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EISENHUT,D.G. Division of Licensing

SUBJECT: Forwards safety parameter display sys implementation plan & parameter selection rept,per 830415 commitment.Rept meets requirements of Generic Ltr 82-33 re Suppl 1 to NUREG-0737.

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FPL

FLORIDA POWER & LIGHT COMPANY

March 1, 1984
L-84-49

Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Eisenhut:

Re: St. Lucie Unit 2
Docket No. 50-389
SPDS Implementation Plan and Parameter Selection Report

In Florida Power & Light (FPL) Letter L-83-238 dated April 15, 1983, FPL committed to provide a Safety Parameter Display System (SPDS) Implementation Plan and Parameter Selection Report by March 1, 1984.

In accordance with FPL's commitment, the attached report meets the requirements of NRC Generic Letter 82-33 entitled, "Supplement 1 to NUREG 0737 Requirements for Emergency Response Capability."

Should you have any questions regarding this submittal, please feel free to call.

Very truly yours,

J.W. Williams, Jr.
Vice President
Nuclear Energy Department

JWW/RJS/DCB/mp
Attachment

cc: Mr. James P. O'Reilly, Region II
Harold F. Reis, Esquire

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SAFETY PARAMETER DISPLAY SYSTEM

PARAMETER SELECTION EVALUATION

AND

IMPLEMENTATION PLAN

I. DESCRIPTION

The purpose of the Safety Parameter Display System (SPDS) is to assist control room personnel in evaluating the safety status of the plant. The SPDS at St. Lucie provides a continuous display of a wide variety of plant parameters on a 19" CRT centrally located in the control room.

Inputs to the St. Lucie SPDS are obtained via existing plant instrumentation, processed through a central computer, and then displayed on CRTs. There are three primary displays that may be shown on the CRTs, one for each major mode of operation - normal, heatup/cooldown, and shutdown cooling modes. The necessary plant parameters are displayed in each mode to allow the control room operator to adequately assess plant safety status for a variety of normal and abnormal plant operating conditions. Supplemental parameters and trending information can also be displayed. A listing of chosen parameters for the primary displays is supplied in Table 1.

II. BASIS FOR PARAMETER SELECTION

NRC Generic Letter 82-33 entitled "Supplement 1 to NUREG-0737 - Requirements for Emergency Response Capability" requires that, as a minimum, the SPDS should provide information to plant operators about:

i) Reactivity Control
ii) Reactor core cooling and heat removal from the primary system
iii) Reactor coolant system integrity
iv) Radioactivity control
v) Containment Integrity

Additional guidance used to select SPDS parameters was obtained from work performed by a utility owners group, Regulatory Guide 1.97, and operating experience. The basis for the parameters selected to meet the requirements of each of the five areas identified in Generic Letter 82-33 is as follows:

1. Reactivity Control

The purpose of monitoring a reactivity control parameter is to provide to the operator the status of flux conditions within the reactor core. In order to assess the reactor core flux conditions it is necessary to monitor reactor power in all ranges and rate of change of power. Therefore, the SPDS monitors the startup range, wide range logarithmic and power range nuclear instruments. This provides the means to monitor core flux conditions throughout all ranges of reactor operation. Changes in flux conditions are monitored on the SPDS by the startup rate indication.

In addition to these parameters, reactor trip status is also displayed to provide the operator additional information on reactivity control systems status.

The SPDS monitors core power, startup rate, and reactor trip status. Based on the above evaluation, these parameters are sufficient to provide the operator with indication of reactivitiy control for a range of plant conditions.

2. Reactor Core Cooling and Heat Removal from the Primary System

The objective in this area is to provide sufficient indication such that an operator can determine if the reactor core is being adequately cooled and heat is being continuously removed from this system. To ensure adequate core cooling and heat removal, it is necessary to ensure there is flow through the core and that a heat sink is available to remove heat from the core. There are three separate cases that must meet these criteria: RCS integrity maintained, loss of RCS integrity, and shutdown cooling.

In the case where RCS integrity is maintained, flow through the core must first be established. Core exit temperatures and cold leg temperatures are monitored on SPDS to assure that there is a differential temperature across the core and heat is being removed. Subcooling margin assures there is no void formation that might impede natural circulation through the core when there is no forced flow. The primary heat sink for this case would be the steam generators. Steam generator levels and pressures provide indication that the steam generators are available as primary heat sinks.

In the case where RCS integrity is not maintained (i.e., LOCA) the Safety Injection Actuation message on SPDS indicates that cooling water is going to the reactor coolant system. Core exit temperatures are monitored to assure that heat is being removed. The reactor vessel level monitor indicates the extent to which the core is covered with water.

Finally, for the special case of shutdown cooling, a separate display provides indication of shutdown cooling flow and temperatures. This, combined with core exit temperatures, is a positive indication of heat removal.

These monitored parameters - core exit temperature, cold leg temperatures, subcooled margin, steam generator level, steam generator pressure, reactor vessel level, shutdown cooling temperatures and flow and the safety injection actuation message -are sufficient for the operator to assess reactor core cooling for a range of plant conditions.

3. RCS Integrity

The objective of this area is to provide sufficient indication such that an operator can determine if all primary coolant system boundaries are intact, thus maintaining coolant inventory for core cooling. RCS integrity may be breached either in the form of a Loss Of Coolant Accident (LOCA) to containment or as a Steam Generator Tube Rupture (SGTR).

Pressurizer level, pressurizer pressure and reactor vessel level are used to provide the operator with indication of a properly maintained Reactor Coolant System boundary.

Additional indication of a failure of RCS integrity in the form of a LOCA can be determined by containment radiation or by the containment environment indication. The containment environment indication will alarm if any of its input parameters - containment temperature, pressure or sump level - exceed set limits.

Indication of a failure of RCS integrity in the form of a Steam Generator Tube Rupture (SGTR) is provided by steam generator levels and pressures and by the secondary radiation indication. Rising steam generator level is one indication of an SGTR. The secondary radiation indication will alarm if either of its inputs, the steam generator blowdown radiation or air ejector radiation monitors, exceeds set limits. A SGTR could cause a secondary radiation alarm.

Additionally, charging and letdown system flows are also displayed. Increased charging flow is the first sign of a small breach in RCS integrity.

These monitored parameters - pressurizer pressure, pressurizer level, reactor vessel level, containment environment, containment radiation, secondary radiation, steam generator levels, steam generator pressures, and charging and letdown flows - are sufficient to assess RCS integrity for a range of operating conditions.

4. <u>Radioactivity Control</u>

The objective of this area is to provide sufficient indication such that an operator can determine that no radioactive substances are being released to the environment in an uncontrolled manner.

Radioactive products can be released from the RCS into either the containment during a LOCA or into the secondary side during a steam generator tube rupture. Radioactivity control is, therefore, monitored in two ways, by the containment radiation indication and by the secondary radiation indication.

Containment radiation is supplied as a digital indication from 1 to 10^8 R/hr. A high radiation signal also causes a containment isolation signal to be initiated to prevent uncontrolled release to the environment.

The secondary radiation indication will alarm if either of its monitored inputs - air ejector radiation or steam generator blowdown radiation - exceeds specified limits.

These indications - containment radiation and secondary radiation - provide the operator with indication of any potential uncontrolled radiation release.

5. Containment Integrity

The objective of this area is to provide sufficient indication such that an operator can determine if a containment boundary is being maintained to control radioactive substances during and following a Loss of Coolant Accident (LOCA). To do this, challenges to the containment must be monitored.

Challenges to the containment are monitored via the containment environment indication. The containment environment indication is a derived parameter using containment temperature, pressure, and sump level as inputs. Should any of these parameters go out of established limits, an alarm will occur. This provides an indication that containment integrity is being challenged, and corrective actions should be taken by the operator. The message for a Safety Injection Actuation Signal (SIAS) on the display will infer that a Containment Isolation Signal (CIS) has been initiated (CIS occurs on SIAS).

These indications - containment environment and Safety Injection actuation - in conjunction with the RCS integrity parameters provide the essential information to assess containment integrity.

Based on the above information, the SPDS displays provide sufficient information for the control room operator to assess plant status during heatup-cooldown, normal operation, shutdown operation, and for a wide range of postulated plant accidents including Main Steam Line Breaks (MSLB), LOCA's, SGTR's, and Boron Dilution Events.

III. SAFETY ANALYSIS

The Safety Parameter Display System is a non-safety, non-seismic system (with the exception of the isolation system). It is a passive, monitoring and indication system only, and does not interact with the automatic initiation of any protection system.

All modifications to safety-class IE circuits where SPDS inputs are obtained satisfy the isolation and qualification requirements of FSAR Section 7.1 and 7.5. Only Safety Class IE equipment is used and separation is provided by routing wires through totally enclosed metallic wireways dedicated to each safety division and terminating in the Class IE Termination Cabinets.

Furthermore, all interface between safety and non-safety signals are through isolation devices fully qualified and installed to IEEE-323-1974 and IEEE-344-1975 standards.

Finally, implementation of the SPDS will require no changes to the plant's Technical Specifications.

Based on the above information, it has been determined that installation and operation of the SPDS does not constitute an unreviewed safety question in accordance with 10CFR50.59.

IV. IMPLEMENTATION

Facility Operating License NPF-16 for St. Lucie Unit 2, Condition of License 2.C.(17)(a)(1)(a), requires that "Prior to startup following the first refueling outage, the Safety Parameter Display System (SPDS) shall be operable, including training of operators". FPL will install the SPDS system in accordance with this Condition of License.

ST. LUCIE PLANT UNIT NO. 2
NUREG 0696 - FUNCTIONAL CRITERIA FOR EMERGENCY RESPONSE FACILITIES
SAFETY PARAMETER DISPLAY SYSTEM (SPDS)
PARAMETER SELECTION

TABLE 1

PLANT FUNCTION	KEY PARAMETERS: DESCRIPTION	RANGE	TYPE	REMARKS: LOCATION OF PARAMETER ON DISPLAY	DISPLAY TYPE e.g. TARGET, BAR GRAPH	NUMBER OF INSTRUMENTS USED
REACTIVITY CONTROL	CPS Source Range Power Level (startup)	10^{-0} to 10^{5} CPS	Direct Average	Below Title	Digital Value	2
	Percent Wide Range Power (Logrithmic)	$2x10^{-8}$ amps to 200%	Direct Average	Below Title	Digital Value	4
	Percent Power	0 to 125%	Direct Average	Below Title	Digital Value	4
	Startup Rate	-1 to 7 dpm	Direct Average	Message Area Line 6	Digital Value	3
	Reactor Trip Signal	-	Calculated	Message Area Line 7	Message	8
REACTOR CORE COOLING AND HEAT REMOVAL FROM THE PRIMARY SYSTEM	Cold Leg Temperature	50 to 705°F	Direct Average	Top Row Right	Bar Graph & Digital Value	4 Wide Range (WR) 4 Narrow Range (NR
	Core Exit Temperature	32 to 2300°F	Direct Average	Bottom Row Right	Digital Value	56 Thermocouples (TC's)
	Feedwater Isolation Signal A&B	This is a derived parameter using AFAS A&B, MSIS A&B, and SIAS A&B		Message Area Line 9	Message	6 Digital Contact Inputs
	Main Steam Isolation Signal (MSIS) A&B		Direct	Message Area Line 8	Message	2
	RCS Average Temperature	A derived parameter from Hot & Cold Leg Temp.		Message Area Line 5	Digital Value	4 WR Cold Leg 4 WR Hot Leg 4 NR Cold Leg 4 NR Hot Leg

TABLE 1

KEY PARAMETERS				REMARKS		
PLANT FUNCTION	DESCRIPTION	RANGE	TYPE	LOCATION OF PARAMETER ON DISPLAY	DISPLAY TYPE e.g. TARGET, BAR GRAPH	NUMBER OF INSTRUMENTS USED
REACTOR CORE COOLING AND HEAT REMOVAL FROM THE PRIMARY SYSTEM	Reactor Vessel Level	0 to 100%	Lowest	Bottom Row Center	Target	1 for Channel A 1 for Channel B
	Shutdown Cooling A&B (SDC) Flow	0 to 5000 gpm	Direct	Center Section	Bar Graph & Digital Value	1 for Loop A 1 for Loop B
	SDC from RCS (Temp.) A&B	0 to 350°F	Direct	Center/Left Section	Bar Graph & Digital Value	1 for Loop A 1 for Loop B
	SDC to RCS (Temp.) A&B	0 to 350°F	Direct	Center/Left Section	Bar Graph & Digital Value	1 for Loop A 1 for Loop B
	Safety Injection Actuation Signal (SIAS) A&B	-	Direct	Message Area Line 10	Message	2 Digital Contacts
	Steam Generator (S/G) Levels A&B	0 to 100%	Average	Center Section	Bar Graph & Digital Value	4 NR S/G A 4 NR S/G B
	S/G Pressure A & B	0 to 1200	Average	Center Section	Bar Graph & Digital Value	3 S/G A 3 S/G B
	Subcooling	700 to -2100°F (subcooled to superheat)	Lowest	Bottom Row Right	Target	8
RCS INTEGRITY	Charging Flow	0 to 150 gpm	Direct	Middle Row/Left	Bar Graph & Digital Value	1
	Containment Environment	A derived parameter using containment pressure, temperature, & level		Bottom Row	Target	Cont. Level 3 Cont. Press. 8 Cont. Temp. 1

ST. LUCIE PLANT UNIT NO. 2
NUREG 0696 - FUNCTIONAL CRITERIA FOR EMERGENCY RESPONSE FACILITIES
SAFETY PARAMETER DISPLAY SYSTEM (SPDS)
PARAMETER SELECTION

TABLE 1

KEY PARAMETERS				REMARKS		
PLANT FUNCTION	DESCRIPTION	RANGE	TYPE	LOCATION OF PARAMETER ON DISPLAY	DISPLAY TYPE e.g. TARGET, BAR GRAPH	NUMBER OF INSTRUMENTS USED
	Containment Radiation	10^0 to 10^8 R/HR	Average	Bottom Row	Digital Value	2 Low Range 2 Wide Range
	Core Exit Temperature	32 to 2300°F	Direct Average	Bottom Row Right	Digital Value	56 TC's
	Letdown Flow	0 to 150 gpm	Direct	Middle Row/Left	Bar Graph & Digital Value	1
	Pressurizer Level	0 to 100%	Average	Top Row Center	Bar Graph & Digital Value	5
RCS INTEGRITY	Pressurizer Pressure	0 to 750 psia	Average	Top Section	Bar Graph & Digital Value	4
	RCS Average Temperature	Derived from Hot & Cold Leg Temps.		Message Area Line 5	Digital Value	4 WR Cold Leg 4 WR Hot Leg 4 NR Cold Leg 4 NR Hot Leg
	RCS Pressure	0 to 3000 psia	Calculated	Top Row	Bar Graph & Digital Value	4 Narrow Ran 2 Wide Range
	Reactor Vessel Level	0 to 100%	Lowest	Bottom Row Center	Digital Value	1 - Ch. A 1 - Ch. B
	Secondary Radiation	Derived from S/G Blowdown & Air Ejector Radiation		Bottom Row Left	Target	1 - Air Ejector 2 - S/G Blowdown
	S/G Level A&B	0 to 100%	Average	Center Section	Bar Graph & Digital Value	4 NR S/G A 4 NR S/G B
	S/G Pressure A&B	0 to 1200 psia	Average	Center Section	Bar Graph & Digital Value	3 S/G A 3 S/G B

TABLE 1

KEY PARAMETERS				REMARKS		
PLANT FUNCTION	DESCRIPTION	RANGE	TYPE	LOCATION OF PARAMETER ON DISPLAY	DISPLAY TYPE e.g. TARGET, BAR GRAPH	NUMBER OF INSTRUMENTS USED
RADIOACTIVTY CONTROL	Containment Radiation	10^0 to 10^8 R/HR	Average Calculated	Bottom Row	Digital Value	2 Low Range 2 Wide Range
	Secondary Radiation	Derived from S/G Blowdown & Air Ejector Radiation		Bottom Row	Target	Air Ejector 1 S/G Blowdown
CONTAINMENT INTEGRITY	Containment Environment	A derived parameter using containment temperature, pressure, level		Bottom Row	Target	Cont. Level 3 Cont. Press. 8 Cont. Temp. 1