REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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FACIL:50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co. 05000389
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UHRIG,R.E. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
EISENHUT,D.G. Division of Licensing

SUBJECT: Forwards responses to request for addl info re matrix power supply isolation device testing.Responses will be incorporated into FSAR in future amend.

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FLORIDA POWER & LIGHT COMPANY

December 10, 1981
L-81-520

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

RECEIVED
DEC 10 1981
U.S. NUCLEAR REGULATORY COMMISSION

Dear Mr. Eisenhut:

Re: St. Lucie Unit 2
Docket No. 50-389
Final Safety Analysis Report
Requests for Additional Information

Attached are the following Florida Power & Light Company (FPL) responses to NRC staff requests for additional information which have not been formally submitted on the St. Lucie Unit 2 docket. These responses will be incorporated into the St. Lucie Unit 2 FSAR in a future amendment.

1. Revision to the description of the Matrix Power Supply Isolation Device testing that was previously described in FPL letter L-81-474 (November 10, 1981), attachment J. This change was discussed and agreed upon by R. Stevens of your staff (Instrumentation & Control Systems Branch).
2. Changes to the Design Basis description in FSAR Section 9.1.2.1 concerning the Spent Fuel Racks as discussed and agreed upon by J. Ridgely of your staff (Auxiliary Systems Branch).
3. Additional clarification to FSAR Section 10.9.4.3 concerning the Condensate Storage Tank as discussed with J. Ridgely of your staff (Auxiliary Systems Branch).
4. ATWS Emergency Operating Procedure dated November 24, 1981 as discussed with W. Kennedy of your staff (Procedures & Test Review Branch).

Very truly yours,

J. A. De Mastry
for
Robert E. Uhrig
Vice President
Advanced Systems and Technology

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REU/DME/ah

Attachments

cc: J.P. O'Reilly, Director, Region II (w/o attachments)
Harold F. Reis, Esquire (w/o attachments)

MATRIX POWER SUPPLY ISOLATION DEVICE TESTING

Isolation within the Reactor Protective System is discussed in general within the response to NRC question 420.7. Below are excerpts from this response:

> "Each matrix is powered from the diode isolated power supplies located in two different channels of the RPS. Each power supply has with it an isolation circuit which limits the fault to acceptable values and prevents the fault from disturbing the independent vital buses.
>
> All isolation devices discussed above are qualified to 480V ac and 325V dc and tested to 600V ac and 400 dc. The entire system is also subjected to an EMI test in accordance with MIL-STD-461A 'Electromagnetic Interference Characteristics Requirements for Equipment' for both conducted and radiated signals using test CS01, CS02, CS06, RS07 and RS03."

The following provides further definition on the method of qualifying the RPS matrix power supply (with associated isolation networks) to the requirements of IEEE-323-1974. Aging qualification requirements are not considered in this discussion. The results of each test discussed below will be provided by the NRC.

A. Fault Isolation Qualification

The maximum credible fault is limited to 600 VAC and 400 VDC due to the following design separation and precaution described below:

- All cables routed from the respective instrument bus to various loads are classified as low level circuits and are routed in enclosed raceways with one exception. This cable is a control circuit whose cable route is through the cable vault area. Both instrumentation and control cables do not exceed a voltage of 480 volt.

- The cable spreading area and control room do not contain high energy equipment such as high energy switchgear, transformers over 480 volts, high energy rotating equipment, or potential sources of missiles or pipe whip, are are not used for storing flammable materials. (Refer to FSAR Subsection 8.3.1.2.2 with regards to Regulatory Guide 1.75).

- High energy circuits are considered to be those with available fault currents in excess of the interrupting rating of the 480V motor control centers.

- Circuits in the cable spreading area and control room are limited to control functions, instrument functions and those power supply circuits and facilities serving the control room and instrument systems.

- D C Power supply feeders from redundant MA, MB, MC and MD instrument buses to the control room are installed in enclosed raceways that qualify as barriers.

- The instrument power supply system equipment is designed to meet seismic and environmental qualification requirements for class IE equipment.

- All cables are flame resistant and are qualified in accordance with IEEE Standard 383.

- Different parameter signal cables are in the same wireway as long as they do not belong to separate redundant channels; separate tray and conduct systems are provided for power and control and low level instrument systems.

- All cables are inspected by site quality control to assure that they are not damaged in the process of cable pulling. The inspection of these cables is documented and subject to random audit by quality compliance.

- All electrical raceways are seismically supported.

- Analysis of the effects of pipe whip, jet impingement, missiles, fire and flooding demonstrate that safety related electrical circuits, raceways and equipment are not degraded beyond an acceptable level, as such all potential causes of single failure events have been addressed.

Matrix power supplies and isolation circuits are configured within the RPS as shown in Figure 1. The test involves simulating (with identical equipment) a typical RPS matrix (Figure 2) including bistable trip units, bistable power supplies, matrix power supplies, matrix relays, and isolation relays. Vital bus power (120 Vac) is simulated by using two power isolation transformers. The isolation test will consist of the application of a 600 Vac and 400 vdc fault in the circuit in the common and transverse modes. The basis for the 600 vac and the 400 Vdc test voltage is as follows:

- <u>600 Vac</u>: The highest credible AC fault voltage which could appear within the RPS is 480 Vac. This voltage is increased by 10% to 528 Vac to account for normal voltage tolerances and then again increased by 10% to 581 Vac to account for IEEE-STD-323-1974 margin. This voltage is then rounded off to 600 Vac.

- 400 Vdc: The highest credible DC fault voltage which could appear within the RPS is 325 Vdc. This voltage is increased by 10% to 358 Vdc to account for normal voltage tolerances and then again increased by 10% to 394 Vdc to account for IEEE-STD-323-1974 margin. This voltage is then rounded off to 400 Vdc.

1. <u>Common Mode Test</u>

The common mode test is accomplished by applying a fault to the DC side of a matrix power supply between point (G) and the power supply chassis. The fault voltage and current are monitored to define the fault characteristics. Also, the 120 Vac line side of the power supply is monitored to document any effect as a result of application of the fault. All monitoring is by means of a light beam recorder. This same process is repeated for point (H) to the power supply chassis.

For the purpose of this test, it has been conservatively assumed that if a fault appeared on vital bus B (points A or B to chassis ground in Figure 1) it

would propagate through the DC power supply (PS-B) and appear at points C or D. Since PS-B is directly connected to PS-A (through CR-1 and CR-2) the fault is assumed to appear at points G of H to ground. Therefore, it is required to show that when a fault is present on the DC side of a matrix power supply it does not propagate to the 120 Vac side of the power supply, thereby affecting more than one vital bus. It should be noted that complete propagation of a fault from power supply primary to secondary is a conservative fault circuit evaluation which would most likely not occur.

2. Transverse Mode Test

The transverse mode test is accomplished by applying the fault directly to the output terminals (E and F) of the isolation circuit. This fault voltage and current are monitored to define the fault characteristics. Also, the input side (G and H) of the isolation circuit and the 120 Vac line side (J and K) of the power supply is monitored to document any effects as a result of application of the faults. All monitoring is by means of a light beam recorder.

Similar to the common mode test, a fault appearing on vital bus B (Figure 1 points A and B) is assumed to propagate completely to points E and F. Therefore, it must be shown that application of a fault to the output of the isolation circuit (points E and F) does not propagate in the 120 Vac side of power supply A thereby affecting more than one vital bus. It should be noted that the isolation circuit clamps the fault voltage such that power supply damage does not occur, as discussed below:

- Clamp Circuit - The power supply fault clamp circuit is designed to limit or shortout a positive or negative fault. Figure 1 is a schematic of the fault clamp circuit which is connected to each matrix power supply. During normal operation VRI is in the open circuit condition, SCR-Q1 is deenergized and CR4 is reverse biased. The normal 28 Vdc output of the power supply will be seen between points E and F.

  The clamp circuit operates in the following manner. On the negative cycle, the fault is clamped or shorted out by CR4, causing F1 to open. On a positive cycle, the fault would cause VR1 to conduct upon reaching an amplitude to 47V (combined 28V PS volts and 19V fault).

  With VRI conducting, SCR-QI will energize, shorting out or clamping the fault and the power supply output, causing F1 and F2 to open.

3. Acceptance Criterion

The acceptance criterion for the above tests is that upon application of the fault the input power supply voltage, observed at points J and K, does not vary more than ± 10% from the nominal voltage. It will be shown that before, during, and after a fault application the system will perform its protective function (trip actuation) when required.

B. Surge Qualification

A surge test will be performed on the RPS according to the guidance of IEEE Standard 472-1974, to the extent practical. The test will be performed similar to that which was performed on the ANO-2 Plant Protection System (PPS) and subsequently approved by the NRC.

The test involves simulating (with identical equipment) a typical RPS matrix (Figure 2) including bistable trip units, bistable power supplies, matrix power supplies, matrix relays, and isolation relays. Vital bus power (120 Vac) is simulated by using two power isolation transformers. A 300 Vac surge (negative peak to positive peak) will then be superimposed on one vital bus. Thus, the test voltage from neutral to peak will be 337 volts (120 Vac + 10%) x 1.414 plus the neutral to peak surge 300V/2. The surge voltage is based on a calculation performed for the ANO-2 PPS which concluded that circuit damage or false operation would not occur provided the peak AC voltage is maintained below 400 Vac. The calculation is based on dielectric strength of materials within the ANO-2 PPS. Since the equipment within the St. Lucie Unit 2 PPS is similar (but not identical) to the ANO-2 PPS it is assumed that calculation conclusions are applicable to the RPS.

An ultra isolation transformer is being added to the vital bus inverter system in order to attinuate any line surges which may pass through the inverter system. The isolation transformer will be surge qualified in accordance with the guidelines of IEEE standard 472-1974. This will include application of the surge (2.5KV to 3.0 KV) to the primary winding in both the common and transverse modes. The acceptance criteria for this test is that the transformer limits this surge on the secondary to a 50 Volt pulse. Note that the credible surge seen by the RPS is limited to 50 volts which is a factor of one third less than the surge being applied to the RPS. The transformer will also be qualified to the requirements of IEEE standard 344-1975 and IEEE standard 323-1974 (minus aging).

1. Common Mode Test (Figure 1)

The common mode test is accomplished by applying a surge to the AC side of the matrix power supply between point (A) and the power supply chassis. During surge application the simulated RPS circuit is operated to show proper function and accuracy. Also, the 120 Vac line of the associated power supply is monitored across points (J) and (K). The same process is repeated for point (B) and the power supply chassis.

2. Transverse Mode Test (Figure 1)

The transverse mode test is accomplished by applying a surge to the AC side of the matrix power supply between points (A) and (B). During application of the surge the simulated RPS circuit is operated to show proper function and accuracy. Also the 120 Vac line of the associated power supply is monitored across points (J) and (K).

3. Acceptance Criterion

The acceptance criterion for the above tests is that all circuits shall operate correctly and within their normal accuracy requirements before, during, and after the surge application. Also, the voltage observed at points J and K should not vary more than ± 10% of the nominal voltage.

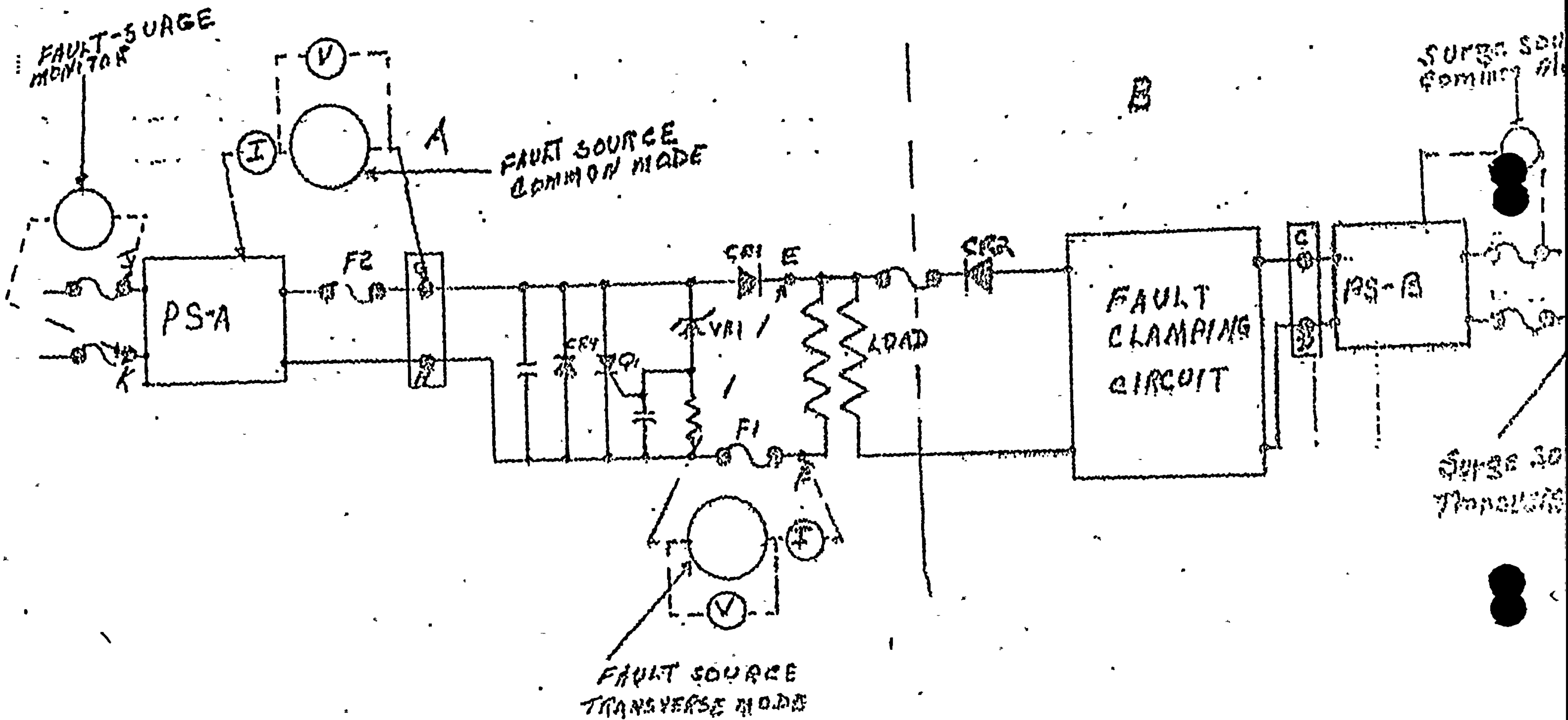
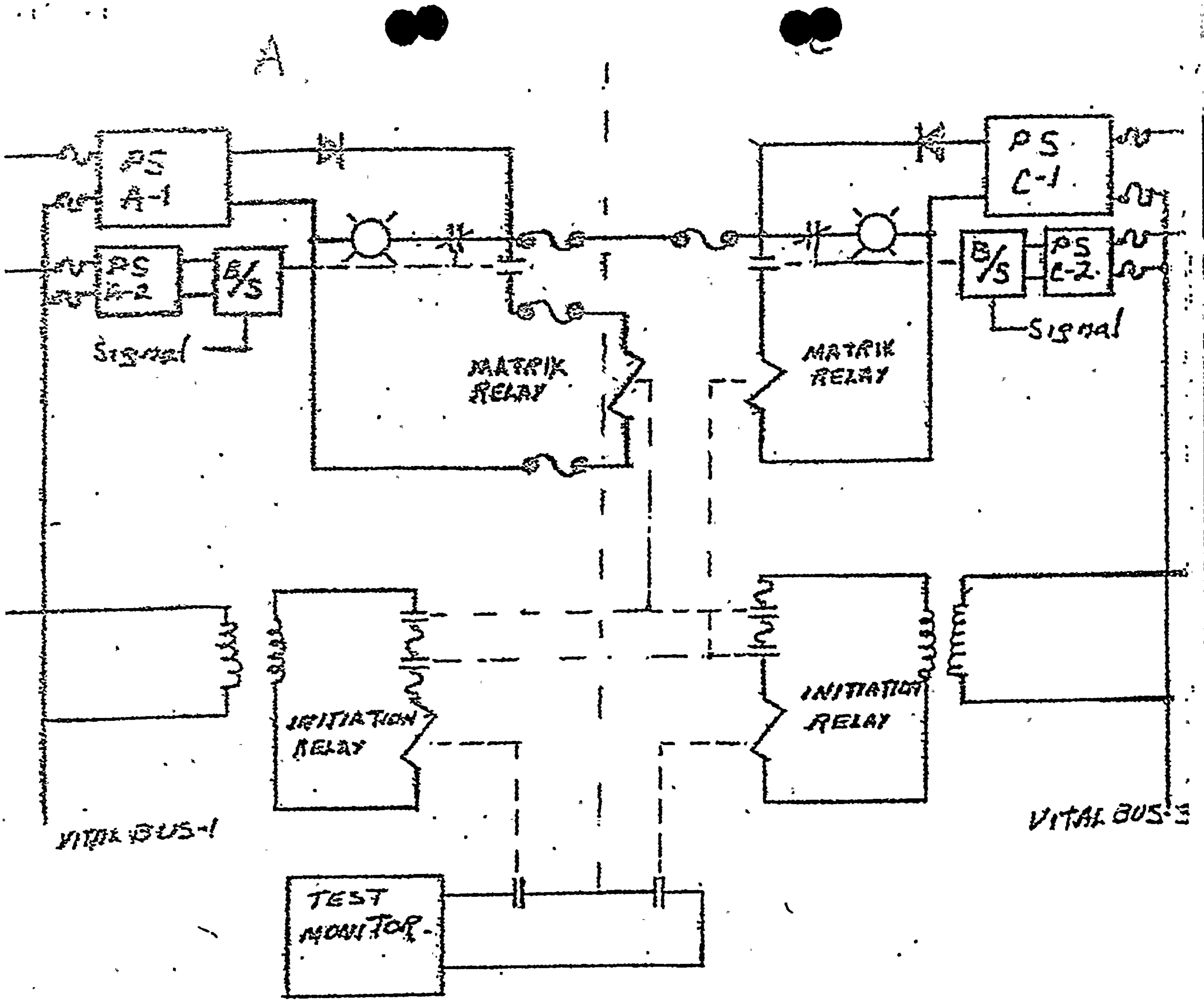

FAULT-SURGE MONITOR
V
I
A
FAULT SOURCE COMMON MODE
B
PS-A
F2
CR1
E
CR2
LOAD
FAULT CLAMPING CIRCUIT
PS-B
F1
Q1
VR1
FAULT SOURCE TRANSVERSE MODE

Figure - 1



B/S - Bistable

PS-A1 & C1 have clamp circuit

Figure -2

9.1.2 SPENT FUEL STORAGE

9.1.2.1 Design Basis

The spent fuel storage racks are designed to:

a) allows storage of 675 fuel assemblies,

b) remain subcritical with a k_{eff} of less than 0.95 assuming non-borated water in the fuel pool,

c) maintain a minimum allowable fuel spacing such that a subcritical array, with the assumption of b), under all design loadings, including the SSE displacements is ensured,

d) preclude insertion of fuel assembly inbetween the fuel racks,

e) allow fuel cooling by the Fuel Pool Cooling System (Subsection 9.1.3),

f) allow fuel assembly removal from the spent fuel racks under the following conditions,

1) thermal expansion loads of the rack modules

2) the impact load resulting from a fuel assembly (with CEA) being dropped in the vertical position from the maximum height it can be lifted above the racks (approximately 1.5 ft. above the racks), in addition to condition (1)

3) loads resulting from seismic disturbances (SSE and OBE), in addition to condition (1).

9.1.2.2 System Description

The Fuel Handling Building general arrangement showing the location of the spent fuel storage facilities is given on Figures 1.2-18 and 1.2-19. The spent fuel racks are shown on Figures 9.1-2, 9.1-3, and 9.1-4. The design and manufacture of the spent fuel racks are performed by Programmed and Remote Systems Corp. (PaR). Similar racks have been provided by PaR for Trojan (Docket 50-344) and Prairie Island (Dockets 50-282 and 50-306).

The fuel pool is located outside the containment in the Fuel Handling Building. It is designed for the underwater storage of 675 spent fuel assemblies (approximately three full cores) and the fuel handling tools. Initial installation has provision for storage of 300 spent fuel assemblies to enable the removal of one full core during that period of time when one-third of a core is stored in the fuel pool following a refueling. Storage racks will be added at a later date to increase the capacity to a maximum of 675 spent fuel assemblies (see Figure 9.1-5). Control element assemblies removed from the core are stored within the fuel assemblies.

tornado missile somehow ruptures the St Lucie Unit 1 CST and the water contained therein (116,000 gallons per St Lucie Unit 1 Technical Specifications) is unavailable to St Lucie Unit 1. When no tornado warnings are in effect, the St Lucie Unit 2 total capacity of 307,000 gallons is available if needed. This minimum capacity accounts for the following volumes. 7

Unusable Volume

All water stored below a line 8 inches above the suction point is considered unusable. This quantity of 9,400 gallons is considered in the determination of the minimum required stored volume. No credit is taken for the height of water in the tank in the evaluation of the Net Positive Suction Head available to the Auxiliary Feedwater Pumps.

Unit 1 Shutdown Volume

A volume of 125,000 gallons is maintained for use by Unit 1 in the event the SL-1 CST is ruptured by a tornado missile. This amount is more than sufficient for shutdown purposes. Unit 1 Tech Spec level is 116,000 gallons. 6

Unit 2 Shutdown Volume

A volume of 149,600 gallons is maintained to shutdown Unit 2 as outlined below.

Instrument Error

Although instrumentation error is expected to be no greater than 1 percent, a conservative margin of 5 percent of the instrument range (21,400 gallons) has been added to the total of the above volumes.

Working Volume

The total of the above volumes, including allowance for instrumentation error, amounts to 305,400 gallons. The minimum stored volume is 307,000 gallons. Approximately 10 feet of usable tank volume remains for operating purposes, which is below the lowest non-seismically qualified nozzle.

Should a tornado missile disable the Unit 1 Condensate Storage Tank (CST), Unit 1 operators will be alerted to the loss of auxiliary feedwater by the redundant safety grade low-level alarm and level indicators (LT-12-11, 12) located in the Control Room. Once alerted, Unit 1 operators will initiate procedures to obtain auxiliary feedwater via the SL1/SL2 intertie. These procedures will require Unit 1 operators to alert Unit 2 to the need to intertie the CST's. The Unit 1 operators will open the intertie isolation valves (E&F on Figure 10.4-8a). Unit 2 operators will in turn open isolation valves A&D or B&C. If Unit 1 requires auxiliary feedwater before or concurrently with Unit 2, procedures will require the opening of valves A and D. If Unit 2 has previously consumed the feedwater required for shutdown, valves B and D would be opened. A misalignment of valves causing a loss of suction to the Auxiliary Feedwater Pumps would be evidenced by the safety grade flow indicators located in the control room.

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2
EMERGENCY PROCEDURE NUMBER 2-0030132
REVISION 0

ANTICIPATED TRANSIENT WITHOUT SCRAM (ATWS)

November 24, 1981

REV	FRG
APPROVAL	PLT MGR

TOTAL NO. OF PAGES 5

FLORIDA POWER & LIGHT COMPANY
[redacted]ST. LUCIE PLANT UNIT 2
EMERGENCY PROCEDURE NUMBER 2-00301[redacted]
(ATWS) REVISION 0

1.0 SCOPE

This procedure provides instructions to be used in the event of an ATWS. The transients which produce most limiting ATWS consequences are covered by this procedure.

2.0 SYMPTOMS

The following are symptoms, related to the three transients, which would cause a reactor trip. Any of these symptoms, not accompanied by insertion of all CEA's, are an indication of ATSW:

	TRIP SIGNAL GENERATED BY:			
SYMPTOM	LOF	LOOP	STUCK OPEN PORV	INDICATION/ALARM
2.1 High Przr Pressure	Yes	Yes	No	2.1 Indications PI-1102A, PI-1102B, PI-1102C, PI-1102D PR-1100 PIC-1100X, PIC-1100Y RPS - Channel 5 2.1 Alarms L-20, L-28
2.2 TM/LP	No	No	Yes	2.2 Indications PIA-1102A, PIA-1102B, PIA-1102C, PIA-1102D RPS - Channel 4 2.2 Alarms L-36, L-41

2.0 SYMPTOMS: (Cont.)

SYMPTOM	TRIP SIGNAL GENERATED BY: LOF	LOOP	STUCK OPEN PORV	INDICATION/ALARM
2.3 Low RCS Flow	Yes	Yes	No	2.3 Indications PDI-1101A, PDI-1101B, PDI-1101C, PDI-1101D RPS - Channel 6 2.3 Alarms L-10, L-18
2.4 Low S/G Level	Yes	No	No	2.4 Indications LIC-9013A, LIC-9013B, LIC-9013C, LIC-9013D LIC-9023A, LIC-9023B, LIC-9023C, LIC-9023D LR-9011, LR-9021 RPS - Channel 7 2.4. Alarms L-3, L-11

3.0 AUTOMATIC ACTIONS:

Some of the following Automatic Actions will occur during the various transients with the absence of a reactor trip:

NOTE: Any Automatic Actions that should occur and do not, must be manually initiated.

3.1 Turbine Trip	3.1 If reactor trip SHOULD HAVE occurred
3.2 AFW Auto Start	3.2 5% S/G level, narrow range
3.3 PORV Actuation	3.3 RCS pressure @ 2400 PSIA
3.4 Main Steam Safety Valves Open	3.4 S/G pressure greater than 975 PSIG
3.5 SBCS Actuation	3.5 Turbine Trip or High S/G pressure
3.6 Generator OCB's Open	

3.0 AUTOMATIC ACTIONS: (Cont.)

3.7 SIAS and CIAS	3.7 RCS pressure 1600 PSIA Containment pressure 5 PSIG
3.8 CSAS	3.8 Containment pressure 10 PSIG

4.0 IMMEDIATE OPERATOR ACTIONS

NOTE: Following steps do not necessarily need to be performed in order.

4.1 Trip Turbine	4.1 RTGB 201
4.2 Ensure AFW Flow	4.2 RTGB 202
4.3 Trip Reactor	4.3 RTGB 201 or 204
AND IF CEA'S DON'T DROP	
4.4 Open RTB's	4.4 RPS Panel
AND IF CEA'S DON'T DROP	
4.5 Manually Insert CEA's	4.5 RTGB 204
AND IF CEA'S DON'T MOVE	
4.6 Emergency Borate by opening MV 2514 and starting BA pumps 2A and 2B	4.6 RTGB 205
4.7 Stop M/G sets either at M/G set or at breaker 2-40212 and 2-40511	4.7 Locally in RAB
4.8 Return to 2-0030130, Reactor Trip/ Turbine Trip, Immediate Operator Actions to determine type of transient and further action required.	

EMERGENCY [redacted]EDURE NUMBER 2-0030132, [redacted]ISION 0
(ATWS)

5.0 SUBSEQUENT ACTIONS:

None

6.0 DISCUSSION:

This procedure starts and ends during a transient. For this reason, there is no subsequent action. The last immediate action is to refer to the Reactor Trip/Turbine Trip procedure and from there determine the course of action to take.

7.0 REFERENCES:

7.1 Memorandum from Frank Schroeder to Robert L. Tedesco, dated June 23, 1980

7.2 CE Emergency Procedure Guidelines, CEN-152

7.3 St. Lucie #1 Off-Normal Operating Procedures

8.0 RECORDS REQUIRED:

8.1 Normal Log Entries

9.0 APPROVAL:

Reviewed by the Facility Review Group ____________________ 19__
Approved by ________________ Plant Manager ____________________ 19__

Rev.____ reviewed by Facility Review Group ____________________ 19__
Approved by ________________ Plant Manager ____________________ 19__

"L A S T P A G E"

EP 2-0030132
REV 0
TOTAL NO. OF PAGES 5

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