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Boyce H. Grier, Director
Office of Inspection and Enforcement
Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA. 19406

License No. DPR-35
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Response to IE Bulletin No. 79-27

Dear Sir:

In a letter dated November 30, 1979 you transmitted IE Bulletin No. 79-27 "Loss of Non-Class 1-E Instrument and Control Power System Bus During Operation. The review and evaluation required by this Bulletin have been completed and is enclosed as an attachment to this letter.

If you require any additional information, please contact us.

Very truly yours,

by G Andognini (JJP)

Attachments

cc: United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Division of Reactor Operation Inspection
Washington, D. C. 20555

Response to USNRC IE Bulletin #79-27

ITEM 1: "Review the class 1-E and non-class 1-E buses supplying power to safety and non-safety related instrumentation and control systems which could affect the ability to achieve a cold shutdown condition using existing procedures or procedures developed under item 2 below."

The systems, or parts of systems, at Pilgrim 1 which are necessary to achieve and maintain cold shutdown conditions are listed below. Initial conditions are: (1) Plant at 100% power and (2) total loss of off-site power.

1) Diesel generator 1 or Diesel generator 2.

2) 4KV AC bus A5 or 4KV AC bus A6.

3) Reactor Core Isolation Cooling (RCIC) System or

4) High Pressure Coolant Injection (HPCI) System.

5) Residual Heat Removal (RHR) System - loop A or loop B.

6) Core Spray (CS) System - loop A or loop B.

7) Reactor Building Closed Cooling Water (RBCCW) System - minimum 2 of 6 pumps running.

8) Salt Service Water (SSW) System - minimum 3 of 5 pumps running.

Of these systems, the last two - RBCCW and SSW - do not require separate instrumentation and control (I&C) power for operation. No interlocks exist between instruments and the pumps and motor-operated valves of these systems. All components required to achieve cold shutdown are manually operated from the main control room (MCR). Controls and indicating lamps are self-powered from control transformers located in each motor starter cubicle. Indication of system status is provided in the MCR.

The remaining systems require I&C power in order to perform their required functions and to indicate system status in the MCR. Six (6) I&C busses in the plant are utilized to provide power to these systems:

1) 125 VDC bus A (D4)

2) 125 VDC bus B (D5)

3) 120 VAC safeguard control bus A (Y3)

4) 120 VAC safeguard control bus B (Y4)

5) 120 VAC vital services bus (Y2)

6) 120 VAC instrument bus. (Y1)

I & C loads are divided as given below. Further details of each load are delineated in appendix A to this report.

1) 125 VDC bus A (D4)

- Diesel generator 1 relay logic, instruments and controls *.
- 4KV AC bus A5 switchgear controls, relaying, metering and indication **.
- RCIC relay logic (partial), turbine controls, instruments and indication.
- HPCI relay logic (partial).
- RHR loop A relay logic, instrumentation and controls.
- CS loop A relay logic, instrumentation and controls.

2) 125 VDC bus B (D5)

- Diesel generator 2 relay logic, instruments and controls*.
- 4KV AC bus A6 switchgear controls, relaying metering and indication **.
- RCIC relay logic (partial).
- HPCI relay logic (partial), trubine controls, instruments and indication.
- RHR loop B relay logic, instrumentation and controls.
- CS loop B relay logic, instrumentation and controls.

3) 120 VAC safeguard control bus A (Y3)

- RCIC valve control logic.
- RHR loop A valve control logic and instrument power.
- CS loop A valve control logic.

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* certain I&C loads "self powered" from generator.
** certain I&C loads powered from 4KV bus.

4) 120 VAC safeguard control bus B(Y4)

- RCIC valve control logic, turbine test circuit and turbine instrumentation.

- RHR loop B valve control logic and instrument power.

- CS loop B valve control logic.

5) 120 VAC vital services bus (Y2)

- RCIC instrument power

- RHR loop A instrument power.

6) 120 VAC instrument bus (Y1)

- HPCI turbine instrument power.

- RHR loop B instrument power

- CS instrument power.

ITEM 1-a: "For each bus identify and review the alarm and/or indication provided in the control room to alert the operator to the loss of power to the bus."

The busses listed above are provided with the following alarms and/or indication in the MCR:

1) 125 VDC bus A (D4)

- Voltmeter

- Ammeter

- Alarms - "Battery A Ground"
"Battery A Undervoltage"
"125V Charger Failure" (common)

2) 125 VDC bus B (D5)

- Voltmeter

- Ammeter

- Alarms - "Battery B Ground"
"Battery B Undervoltage"
"125V Charger Failure" (common)

3) 120 VAC safeguard control bus A (Y3)
no specific bus-related alarms or indication.

4) 120 VAC safeguard control bus B (Y4)
no specific bus-related alarms or indication

5) 120 VAC vital services bus (Y2)

- Voltmeter
- Ammeter
- Alarms - "Vital Instrument MG Set Out of Service"
  "Vital Instrument Sys. Loss of DC Power"
  "Vital Instrument Sys. Loss of DC Control"

6) 120 VAC instrument bus (Y1)

- Alarms - "Instrument Power Supply Bkr. Trip"
  "Instrument Power Transfer"
  "Instrument Standby Power Bkr. Trip"

In addition, the following power alarms are provided on a system basis in the MCR:

"RCIC Logic Bus Power Failure"
"RCIC Inverter Circuit Failure"
"HPCI Logic Bus Power Failure"
"HPCI Inverter Circuit Failure"
"RHR A Logic or Aux. Power Failure"
"RHR B Logic or Aux. Power Failure"
"CS A Logic or Aux. Power Failure"
"CS B Logic or Aux. Power Failure"

ITEM 1-b: "For each bus identify the instrument and control system loads connected to the bus and evaluate the effects of loss of power to these loads including the ability to achieve a cold shutdown condition."

The I&C loads connected to each bus are described in Appendix A to this report. Loss of power to each bus will have the following effects on ability to achieve cold shutdown:

1) Loss of 125 VDC bus A (D4)

- Loss of control to Diesel generator 1*.
- Loss of control to bus A5 switchgear **.
- Loss of RCIC turbine controls and relay logic (essential portion).
- Loss of HPCI backup relay logic.
- Loss of RHR loop A relay logic and controls.
- Loss of CS loop A relay logic and controls.

- The loss of these systems does not affect the ability to achieve cold shutdown as a redundant system or sub-system remains available.

2) Loss of 125 VDC bus B(D5)

- Loss of control to Diesel generator 2*.
- Loss of control to bus A6 switchgear**.
- Loss of RCIC backup relay logic.
- Loss of HPCI turbine controls and relay logic (essential portion).
- Loss of RHR loop B relay logic and controls.
- Loss of CS loop B relay logic and controls.
- The loss of this bus is similar in effect to the loss of 125 VDC Bus A. There is no effect on the ability to achieve cold shutdown.

3) Loss of 120 VAC safeguard control bus A (Y3)

- Loss of RCIC check valve test function
- Loss of RHR loop A valve function (partial) and instrument function (partial).
- Loss of CS loop A valve function (partial).
- The loss of this bus will not affect the ability to reach cold shutdown.

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* - Diesel generators can be started and run manually when 125 VDC control power is lost.

**- Switchgear breakers can be operated mechanically if necessary.

4) Loss of 120 VAC safeguard control bus B(Y4)

- Loss of HPCI check valve test function, turbine test function and turbine vibration instruments.
- Loss of RHR loop B valve function (partial) and instrument function (partial).
- Loss of CS loop B valve function (partial).
- The loss of this bus does not affect the ability to achieve cold shutdown.

5) Loss of 120 VAC vital services bus (Y2)

- Loss of RCIC instrumentation (partial).
- Loss of RHR loop A instrumentation (partial).
- Loss of this bus produces no effects on ability to reach cold shutdown.

6) Loss of 120 VAC instrument bus (Y1)

- Loss of HPCI turbine temperature recorder
- Loss of RHR Loop B instrumentation
- Loss of CS non-essential flow and pressure indication in loops A and B.
- Loss of this bus will not effect on ability to reach cold shutdown.

ITEM 1-C: For each bus describe any proposed design modifications resulting from these reviews and evaluations, and your proposed schedule for implementing those modifications."

No modifications are planned at this time.

ITEM 2: "Prepare emergency procedures or review existing ones that will be used by control room operators, including procedures required to achieve a cold shutdown condition, upon loss of power to each class 1-E and non-class 1-E bus supplying power to safety and non-safety related instrument and control systems. The emergency procedures should include:

a) the diagnostics/ alarms/ indicators/ symptoms resulting from the review and evaluation conducted per item 1 above.

b) the use of alternate indication or control circuits which may be powered from other non-class 1-E or class 1-E instrumentation and control buses.

c) methods for restoring power to the bus. Describe any proposed design modification or administrative controls to be implemented resulting from these procedures, and your proposed schedule for implementing the changes."

Procedures for dealing with loss of a particular I & C power bus exist as follows:

1) Loss of 125 VDC bus A (D4)

2) Loss of 125 VDC bus B (D5)

3) Loss of 120 VAC vital services bus (Y2)

4) Loss of 120 VAC instrument bus (Y1)

No procedures exist at present for loss of either 120 VAC safeguard control bus A (Y3) or B (Y4).

The existing procedures are discussed in more detail below.

1) Procedure #5.3.11, "Loss of Essential DC Bus D4."

This procedure describes the symptoms, indication and some of the alarms which will exist when loss of power occurs (item 2-a above). Not all alarms are given.

The procedure does not list alternate I & C circuits as required by item 2-b above.

The procedure does define methods for restoring power to the bus in accordance with item 2- c above.

2) Procedure #5.3.12, " Loss of Essential DC Bus D5"

This procedure presents the same format as procedure 5.3.11.

3) Procedure #5.3.6, "Loss of Vital AC (Y2)"

This procedure lists symptoms and alarms in accordance with item 2-a above.

Alternate circuits are not listed as required by item 2-b above.

The procedure does not define the methods for restoring power to the bus as required by item 2-c above.

4) Procedure 5.3.7, " Loss of Instrument Power Bus"

This procedure lists symtoms of loss of power to the bus as required by item 2-a above. Not all alarms are given.

The procedure does not list alternate circuits required by item 2-b above.

The procedure does not define the methods for restoring power to the bus as required by item 2-c above.

ITEM 3: "Re-review IE Circular No. 79-02, Failure of 120 Volt Vital AC Power Supplies, dated Jan. 11, 1979, to include both class 1-E and non-class 1-E safety related power supply inverters. Based on a review of operating experience and your re-review of IE Circular No. 79-02, describe any proposed design modifications or administrative controls to be implemented as a result of the re-review."

Pilgrim 1 does not use inverters to power busses in the manner described in Circular 79-02. Motor-generator sets are used instead. Two inverters are used, however, to power the flow control loops for the HPCI and RCIC turbine-powered pumps. These inverters are of small capacity and no transfer circuitry is provided. The output of each inverter is monitored and an alarm will occur in the MCR if loss of output voltage is detected.

It is not believed that this circular is applicable to the Pilgrim 1 design.

APPENDIX "A"

I & C BUS LOADS FOR SYSTEMS REQUIRED TO ACHIEVE COLD SHUTDOWN

1. DIESEL GENERATORS 1 & 2

   a. 125 VDC Bus A
      Diesel 1 relay logic

   b. 125 VDC Bus B
      Diesel 2 relay logic

NOTE: both Diesel generators contain "self-powered" control circuits, such as governor and voltage control circuits.

2. 4KV AC POWER BUSSES A5 & A6

a. 125 VDC Bus A

Bus A5 switchgear controls - breakers A501 through A509
A501 - Feeder from shutdown xfmr.
A502 - Control rod drive water pump P-209A.
A503 - RHR pump P-203A.
A504 - Feeder from start-up xfmr.
A505 - Feeder from unit xfmr.
A506 - RHR pump P-203C.
A507 - CS pump P-215A.
A508 - Feeder to load center B1 xfmr.
A509 - Feeder from Diesel generator 1.

b. 125 VDC Bus B

Bus A6 switchgear controls - breakers A601 through A609
A601 - Feeder from shutdown xfmr.
A602 - Control rod drive water pump P-209B.
A603 - RHR pump P-203B.
A604 - Feeder from start-up xfmr.
A605 - Feeder from unit xfmr.
A606 - RHR pump P-203D
A607 - CS pump P-215 B
A608 - Feeder to load center B2 xfmr.
A609 - Feeder from Diesel generator 2.

3. RCIC SYSTEM

a. 125 VDC BUS A

Turbine trip
Turbine governor
Turbine supervisory lights
Valves 1301-34
-35
-12
-13
-32

Relay logic
Reactor vessel low water level
Steam leak detection
Steam line high diff. press
Auto isolation reset
Turbine test
Steam supply low press.
Turbine aux. relay function
Pump low flow

Pump low suction press.
Steam supply valve
Gland seal vacuum control
Initiation signal seal-in
Isolation signal seal-in
Exhaust press. high
Initiation signal reset
Valve position monitors
Auto isolation signal

RCIC inverter (pump flow control loop)
Turbine test power supply 1340-15.

b. 125 VDC BUS B

Relay logic
Reactor vessel high level
Steam leak detection
Steam line high delta press.
Auto isolation logic

c. 120 VAC VITAL SERVICES BUS

Instrument power supply 1340-4

d. 120 VAC SAFEGUARD CONTROL BUS A

Testable check valve 1301-50

4. HPCI SYSTEM

a. 125 VDC BUS A

Relay logic
Steam leak detection
Steam line high diff. pressure
Auto isolation signal
Reactor high water level

b. 125 VDC BUS B.

Turbine trip
Turbine governor
Turbine supervisory lights
Valves 2301-29
-30
-64
-65
-31
-32

Relay logic
- Reactor low water level
- High drywell pressure
- Steam leak detection
- Steam line high diff. press.
- Steam line break reset ckt.
- Valve monitors
- High reactor water level seal-in
- Turbine aux. relay function
- Turbine exhaust high press.
- Pump discharge flow low
- Pump suction pressure low
- Steam supply pressure low.
- Supervisory alarm timer
- Gland seal condenser high level
- Suppression chamber high level
- HPCI initiation seal-in
- Auto isolation seal- in
- Condensate storage tank low level
- Auto isolation signal

HPCI inverter (pump flow control loop)
Instrument power supply 2340-3.
Condensate drain valves 9068A & B.

c. 120 VAC INSTRUMENT BUS

Turbine temperature recorder.

d. 120 VAC SAFEGUARD CONTROL BUS B.

- Testable check valve 2301-7
- Valve 2301-94
- Turbine test ckt.
- Turbine vibration instruments

5. CORE SPRAY SYSTEM

a. 125 VDC BUS A

Relay logic A
- System A pump power monitor
- Drywell high pressure
- Reactor low level
- Reactor low pressure
- CS pump A auto start
- CS pump A standby
- CS pump A auto stop
- Valve 1400-25A auto open
- CS pump discharge pressure low/high

b. 125 VDC BUS B

Relay logic B
similar to relay logic A.

c. 120 VAC SAFEGUARD CONTROL BUS A

Valves 1400-9A & 1400-6A

d. 120 VAC SAFEGUARD CONTROL BUS B

Valves 1400-9B & 1400-6B

e. 120 VAC INSTRUMENT BUS

Instrument power supply 1450-6 (common to loops A & B - indication only)

6. RHR SYSTEM

a. 125 VDC BUS A

Relay logic A
- Reactor low level
- Drywell high pressure
- Reactor low pressure
- RHR pump A auto start
- RHR pump A auto stop
- Reactor vessel shroud level
- Valves monitors
- RHR pump C auto start
- RHR pump C auto stop
- Containment spray valve controls
- RHR break detection logic

b. 125 VDC BUS B

Relay logic B
similar to relay logic A.

c. 120 VAC SAFEGUARD CONTROL BUS A

Valves 1001-68A
-95A
-33A
Flow controller FIC-1040-14
Recorder FR-1040-7
Indicator LI-263-106A

d. 120 VAC SAFEGUARD CONTROL BUS B

Valves 1001-68B
-95B
-33B
Indicator LI-263-106B

e. 120 VAC VITAL SERVICES BUS

Sq. root conv. 1040-15A
1040-10A
Inst. power supply 1040-9A

f. 120 VAC INSTRUMENT BUS

Sq. root conv. 1040-15B
1040-13
1040-10B
Inst. power supply 1040-9B.

7. RB CCW SYSTEM

No I&C loads required for cold shutdown

8. SSW SYSTEM

No I&C loads required for cold shutdown.