Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

August 14, 1997
3F0897-02

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Subject: LICENSEE EVENT REPORT (LER) 97-003-05

Gentlemen:

Please find the enclosed revised Licensee Event Report (LER) 97-003-05 regarding Generic Letter (GL) 96-01 testing deficiencies. Florida Power Corporation's (FPC) GL 96-01 review has been completed. Included in the LER is the cause and the corrective actions.

This report is submitted in accordance with 10 CFR 50.73.

Sincerely,

J. J. Holden
Director,
Nuclear Engineering and Projects

JJH/pmp

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xc: Regional Administrator, Region II
Senior Resident Inspector
NRR Project Manager

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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104

EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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TITLE (4)

Personnel Error Causes Testing Deficiencies Resulting in a Condition Prohibited by Technical Specifications

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	31	97	97	-- 003 --	05	08	14	97	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
POWER LEVEL (10)	000	20.2201(b)	20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iv)	50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
W. J. Leonard, Sr. Licensing Engineer	(352) 795-6486

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On January 31, 1997, Florida Power Corporation's (FPC) Crystal River Unit 3 (CR-3) was in MODE 5 (COLD SHUTDOWN). FPC personnel were performing a comparison of schematic diagrams against plant surveillance procedures in response to Generic Letter (GL) 96-01, "Testing of Safety Related Logic Circuits." Testing deficiencies were identified to be violations of Technical Specification Surveillance Requirements. Separate deficiencies were identified on January 31, 1997, February 11, 1997, March 17, 1997, April 28, 1997, May 21 through 23, 1997, and June 3, 1997. FPC has completed the review as requested in GL 96-01. The testing deficiencies did not compromise the health and safety of the general public. The cause was cognitive human error based on personnel not fully identifying all components and contacts that should be tested. Corrective actions include procedure revisions, surveillance testing, and completion of the reviews requested by GL 96-01. Actions to Prevent Recurrence include revisions to administrative procedures and training. This report is submitted in accordance with 10 CFR 50.73(a)(2)(i)(B) for operation or condition prohibited by the plant's Technical Specifications.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

EVENT DESCRIPTION

On January 31, 1997, Florida Power Corporation's (FPC) Crystal River Unit 3 (CR-3) was in MODE 5 (COLD SHUTDOWN). FPC personnel were performing a comparison of schematic diagrams against plant surveillance procedures in response to Generic Letter (GL) 96-01, "Testing of Safety Related Logic Circuits." Testing deficiencies were identified to be violations of Technical Specification Surveillance Requirements. Separate deficiencies were identified on January 31, 1997, February 11, 1997, March 17, 1997, April 28, 1997, May 21 through 23, 1997, and June 3, 1997.

On January 31, 1997, deficiencies were identified in the testing of the Loss of Power Start (LOPS) logic circuitry. On February 11, 1997, deficiencies were identified in the testing of the Emergency Feedwater Initiation and Control [JB](EFIC) Automatic Actuation logic circuitry. On March 17, 1997, two separate deficiencies were identified in the testing of the Engineered Safeguards Actuation System (ESAS). The first deficiency involved the testing of the ESAS Instrumentation Reactor Coolant System [AB](RCS) Pressure Low and Low-Low logic circuitry. The second deficiency involved the ESAS Automatic Actuation reset logic circuitry for Emergency Diesel Generator [EK,DG](EGDG) load blocks 4 and 6 timers. On April 28, 1997, deficiencies were identified in the testing of the EFIC Automatic Actuation Vector Valve Enable logic. On May 21 through 23, 1997, deficiencies were identified in the testing of the Reactor Protection System (RPS) [RP] trip functions. On June 3, 1997, testing deficiencies were found in the emergency bus load shedding circuits for the 480 Volt Alternating Current (VAC) Engineered Safeguards (ES) buses.

GL 96-01 requests licensees to perform a comparison of electrical schematic drawings and logic diagrams for the RPS, EGDG load shedding and sequencing, and actuation logic for the ESAS against plant surveillance test procedures. This comparison ensures that all portions of the logic circuitry, including the parallel logic, interlocks, bypasses and inhibit circuits, are adequately covered in the surveillance procedures to fulfill Improved Technical Specifications (ITS) requirements.

FPC has completed the review as requested in GL 96-01. Details of the testing deficiencies are described in the following paragraphs.

This report is submitted in accordance with 10 CFR 50.73(a)(2)(i)(B) for operation or condition prohibited by the plant's Technical Specifications.

Loss of Power Start Testing Deficiencies

On January 31, 1997, during the review of the EGDG LOPS logic circuitry, FPC determined that six contacts in the Second Level Undervoltage Relays (SLUR) portion of the LOPS logic circuitry for each EGDG were not individually tested during the required once per 31 day CHANNEL FUNCTIONAL TEST Surveillance Requirement 3.3.8.1, nor during the required once per 24 months CHANNEL CALIBRATION Surveillance Requirement 3.3.8.2.

ES equipment is powered from one of two ES Buses. Each ES bus is normally powered from an off-site source with backup supply from an EGDG. The LOPS circuits protect ES equipment from damage

due to sustained undervoltage conditions and provide for rapid re-energization of the ES buses by the EGDGs in the event of a total loss of voltage or sustained degraded voltage. There is one LOPS logic circuit for each of the two ES Buses. In the event of LOPS actuation, the affected ES Bus is automatically powered by its associated EGDG.

The LOPS logic consists of First Level Undervoltage Relays (FLUR) and SLUR. The FLUR logic detects a complete loss of voltage on an ES Bus. The SLUR logic detects sustained degraded voltage conditions on an ES Bus.

Three ES Bus 'A' SLUR relays (27B-A, 27B-B, and 27B-C) sense voltage on the three ES 'A' bus phases. If all three SLUR relays sense degraded voltage for 5 seconds, SLUR relay 27BY actuates the FLUR logic circuit after a 13 second time delay. If there is an ESAS actuation during the 13 second time delay, relay 27BES bypasses the 13 second time delay and immediately actuates the FLUR logic. Relay 27BY and 27BES contacts are in parallel in the FLUR circuit. An identical circuit is provided for ES Bus 'B'.

An annunciator is provided in the Control Room to monitor the status of the SLUR 'A' relays (27B-A, 27B-B, and 27B-C). The annunciator is actuated if one or more of the three SLUR relays is actuated. Three parallel contacts from the SLUR 'A' relays actuate the ES Degraded 'A' Voltage annunciator. An identical circuit is provided for ES Bus 'B'.

The LOPS logic circuits are tested once per 31 days by Surveillance Procedures SP-907A, "Monthly Functional Test of 4160V ES Bus 'A' Undervoltage and Degraded Grid Relaying," and SP-907B, "Monthly Functional Test of 4160V ES Bus 'B' Undervoltage and Degraded Grid Relaying." SP-907A and SP-907B do not independently test the parallel 27BES and 27BY relay contacts in the FLUR logic. SP-907A and SP-907B also did not independently test parallel SLUR logic relay contacts which actuate the Control Room annunciator for ES Bus Degraded Voltage.

The LOPS relays are tested once per 18 months by SP-904A, "Calibration of 4160 Volt ES 'A' Bus Undervoltage and Bus Degraded Grid Relays," and SP-904B, "Calibration of 4160 Volt ES 'B' Bus Undervoltage and Bus Degraded Grid Relays." SP-904A and SP-904B did not independently test the parallel 27BES and 27BY relay contacts in the FLUR logic. However, SP-904A and SP-904B did independently test the parallel SLUR logic relay contacts which actuate the Control Room annunciators for ES Bus Degraded Voltage.

Emergency Feedwater Initiation and Control Automatic Actuation Logic Circuitry Testing Deficiencies

On February 11, 1997, during the review of the EFIC logic circuitry, FPC determined that four relays were not tested during the required once per 31 day CHANNEL FUNCTIONAL TEST ITS Surveillance Requirement 3.3.13.1.

The Emergency Feedwater System (EFW) is designed to provide adequate flow to one or more steam generators for decay heat removal. The principal function of EFW is to remove decay heat from the Reactor Coolant System upon the unavailability of the normal feedwater supply. EFW consists of two

pumps (EFP-1 and EFP-2) and associated valving. For EFW to function, isolation of the Main Steam lines and Main Feedwater lines is required. The EFIC automatic actuation circuitry automatically initiates the EFW pumps, aligns valves, and isolates the Main Steam lines and Main Feedwater lines.

Relays 3EFWA-1 and 3EFWA-2 are interposing relays between the electronic portion and the relay actuation matrix portion of the 'A' EFIC Automatic Actuation logic which controls the EFW system pumps. Relays 3EFWB-1 and 3EFWB-2 are the comparable interposing relays for the 'B' EFIC Automatic Actuation logic.

The EFIC logic circuitry is tested by Surveillance Procedures SP-146A, "EFIC Monthly Functional Test, During MODEs 1, 2, and 3," and SP-146B, "EFIC Monthly Functional Test, During Plant Shutdown Conditions." SP-146A and 146B tested the output of the EFIC Automatic Actuation electronics but did not test relays 3EFWA-1, 3EFWA-2, 3EFWB-1, and 3EFWB-2.

ESAS Instrumentation RCS Pressure Low and Low Low Logic Circuitry Testing Deficiency

On March 17, 1997, during the review of the ESAS Instrumentation RCS Pressure logic circuitry, FPC determined that 12 contacts in each actuation train were not independently tested during the required once per 31 day CHANNEL FUNCTIONAL TEST Surveillance Requirement 3.3.5.2.

The ESAS Instrumentation initiates ES systems, based on values of RCS pressure and Reactor Building pressure, to protect core design and reactor coolant pressure boundary limits and to mitigate accidents. The ES systems initiated by the ESAS are High Pressure Injection (HPI)[BQ], Low Pressure Injection [BP], Reactor Building Isolation and Cooling [JM], Reactor Building Spray [BE], Emergency Diesel Generator, Control Complex Ventilation [VI], and Emergency Feedwater.

The HPI ESAS consists of two actuation trains. Each train is initiated by a 2 out of 3 trip logic circuitry. Each logic channel is initiated by opening one or more of the three series contacts from the RCS Pressure Low, the RCS Pressure Low-Low, or the Reactor Building Pressure High instrumentation channel.

The HPI ESAS Instrumentation logic circuitry is tested by surveillance procedure SP-130, "Engineered Safeguards Monthly Functional Test." In each of the three logic channels in both actuation trains, SP-130 did not independently test the two series contacts from the RCS Pressure Low and the RCS Pressure Low-Low instrumentation channels.

ESAS Automatic Actuation Load Block Auto Reset Logic Circuitry Testing Deficiency

On March 17, 1997 during the review of the HPI ESAS Automatic Actuation logic circuitry, FPC determined that two parallel contacts in each of the three HPI logic channels in each actuation system were not tested independently during the required once per 31 day CHANNEL FUNCTIONAL TEST Surveillance Requirement 3.3.7.1. The parallel contacts are in the auto reset of ES load blocks 4 and 6 sequencing timers circuit.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

The ESAS Automatic Actuation initiates ES systems to protect core design, reactor coolant pressure boundary limits, and to mitigate accidents. The ES systems initiated by the ESAS are High Pressure Injection, Low Pressure Injection, Reactor Building Isolation and Cooling, Reactor Building Spray, Emergency Diesel Generator, Control Complex Ventilation, and Emergency Feedwater. The load block sequencing timers control the loading sequence of ES components onto the EGDG. The auto reset function is required if; 1) offsite power is lost after an ES actuation, or 2) an EGDG trips and then restarts after an ES actuation.

The ESAS consists of two actuation trains. Each train is initiated by a trip of 2 out of 3 logic channels. The ESAS Automatic Actuation logic circuitry is tested by surveillance procedure SP-130, "Engineered Safeguards Monthly Functional Test." SP-130 tested the auto reset function of load blocks 4 & 6 sequencing timers but did not independently test two parallel contacts in the circuit.

EFIC Automatic Actuation Vector Valve Enable Logic Circuitry Testing Deficiencies

On April 28, 1997, during the review of the EFIC Vector Valve Enable logic circuitry, FPC determined that the output "NOR" gate in both A and B logic circuitry was not tested during the required once per 31 day CHANNEL FUNCTIONAL TEST Surveillance Requirement 3.3.13.1.

The EFW is designed to provide adequate flow to one or more steam generators for decay heat removal. The principal function of EFW is to remove decay heat from the Reactor Coolant System upon the unavailability of the normal feedwater supply. EFW consists of two pumps (EFP-1 and EFP-2) and associated valving. The EFIC automatic actuation circuitry automatically initiates the EFW pumps, aligns valves, and isolates the Main Steam lines and Main Feedwater lines. The EFIC Vector Valve Enable logic circuitry enables the vector valve logic to generate open or close signals to the EFW valves feeding the two Once Through Steam Generators (OTSG) depending on the relative values of OTSG pressures.

The EFIC Vector Valve Enable logic circuitry is tested by Surveillance Procedures SP-146A, "EFIC Monthly Functional Test, During MODEs 1, 2, and 3," and SP-146B, "EFIC Monthly Functional Test, During Plant Shutdown Conditions." SP-146A and 146B did not test the logic circuit's output "NOR" gate.

RPS Trip Function Testing Deficiencies

On May 21 through 23, 1997, during review of the RPS Main Turbine Trip circuitry, it was determined that the RPS trip bistable contacts in the RPS Trip channels were not directly tested during the required once per 45 day on a STAGGERED TEST BASIS CHANNEL FUNCTIONAL TEST Surveillance Requirement 3.3.1.4 or during the required once per 92 day CHANNEL CALIBRATION Surveillance Requirement 3.3.1.5.

The RPS initiates a reactor trip (i.e., full insertion of all CONTROL RODS) to protect against violating core fuel design limits and the RCS pressure boundary during anticipated operational occurrences

(AOO). By tripping the reactor, the RPS also functions, in conjunction with the ES systems, to mitigate accidents.

The RPS consists of four separate redundant protection channels that receive input from critical plant parameters. Each channel is composed of measurement channels, a reactor trip module (RTM), and CRD trip devices. An RPS measurement channel measures a critical plant parameter and compares it to the applicable setpoint. If the setpoint is exceeded, two contacts of the measurement channel output relay open, tripping the RPS channel RTM. If the RTMs in two-out-of-four RPS channels trip, a full insertion of all CONTROL RODS will occur.

The RPS Trip Functions not directly tested, as specified in Technical Specifications Table 3.3.1-1, "Reactor Protection System Instrumentation," are:

Function No.	Function Description
1	Nuclear Overpower
2	RCS High Outlet Temperature
3	RCS High Pressure
4	RCS Low Pressure
5	RCS Variable Low Pressure
6	Reactor Building High Pressure
7	Reactor Coolant Pump Power Monitor
8	Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE
9	Main Turbine Trip (Control Oil Pressure)
10	Loss of Both Main Feedwater Pumps (Control Oil Pressure)

The RPS Trip Function circuitry is tested by Surveillance Procedures SP-110A (B) (C) (D) "A (B) (C) (D) Channel Reactor Protection System Functional Testing."For ITS Table 3.3.1-1 Functions 1 through 10, SP-110A (B) (C) (D) confirmed that each Function measurement channel output bistable had tripped but the procedure did not directly test whether the two bistable output series contacts in the RPS channel caused the associated RTM to change state.

480 V ES Load Shedding Logic Circuitry Testing Deficiency

On June 3, 1997, During the review of the 480 VAC ES bus load shedding circuitry, it was determined that the EGDG output breaker (closed status) was not tested during the required once per 24 month interval specified in Surveillance Requirement 3.8.1.10.

During an ES actuation coincident with a loss of offsite power (LOOP), the EGDG automatically energizes ES Buses so that ES electrical loads can be automatically energized in sufficient time to mitigate the consequences of the accident. There are two EGDGs, each of which powers a 4160 VAC ES bus, and in turn feeds a 480 VAC ES bus. ES loads are powered by the ES buses. The ES buses also power loads which are not essential for accident mitigation. Due to limited capacity when powered by the diesel, it is necessary to automatically shed and prevent the re-energization of the loads not essential for accident mitigation to prevent overloading the EGDG. The 480 VAC ES bus load

shedding logic circuit protects the EGDG from overload condition by automatically shedding and preventing the re-energization of the 480 VAC ES bus loads not essential for accident mitigation.

The 480 VAC ES Bus load shedding logic circuitry is tested by Surveillance Procedure SP-417, "Refueling Interval Integrated Plant Response to an Engineered Safeguards Actuation." For 480 VAC ES Bus A and Bus B, SP-417 did not independently test the EGDG output breaker lockout.

EVENT EVALUATION

Loss of Power Start Testing Deficiencies

At the time of discovery, EGDG-1A was inoperable for scheduled maintenance and modification; EGDG-1B was operable. In MODE 5, one EGDG is required to be operable in accordance with ITS Limiting Condition for Operation (LCO) 3.8.2. In order for an EGDG to be operable, its associated LOPS logic circuitry is required to be operable.

The LOPS logic circuitry is important to the mitigation of most plant transients and accidents because it ensures the availability of an adequate supply of AC power to ES systems.

The SLUR relay contacts not tested during the CHANNEL FUNCTIONAL TESTs have not been tested independently by any plant surveillance procedure. However, the contacts have been satisfactorily tested together during past performance of SP-907A and B, assuring that at least one of the two parallel contacts functioned in each circuit. When tested independently for the immediate corrective action for this report, the contact testing was satisfactory.

The SLUR annunciator contacts not tested during the CHANNEL FUNCTIONAL TESTs have been satisfactorily tested during performance of procedures SP-904A, "Calibration of 4160 Volt ES 'A' Bus Undervoltage and Bus Degraded Grid Relays," and SP-904B, "Calibration of 4160 Volt ES 'B' Bus Undervoltage and Bus Degraded Grid Relays." This test is performed on an 18 month frequency in accordance with ITS Surveillance Requirement 3.3.8.2. FPC has determined that testing of this annunciator circuit on the 18 month CHANNEL CALIBRATION frequency provides assurance of public health and safety. Any increase in assurance given by increased testing would be offset by the increased circuit complexity and probability of testing errors caused by the installation and manipulation of the additional circuit components required to enable once per 31 day testing.

Therefore, this testing deficiency did not compromise the health and safety of the general public.

EFIC Logic Circuitry Testing Deficiencies

The EFIC system is not required to be operable in MODEs 4 and 5. It is required to be operable in MODEs 1, 2, and 3.

The actuation circuits for EFP-1 and EFP-2, including their interposing relays, are initiated when tested in accordance with Surveillance Requirement 3.7.5.2 once per 45 days on a STAGGERED TEST

BASIS using surveillance procedures SP-349A, "EFP-1 and Valve Surveillance," and SP-349B, "EFP-2 and Valve Surveillance." However, they are not tested completely during the required CHANNEL FUNCTIONAL TEST.

Satisfactory performance of the CHANNEL FUNCTIONAL TESTs in conjunction with SP-349A and SP-349B has demonstrated the operability of the EFIC actuation circuits. Therefore, this testing deficiency did not compromise the health and safety of the general public.

ESAS Instrumentation RCS Pressure Low and Low-Low Logic Circuit Testing Deficiency

The ESAS RCS Pressure Low and Low-Low logic is not required to be operable with RCS pressure less than 1700 psig and 900 psig, respectively. The RCS Pressure Low logic circuitry is required to be operable when RCS pressure is greater than or equal to 1700 psig. The RCS Pressure Low-Low logic circuitry is required to be operable when RCS pressure is greater than or equal to 900 psig.

The ESAS Instrumentation logic circuitry is important to the mitigation of many plant accidents because it initiates ES systems.

Even though the series contacts for ESAS RCS Pressure Low and RCS Pressure Low-Low have not been tested independently, they have been tested in accordance with Surveillance Requirement 3.3.5.2 at the required once per 31 day CHANNEL FUNCTIONAL TEST frequency, in accordance with procedure SP-130, "Engineered Safeguards Monthly Functional Test." This has provided assurance that at least one of the two series contacts functioned in each circuit.

If the failed contact in two logic channels were the 1500 psig contact, the RCS Pressure initiation of the HPI system during a Small Break Loss of Coolant Accident (SBLOCA) would be delayed until 500 psig. In this unlikely event, the ES initiation function would be assured by two defense in depth considerations. First, for some SBLOCA accident scenarios, an independent ESAS HPI actuation signal, and Reactor Building Pressure High, would function to initiate ES systems. Secondly, Emergency Operating Procedures (EOP) require operators to manually initiate ES systems, when required, should automatic actuation fail.

This testing deficiency did not compromise the health and safety of the general public because 1) some testing was conducted, 2) inadequate testing does not cause circuit failures, 3) these circuits are inherently reliable, 4) multiple failures would have to be postulated for a loss of function, and 5) alternative methods of initiating the ES systems exist.

ESAS Automatic Actuation Load Block Auto Reset Testing Deficiency

The ESAS Automatic Actuation logic circuits for the Reactor Building High and High-High functions are not required to be operable in MODEs 4 or 5. The ESAS Automatic Actuation logic circuits for the RCS Pressure Low and Low-Low functions are not required to be operable with RCS pressure less than 1700 psig and 900 psig, respectively.

The ESAS Automatic Actuation automatic reset of the ES blocks 4 & 6 timer logic circuitry is important to the mitigation of accidents when the Loss of Offsite Power (LOOP) occurs after the timers have cycled, i.e., after the ES actuation.

Although the independent functioning of two parallel contacts in the logic had not been verified on the once per 31 day on STAGGERED TEST BASIS frequency, the auto reset function of ES load blocks 4 and 6 sequencing timers has been tested satisfactorily on a once per 31 day frequency in accordance with procedure SP-130, "Engineered Safeguards Monthly Functional Test." This has provided assurance that at least one of the two parallel contacts functioned in each channel.

Proper ES load sequencing would be accomplished if the LOOP occurs before or simultaneously with ES actuation even if the auto reset circuits malfunction. If the LOOP occurs after ES actuation, proper ES load sequencing would still be accomplished, except in the unlikely event that:

1. Block 4 and 6 loads start to load on the ES Bus in the absence of a LOOP and a LOOP occurs during the 10 second interval while the loading is in progress, and,
2. One contact in two logic channels is failed and not detected, and,
3. The combination of contact failures is such that the automatic reset does not occur until after the Block 6 timer actuates.

Because of the assurance given by the testing conducted, the fact that inadequate testing does not cause circuit failures, the fact that these circuits are inherently reliable, and that a very unlikely scenario which would have to be postulated in conjunction with multiple undetected circuit failures to conclude a loss of a safety function, this testing deficiency did not compromise the health and safety of the general public.

FPC has determined that testing of the automatic reset of the ES blocks 4 & 6 timer logic circuitry on the 24 month CHANNEL CALIBRATION frequency is appropriate. Any increase in testing frequency would be offset by the increased circuit complexity and probability of testing error caused by the installation and manipulation of the additional circuit components required to enable such testing.

EFIC Vector Valve Enable Logic Circuitry Testing Deficiencies

The EFIC system is not required to be operable in MODEs 4 and 5. It is required to be operable in MODEs 1, 2, and 3. The safety function of the EFIC Vector Valve Enable logic circuitry would only be jeopardized if the "NOR" gates failed in both the "A" and the "B" logic circuitry.

The EFIC Vector Valve Enable Logic Circuitry has been tested satisfactorily at a Refueling interval in accordance with surveillance procedure SP-416, "Emergency Feedwater Automatic Actuation." In addition, while not stated as an acceptance criteria, it is expected that a failure of the EFIC Vector Valve Enable logic circuitry would be observed by plant operators when EFW is tested in accordance with Surveillance Requirement 3.7.5.2 once per 45 days on a STAGGERED TEST BASIS using Surveillance Procedures SP-349A, "EFP-1 and Valve Surveillance," and SP-349B, "EFP-2 and Valve Surveillance."

This testing deficiency did not compromise the health and safety of the general public because 1) inadequate testing does not cause circuit failures, 2) these circuits are inherently reliable, and 3) that multiple undetected circuit failures would have to occur to cause a loss of a safety function.

RPS Trip Function Testing Deficiencies

All Control Rod Drive (CRD) trip breakers were in the open position and the Control Rod Drive Control System (CRDCS) was not capable of rod withdrawal. RPS Trip Functions 2 through 10 are not required to be operable in MODE 5. RPS Trip Function 1 is required to be operable in MODE 5 during shutdown bypass operation with any CRD trip breaker in the closed position and the CRDCS capable of rod withdrawal.

The safety function of the RPS is to protect against violating core fuel design limits and the RCS pressure boundary during AOO and, in conjunction with ES systems, to mitigate accidents.

The RPS bistable contacts not tested during the CHANNEL FUNCTIONAL TESTs have not been previously tested by any plant surveillance procedure. The testing was performed and the contact testing was satisfactory.

This testing deficiency did not compromise the health and safety of the general public because satisfactory contact performance has been demonstrated.

480 VAC ES Bus Load Shedding Testing Deficiency

ITS 3.8.1, AC Sources - Operating, specifies the operability requirements for the AC power sources in MODEs 1, 2, 3, and 4. For the AC Sources to be operable, Surveillance Requirement 3.8.1.1 through 3.8.1.17 must be satisfied. ITS 3.8.2, AC Sources - Shutdown, specifies the operability requirements for the AC power sources in MODEs 5 and 6. Surveillance Requirement 3.8.2.1 requires the performance of the Surveillance Requirements of Specification 3.8.1 except Surveillance Requirements 3.8.1.7, 3.8.1.9, and 3.8.1.10.

The 480 VAC ES Bus Load Shedding logic circuits are important to the mitigation of accidents when a LOOP occurs in conjunction with an ES actuation.

Although the independent functioning of two parallel contacts in the logic has not been verified, the 480 VAC ES Bus Load Shedding Logic Circuitry has been tested once per 24 months, in accordance with procedure SP-417, "Refueling Interval Integrated Plant Response to an Engineered Safeguards Actuation." This has provided assurance that at least one of the two parallel contacts functioned in each channel.

Assuming that one of the two parallel contacts failed in the load shedding logic for both the 480 VAC buses A and B, and postulating an additional single failure of a contact in the load shedding logic, during an ES actuation with a LOOP, either, but not both EGDG-1A and -1B could be rendered

inoperable. Safety functions are assured at CR-3 if either EGDG-1A or EGDG-1B is capable of powering its ES buses.

Assuming that one of the two parallel contacts failed in the breaker trip logic and postulating an additional single failure of a contact in the load shedding logic during an ES actuation with a LOOP, only EGDG-1B would be affected. Safety functions are assured at CR-3 if either EGDG-1A or EGDG-1B is capable of powering its ES buses.

Based on the above, this testing deficiency did not compromise the health and safety of the general public.

CAUSE

The root cause of these testing deficiencies has been determined to be cognitive human error. Personnel responsible for procedure development and review did not apply adequate test methodologies to ensure all component/contacts were properly tested.

Three contributing causes led to the primary cause. The first contributing cause is circuit complexity. The potential for development of a test procedure with a missed component/contact increases as the complexity of the circuit increases.

The second contributing cause stems from the lack of procedural guidance for test development which allowed procedure writers and reviewers to reach differing interpretations of Technical Specifications definitions and regulatory expectations.

The third contributing factor deals with the CR-3 implementation of IEEE Standard 279, "Criteria for Protection Systems for Nuclear Power Generating Stations." This standard requires that protection systems merely be designed such that they are capable of being tested. But the standards in effect at the time of CR-3 licensing provided no guidance on the performance of or the extent of testing.

IMMEDIATE CORRECTIVE ACTION

Loss of Power Start Testing Deficiencies

Technical Specification 3.3.8 Required Actions B.1 and C.1 were initiated. SP-907A and SP-907B were revised and performed. The relay contacts in question were tested satisfactorily. Technical Specification 3.3.8 Required Actions B.1 and C.1 were exited.

EFIC Logic Circuitry Testing Deficiencies

A restart restraint (R-1-B) was created to prevent entry into Technical Specification LCO Action 3.3.13.B.

ESAS Instrumentation RCS Pressure Low and Low-Low Logic Circuitry Testing Deficiencies

A restart restraint (R-1-A) was created to prevent entry into Technical Specification LCO Action 3.3.5.C.

EFIC Vector Enable Logic Circuitry Testing Deficiencies

A restart restraint (R-1-E) was created to prevent entry into Technical Specification LCO Action 3.3.13.B.

RPS Trip Function Testing Deficiencies

Technical Specification LCO Action 3.3.1.G was initiated.

A restart restraint (R-1-F) was created to prevent entry into Technical Specification LCO Action 3.3.1.D.1 and Action D.1 and referenced in Table 3.3.1-1 for each function not properly tested.

The contacts not tested by the CHANNEL FUNCTIONAL TEST were tested by Temporary Work Instructions to demonstrate satisfactory contact performance.

480 VAC ES Bus Load Shedding Testing Deficiencies

A restart restraint (R-1-G) was created to preclude entry into Technical Specification LCO Action 3.8.1.E.

ADDITIONAL CORRECTIVE ACTION

FPC will complete the corrective actions for deficiencies identified during the reviews. The corrective actions include revising and performing the procedures identified in Immediate and Additional Corrective Actions. The corrective actions will also ensure that appropriate testing requirements are established for systems being modified during the current outage. These activities are being tracked as a CR-3 Restart Issue.

EFIC Logic Circuitry Testing Deficiencies

Prior to satisfying restart restraint R-1-B, Technical Specification 3.3.13.B, SP-146A and B will be revised and appropriate testing will be performed in accordance with Surveillance Procedure SP-440, "Unit Start-up Plan."

ESAS Instrumentation RCS Pressure Low and Low-Low Logic Circuitry Testing Deficiencies

Prior to satisfying restart restraint R-1-A for Technical Specification 3.3.5.C, SP-130 will be revised and appropriate testing will be performed in accordance with Surveillance Procedure SP-440, "Unit Start-up Plan."

ESAS Automatic Actuation Logic Circuitry Testing Deficiencies

Prior to satisfying restart restraint R-1-A, Surveillance Procedure SP-137, Engineered Safeguards Actuation System Time Delay Relay Calibration will be revised and the appropriate testing will be performed in accordance Surveillance Procedure SP-440, "Unit Start-up Plan." This procedure will independently test parallel contacts in the ESAS Automatic Actuation automatic reset of the ES blocks 4 and 6 timers logic circuitry.

EFIC Vector Enable Logic Circuitry Testing Deficiencies

Prior to satisfying restart restraint R-1-E for Technical Specification 3.3.13.B, SP-146 A and SP-146 B will be revised and appropriate testing will be performed in accordance with Surveillance Procedure SP-440, "Unit Start-up Plan."

RPS Trip Function Testing Deficiencies

Prior to satisfying restart restraint R-1-F for Technical Specification 3.3.1.H, SP-110A, B, C, D, and SP-113 will be revised and appropriate testing will be performed in accordance with Surveillance Procedure SP-440, "Unit Start-up Plan." This procedure will satisfy Surveillance Requirement 3.3.1.4 for Table 3.3.1-1 Functions 2, 3, 4, 5, 6, 7, 9, and 10 and Surveillance Requirement 3.3.1.5 for Table 3.3.1-1 Functions 1 and 8.

480 VAC ES Bus Load Shedding Testing Deficiencies

Prior to satisfying restart restraint R-1-G for Technical Specification 3.8.1.E, SP-457 and 457A will be revised and appropriate testing will be performed in accordance with Surveillance Procedure SP-440, "Unit Start-up Plan."

ACTION TO PREVENT RECURRENCE

Training has been conducted for design engineers, system engineers, and procedure writers to provide assurance that proper consideration is given to logic testing of safety systems for plant and procedure modifications being implemented during the current outage.

Revise the continuing education program for Electrical and Instrumentation and Control Engineers to include refresher training on the FPC requirements and expectations for the testing of safety related logic circuits. The revision is scheduled to be completed by March 31, 1998.

Revise the continuing education program for Electrical and Instrumentation and Control Engineers to include refresher training on the FPC requirements and expectations for the testing of safety related logic circuits. The revision is scheduled to be completed by March 31, 1998.

Design Input Record in Nuclear Engineering Procedure NEP-210 has been revised to include guidance on the FPC requirements and expectations for testing for design engineers developing modifications of safety related logic circuits.

FPC Procedure Development Procedure AI-402B has been revised to include guidance on the requirements and expectations for testing for procedure writers revising test procedures for safety related logic circuits.

PREVIOUS SIMILAR EVENTS

There have been several previous reports involving testing of safety related logic circuits. LERs 96-011-00 and 96-025-00 were similar to this LER in that they reported logic system testing deficiencies identified by FPC's preliminary investigations in response to GL 96-01.

ATTACHMENT

Attachment 1 -Abbreviations, Definitions and Acronyms
Attachment 2 -List of Commitments

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
CRYSTAL RIVER UNIT 3	05000302	97	-- 003 --	05	15 OF 16

TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

ATTACHMENT 1 - ABBREVIATIONS, DEFINITIONS AND ACRONYMS

AOO	Anticipated operational Occurrence
CRD	Control Rod Drive
CRDCS	Control Rod Drive Control System
EFIC	Emergency Feedwater Initiation and Control
EFP	Emergency Feedwater Pump
EFW	Emergency Feedwater
EGDG	Emergency Diesel Generator
ES	Engineering Safeguard
ESAS	Engineered Safeguards Actuation System
FPC	Florida Power Corporation
FLUR	First Level Undervoltage Relaying
GL 96-01	Generic Letter 96-01, Testing of Safety Related Logic Circuits
IEEE	Institute of Electrical and Electronic Engineers
LOOP	Loss of Offsite Power
LOPS	Loss of Power Start
LPI	Low Pressure Injection
MODE FIVE	COLD SHUTDOWN
MODE FOUR	HOT SHUTDOWN
RCS	Reactor Coolant System
RPS	Reactor Protection System
RTM	Reactor Trip Module
SLUR	Second Level Undervoltage Relaying
VAC	Voltage Alternating Current

NOTES: ITS defined terms appear capitalized in LER text {e.g. MODE ONE}

Defined terms/acronyms/abbreviations appear in parenthesis when first used {e.g. Reactor Building (RB) }.

EIIS codes appear in square brackets {e.g. Engineering Safeguards [ES] }

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

ATTACHMENT 2

RESPONSE SECTION	COMMITMENT	DUE DATE
Page 12	SP-146A and B will be revised and appropriate testing will be performed to satisfy Surveillance Requirement 3.3.13.1.	Procedure - 11/3/97 Test - Perform in accordance with SP-440.
Page 13	SP-130 will be revised and appropriate testing will be performed to satisfy Surveillance Requirement 3.3.5.2.	Procedure - 10/22/97 Test - Perform in accordance with SP-440.
Page 13	Surveillance Procedure SP-137, Engineered Safeguards Actuation System Time Delay Relay Calibration will be revised and performed to independently test parallel contacts in the ESAS Automatic Actuation automatic reset of the ES blocks 4 and 6 timers logic circuitry	Procedure - 10/22/97 Test - Perform in accordance with SP-440.
Page 13	SP-146 A and SP-146 B will be revised and appropriate testing will be performed to satisfy Surveillance Requirement 3.3.13.1.	Procedure - 11/3/97 Test - Perform in accordance with SP-440.
Page 13	SP-110A, B, C, D, and SP-113 will be revised and appropriate testing will be performed to satisfy Surveillance Requirement 3.3.1.4 for Table 3.3.1-1 Functions 2, 3, 4, 5, 6, 7, 9, and 10 and Surveillance Requirement 3.3.1.5 for Table 3.3.1-1 Functions 1 and 8.	Procedure - 10/27/97 Test - Perform in accordance with SP-440.
Page 13	SP-457 and 457A will be revised and appropriate testing will be performed to satisfy Surveillance Requirement 3.8.1.10.	Procedure - 10/15/97 Test - Perform in accordance with SP-440.
Page 13	Revise the continuing education program for Electrical and Instrumentation and Control Engineers to include refresher training on the FPC requirements and expectations for the testing of safety-related logic circuits.	March 31, 1998