evaluated and used to determine bounding values of two-hour site boundary radiation doses for comparison to 10 CFR 100 limits. The same method was used to assess the minimum Shutdown Margin (SDM) that would be achieved during the transient at PSL1. Changing the PSL1 UFSAR to include this evaluation requires prior NRC approval pursuant to 10 CFR 50.59, "Changes, Tests, and Experiments."

## Background

The Chapter 15 accident analyses reported in the PSL1 UFSAR are based on the "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," [USAEC] Guide 1.70, Revision 1, issued October, 1972. Postulated transients and accidents analyzed for St. Lucie Unit 1 are listed in TABLE 15.1.1-1 of UFSAR section 15.1.1, CLASSIFICATION OF ACCIDENTS. The Class 1, EXCESS LOAD accident is described as, "Excessive load increase, including that resulting from a pressure regulator failure, or inadvertent opening of a relief or safety valve." It should be noted that an excess load incident is defined as any rapid increase in steam generator steam flow other than a steam line rupture (UFSAR 15.2.11.1).

The radiological analysis performed for the Excess Load event assessed the consequences of the inadvertent opening of a power operated atmospheric steam dump valve (ADV). The results of this radiological analysis are contained in UFSAR section 15.2.11.2.3, and show that, for the set of assumptions contained in Table 15.2.11-5 (ADV open for 10 minutes), the dose to a person at the site boundary would be 0.0878 rem to the thyroid and  $4.69 \times 10^{-5}$  rem whole body. Other more severe steam demand scenarios were postulated to demonstrate that fuel design limits would not be violated.

An assessment of the inadvertent opening of an MSSV is not presently contained in the PSL1 UFSAR, Chapter 15 safety analyses. To support FPL's plans for future safety valve "in-place" set point verification in operational MODE 1, FPL determined that an

evaluation should be performed to conservatively estimate the consequences of a stuck open MSSV. Because the radiation doses determined by the evaluation demonstrate an increase in consequences beyond those of the radiological analysis reported for the existing Excess Load event of record (inadvertent opening of an ADV), the postulated stuck open MSSV scenario represents an unreviewed safety question. In such cases, 10 CFR 50.59(c) requires that the licensee submit an application for amendment of the facility operating license.

### Comparative Evaluation

The information presented in this section is based on FPL Safety Related Engineering Evaluation PSL-ENG-SENS-97-039, Revision 0, June 4, 1997, and attachments thereto. The Engineering Evaluation will be incorporated by reference into the PSL1 UFSAR pending NRC approval of this amendment application.

The evaluation includes a comparison of PSL1 transient analysis key input parameters to those of an explicit analysis which was previously performed to assess the consequences of an inadvertent opening of an MSSV at PSL2, and is reported in PSL2 UFSAR Section 15.1.3.1.1. The impact of differences identified between the two units was evaluated and used to adjust the PSL2 analysis results to obtain the two-hour site boundary doses and the minimum shutdown margin that would be expected for this event at PSL1.

PSL2 EVENT: The postulated inadvertent opening of an MSSV is initiated from Hot Zero Power (HZP) conditions, and causes the entire blowdown of one steam generator (SG) and partial blowdown of the other SG. The assumed operating parameters were selected to maximize the radioactivity release and loss of SDM. Credit was taken for the protective action of the SG Water Level-Low trip, automatic starting of one safety injection pump, operator action after 10 minutes to terminate auxiliary feed water flow, and operator action after 30 minutes to commence boration to cold shutdown conditions.

In the calculation of site boundary doses, it was conservatively assumed that the maximum SG inventory (corresponding to HZP conditions) and all radioactivity in both SGs, including primary to secondary leakage, is released to the environment. Technical Specification (TS) values for maximum allowed primary to secondary leakage, SG activity, and RCS activity concentrations were used in the analysis.

For reactivity considerations, conservative assumptions were made that include: (a) a minimum Control Element Assembly (CEA) worth of -4000 pcm available for shutdown at the time of reactor trip; (b)



a maximum core inlet temperature for HZP conditions to maximize the total heat transferred from primary to secondary, and thereby maximize the total steam release through the stuck open MSSV; (c) the reactivity worth of boron injected by the safety injection system is  $-1.0 \text{ } \Delta\rho$  per 95 ppm, and (d) one of two available high pressure safety injection pumps fails.

Relative to radiological release and loss of Shutdown Margin (SDM), the PSL2 analysis represents the worst case Anticipated Operational Occurrence (AOO) in the group of transients evaluated for increased heat removal by the secondary system. The two-hour site boundary doses are 2 Rem Thyroid (DEQ I-131) and 10 mrem Whole Body (DEQ Xe-133). The maximum post-trip reactivity is  $-1.2 \text{ } \Delta\rho$  using a Moderator Temperature Coefficient (MTC) of  $-27 \text{ pcm}/^\circ\text{F}$  (original analysis), and  $-0.8 \text{ } \Delta\rho$  using an MTC of  $-30 \text{ pcm}/^\circ\text{F}$  (current TS limit for negative MTC at rated thermal power).

Table 2 (Page 6 of 6 in this attachment) lists the key input parameters used in the PSL2 analysis.

#### PSL1 COMPARISON:

The St. Lucie Unit 1 key parameters and references used in the evaluation are listed in Table 2 and can be easily compared to those used in the PSL2 analysis of an inadvertent opening of an MSSV. The PSL1 operating parameters consist of TS limiting values and initial conditions used in similar HZP events reported in the PSL1 UFSAR.

Like-for-like parameter values between the two PSL units are not further discussed except to note that, for a given set of secondary conditions, the MSSV orifice area of  $16 \text{ in}^2$  will provide the same rate of SG blowdown for both units.

For the small differences in Initial Inlet Temperature ( $1^\circ\text{F}$ ) and Initial Pressurizer Pressure (8 psi), it was determined that the combined impact is not significant and would not change the conclusion reached in the evaluation. In addition, the difference in specifications involving Primary to Secondary Leak Rate will not affect the consequences of the transient, e.g., 1 gpm leakage to one SG or 1 gpm leakage split between the two SGs results in the same amount of total radioactivity since it is assumed that the inventory of both SGs is released.

**Assessment of Site Boundary Doses:** Given the same maximum concentrations of DEQ-Iodine and Noble Gas, and primary to secondary leak rate, a comparison of the PSL1 to PSL2 total radioactivity release will be a function of the SG Fluid Mass that is blown to the atmosphere. Since the PSL2 analysis assumes a

slightly higher value for SG fluid inventory, the doses determined in the PSL2 analysis will be greater than those resulting from this transient at PSL1. Similarly, the larger value used for the Atmospheric Dispersion Coefficient in the PSL2 calculation will yield higher site boundary doses. Based on these differences, the comparative evaluation demonstrates that the PSL2 calculation of site boundary doses is at least 30% higher than would be expected from the same transient at PSL1. Therefore, the conservative estimate for two-hour site boundary doses resulting from an inadvertent opening of an MSSV at PSL1 is  $\leq 2$  Rem Thyroid (DEQ I-131), and  $\leq 10$  mrem Whole Body (DEQ Xe-133).

**Assessment of Post-Trip Peak Reactivity:** As a result of the comparative evaluation, the PSL2 post-trip peak reactivity (minimum SDM) was adjusted to provide a conservative prediction for PSL1 based on the following key parameter differences.

(a) The difference between the PSL1 Available SDM at time of reactor trip and the value used in the PSL2 analysis will directly change the PSL2 calculated value of post-trip peak reactivity (reduce the SDM) by 400 pcm.

(b) As described in Note (4) of Table 2, a change in the value of MTC from  $-27$  pcm/ $^{\circ}$ F to  $-30$  pcm/ $^{\circ}$ F resulted in a 400 pcm change in the calculated value of PSL2 post-trip peak reactivity. Based on this information, it was determined conservatively that the 1 pcm/ $^{\circ}$ F difference between the PSL1 and PSL2 MTC shown in Table 2 would likewise change the PSL2 post-trip peak reactivity (reduce the SDM) by no more than 200 pcm.

(c) The analysis of record for PSL2 shows that an Inverse Boron Worth (IBW) of 95 ppm/ $\Delta\rho$  results in a total negative reactivity insertion of approximately 700 pcm after 30 minutes into the transient. The value of Maximum Inverse Boron Worth listed in Table 2 for PSL1 is slightly less conservative than the PSL2 value. It was determined that this difference would change the PSL2 calculated value of post-trip peak reactivity (reduce the SDM) by no more than 70 pcm.

The post-trip reactivity calculated in the PSL2 analysis ( $-1200$  pcm corresponding to MTC  $-27$  pcm/ $^{\circ}$ F) was adjusted to reduce the SDM by 670 pcm to account for the total effect of the PSL1 reactivity differences. The conservative estimate of post-trip peak reactivity for this transient at PSL1 at the time the operator begins to borate the system to cold shutdown conditions is  $-530$  pcm. Therefore, criticality would not occur as a result of an inadvertent opening of an MSSV at PSL1.

### Conclusion

The comparative evaluation demonstrates that the radiological consequences from an inadvertent opening of an MSSV at PSL1 is conservatively bounded by the results of the explicit analysis performed for that event at PSL2. As shown in Table 1, the potential two-hour site boundary doses predicted for St. Lucie Unit 1 are higher than those reported for the Excess Load event in the PSL1 UFSAR (inadvertent opening of an ADV), but the doses remain a small fraction of 10 CFR 100 limits.

TABLE 1: TWO-HOUR SITE BOUNDARY DOSES (PSL1)

Event / Subject	Thyroid Dose (REM)	Whole Body Dose (REM)
Inadvertent Opening of ADV	0.0878	0.0000469
Stuck Open MSSV	≤ 2	≤ 0.01
10 CFR 100 Limits	300	25

The minimum SDM that would be achieved during this transient at PSL1 demonstrates that criticality would not occur following the reactor trip from HZP. In addition, it should be noted that the design of the Main Steam Isolation Valves at PSL1 includes a reverse-flow check valve. To maximize conservative results in the comparative evaluation, credit was not taken for this design feature.

**TABLE 2: TRANSIENT ANALYSIS KEY PARAMETERS**

PARAMETER	PSL1 REFERENCE*	PSL1 VALUE	PSL2 VALUE *
RPS Trip Setpoint, SG Water Level-Low	TS Table 2.2-1	19.5 % (note 1)	19.5 % (note 1)
Available SDM at time of trip	TS 3.1.1.1	3600 pcm	4000 pcm (note 2)
Initial Power	UFSAR Table 15.2.11-3	1 MWt	1 MWt
Initial Inlet Temperature	UFSAR Table 15.2.11-3	534 °F (note 3)	535 °F
Initial Pressurizer Pressure	UFSAR Table 15.2.11-3	2178 psia (note 3)	2170 psia
Initial Core Mass Flow	UFSAR Table 15.2.11-3	137 E6 lbm/hr	137 E6 lbm/hr
MTC	TS 3.1.1.4 (COLR 2.1)	-28 pcm/°F	-27 pcm/°F (note 4)
Doppler Multiplier	UFSAR Table 15.2.11-3	0.85	0.85
Primary to Secondary Leak Rate	TS 3.4.6.2	1 gpm all SGs	1 gpm all SGs, 720 gpd any one SG
MSSV Orifice Area	TS 3.7.1.1, Table 4.7-1	16 in <sup>2</sup>	16 in <sup>2</sup>
RCS Maximum Allowable DEQ I-131 Concentration	TS 3.4.8.a	1.0 µCi/gram	1.0 µCi/gram
RCS Maximum Allowable Concentration of Noble Gases	TS 3.4.8.b	100/E µCi/gram	100/E µCi/gram
SG Maximum Allowable DEQ I-131 Concentration	TS 3.7.1.4	0.1 µCi/gram	0.1 µCi/gram
SG Fluid Mass (Total both SGs)	UFSAR Table 15.4.6-1	446,204 lbm	448,000 lbm
Atmospheric Dispersion Coefficient, 0-2 hours at EAB	UFSAR Table 15.2.11-5	(note 5) 1.2 E-4 sec/m <sup>3</sup>	(note 5) 1.6 E-4 sec/m <sup>3</sup>
Breathing Rate	UFSAR Table 15.2.11-5	3.47 E-4 m <sup>3</sup> /sec	3.47 E-4 m <sup>3</sup> /sec
Dose Conversion Factor	UFSAR Table 15.4.4-3	1.48 E6 Rem/Ci	1.48 E6 Rem/Ci
Maximum Inverse Boron Worth	UFSAR Table 15.2.11-3	100 ppm per %Δρ	95 ppm per %Δρ

\* PSL1 UFSAR through Amendment 15 (1/97), TS through Amendment 151(5/97), COLR Revision 0. The PSL2 event is described in UFSAR Section 15.1.3.1.1. Parameter values are documented in UFSAR Section 15.1.3.1.1.2, UFSAR Tables 15.1.3.2, 15.1.3.3, and 15.0-19 (PSL2 UFSAR through Amendment 10, 7/96), and/or the analysis of record.

- (1) Minimum allowable value permitted by TS. Results in longer time to reactor trip and greater steam release.
- (2) PSL2 required SDM per TS 3.1.1.1 is 5000 pcm. The analysis of record conservatively used a minimum CEA worth for HZP of 4000 pcm (available for shutdown at time of reactor trip).
- (3) PSL1 UFSAR Table 15.2.11-3 lists nominal values of 532 °F for inlet temperature and 2200 psia for pressurizer pressure. UFSAR Section 15.1.6.3 lists uncertainties of +2 °F and -22 psia, respectively, for these parameters.
- (4) Original PSL2 analysis used MTC -27 pcm/°F, which yields a post-trip peak reactivity of -1200 pcm. UFSAR Section 15.1.3.1.1.3 also reports results for MTC -30 pcm/°F, which yields a post-trip peak reactivity of -800 pcm. Original PSL2 analysis MTC is used in the peak reactivity comparative evaluation because that MTC is closer to the PSL1 value.
- (5) PSL1 methods from AEC Safety Guide 4. PSL2 methods from USNRC Regulatory Guide 1.145.

St. Lucie Unit 1  
Docket No. 50-335  
Proposed License Amendment  
UFSAR Evaluation of MSSV Inadvertent Opening

L-97-158, ATTACHMENT 2

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

#### DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

*Description of amendment request:* The proposed amendment will incorporate a recent evaluation of a postulated inadvertent opening of a Main Steam Safety Valve (MSSV) into the current licensing basis for St. Lucie Unit 1 (PSL1). An assessment of the potential consequences of this specific transient is not presently contained in the Updated Final Safety Analysis Report (UFSAR), and the proposed license amendment is required by 10 CFR 50.59(c).

Pursuant to 10CFR50.92, a determination may be made that a proposed license amendment involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. Each standard is discussed as follows:

(1) Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated.

The Unit 1 UFSAR includes analyses for excess load events; however, a stuck open MSSV is not specifically evaluated in the UFSAR. This proposed amendment will add an evaluation of an inadvertent opening of an MSSV to the licensing basis of the plant. The probability of occurrence of an excess load event is not increased by this amendment since the frequency of initiating events has not changed and there is no change to the plant or plant operation as a result of this amendment. Thus, there is no significant increase in the probability of any accident previously analyzed.

The radiological consequences of an excess load event other than steam line ruptures are discussed in UFSAR Section 15.2.11.2.3, and are based on the inadvertent opening of an Atmospheric Steam Dump Valve (ADV). This proposed amendment revises the radiological consequences of the UFSAR excess load event to incorporate the results of a recent evaluation of an inadvertent opening of an MSSV. The consequences of the postulated MSSV scenario are greater than those of an inadvertent opening of an ADV, but the predicted two hour site boundary doses remain a small fraction of 10 CFR 100 limits. In addition, the Unit 1 results are bounded by the St. Lucie Unit 2 analysis results which are reported in Section 15.1.3.1.1.3 of the Unit 2 UFSAR. Therefore, operation of the



facility in accordance with the proposed amendment will not involve a significant increase in the consequences of an accident previously evaluated.

(2) Operation of the facility in accordance with the proposed amendment would not create the possibility of a new or different kind of accident from any accident previously evaluated.

The proposed amendment will add an evaluation of an inadvertent opening of an MSSV to the licensing basis of the plant. The evaluation addresses an anticipated operational occurrence (AOO) and is classified as an Excess Load event under the PSL1 accident classification criteria. Although an analysis of this specific transient is not currently provided in the UFSAR, analyses of Excess Load events other than steam line ruptures are reported in UFSAR Section 15.2.11. The amendment does not change plant design or operation and does not introduce new failure modes or system interactions. Thus, operation of the facility with the proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) Operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety.

The proposed license amendment adds an engineering evaluation to the licensing basis of the plant to address the consequences of a postulated stuck open MSSV. A change is not being made to plant design or operation. A change is not being made to any Technical Specification Limiting Condition for Operation, Action, or Surveillance Requirement. The evaluation demonstrates that, post-trip, the reactor would remain subcritical throughout the transient, and that the radiological consequences of a stuck open MSSV are a small fraction of 10 CFR 100 limits. Therefore, operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety.

Based on the discussion presented above, FPL has concluded that this proposed license amendment involves no significant hazards consideration.