ESFAS

3.0 PRESENTATION

3.1 INTRODUCTION

3.1.a Complete Accident Symptoms Chart

3.1.1 PURPOSE - TO ACTUATE EQUIPMENT

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TO MITIGATE THE EFFECTS OF:

3.1.1.1 LOSS OF COOLANT ACCIDENT

3.1.1.2 STEAM LINE BREAK

3.1.1.3 FEEDWATER LINE BREAK

3.1.2 FUNCTIONS

3.1.2.1 MINIMIZE CLAD DAMAGE

A) ECCS

3.1.2.2 PROVIDE RB ISOLATION

A) CONTAINS FISSION PRODUCTS

IEEE-323
IEEE-279
10CFR50 Apdx A

3.1.2.3 DECREASE RB PRESSURE

A) MAINTAINS RB INTEGRITY

B) MINIMIZES LEAKAGE DRIVING FORCE

3.1.2.4 REMOVE FISSION PRODUCTS FROM RB ATMOSPHERE

A) MINIMIZES IODINE RELEASE

COVER ACCIDENT PRESSURES

3.1.2.5 LONG TERM CORE COOLING

A) BWST RECIRC

3.1.2.6 ISOLATION OF RUPTURED OTSG

A) TERMINATES ~~RUPTURE~~ RCS COOLDOWN AND ASSOCIATED $+\Delta K/K$ ADDITION INCLUDES AFW ISOLATION

FIGURE 11.2-1

3.2 ESFAS ORGANIZATION

2/3 LOGIC

3.2.1 INPUTS -

3.2.1.1 RCS PRESSURE

3.2.1.1 A & B OTSG PRESSURES

3.2.1.2 RB PRESSURE

3.2.1.3 BWST LEVEL

3.2.2 ANALOG SUB ASSEMBLIES

3.2.2.1 3 REDUNDANT SUBASSEMBLIES

3.2.2.2 SERVE TO COMPARE INPUT DEVICES WITH SETPOINT

3.2.2.3 BISTABLES "DE-ENERGIZE" TO ACTUATE

~~3.2.2.4 [illegible]~~

3.2.3 DIGITAL SUBASSEMBLIES (2 REDUNDANT)

3.2.3.1 RECIEVE AN INPUT FROM EACH ANALOG SUBASSEMBLY

MUST ENERGIZE TO ACTUATE

3.2.3.2 DIGITAL SUBASSEMBLIES ACTUATE CHANNELS

PAGE 11.2-3

3.2.3.4 COVER TABLE ON PAGE 11.2-3

A) 1A & 1B — AUX FEEDWATER

B) HPI PERMISSIVE FOR AUTO RECIRCULATION LPI/HPI CROSSOVER

* C) FOGG

FIGURE 11.2-2

3.3. ANALOG OPERATION

3.3.1 INPUTS

3.3.1.1 OTSG PRESSURE ⇒ 0-1500 PSIG

3.3.1.2 RCS PRESSURE ⇒ 0-2500 PSIG

3.3.1.3 RB PRESSURE ⇒ -5 TO 35 PSIG

3.3.1.4 BWST LEVEL ⇒ 0 TO 55 FEET

3.3.2 BUFFER AMPLIFIERS

3.3.2.1 SIGNAL CONVEETER

A) 4 to 20 ma TO 0 TO 10 VDC

3.3.2.2 LOCAL METER

A) CHANNEL CHECK

3.3.3 BISTABLE

3.3.3.1 COMPARES INPUT WITH SETPOINT

3.3.3.2 INPUT TO BYPASS BISTABLES

3.3.4 OTSG ISOLATION "OR" GATES

3.3.4.1 INPUTS

A) "A" OTSG PRESSURES } 600 PSIG POINT OUT FOGG INPUTS

B) "B" OTSG PRESSURE

C) RB PRESSURE -4PSIG

D) COVER INSIDE / OUTSIDE

BREAK PRESSURE CHANGES

LOGIC 1 ⇒ DE-ENERGIZES

3.3.4.2 LOGIC BUFFER

A) DRIVE INFARED POT

B) DE-ENERGIZE POT TO ACTUATE

C) ACTUATE DIGITALS 6A & 6B MAIN STEAM ISOLATION

3.4.5 ECC OR GATE

3.4.5.1 INPUTS

A) A OTSG PRESSURE } 600 PSIG
B) B OTSG PRESSURE }

C) LOW RCS PRESSURE - 1600 PSIG

D) HI RB PRESSURE - 4 PSIG

3.4.6.2 LOGIC BUFFER

A) ACTUATES 1A & 1B (HPI) } ECCS EQUIP

B) ACTUATES 2A & 2B (LPI) }

3.4.6 RB ISOLATION OR GATE

3.4.6.1 INPUTS

A) LOW RCS PRESSURE - 1600 PSIG

B) LOW RB PRESSURE - 4 PSIG

3.4.6.2 LOGIC BUFFER

A) ACTUATES 3A & 3B - NON ECC RB PENETRATIONS

B) ACTUATES 3A & 3B - RB COOLING

3.4.7 HIGH-HIGH RB PRESSURE

3.4.7.1 OR GATE NOT REQUIRED

3.4.7.2 RB PRESS > 10 PSIG ONLY INPUT

3.4.7.3 ACTUATES

A) 4A & 4B - SPRAY PUMPS

B) 5A & 5B - SPRAY VALVES

NaOH VALVES

C) SEPARATED TO PREVENT

INADVERTANT RB SPRAY DOWN

3.4.8 LOW BWST LVL

3.4.8.1 INPUT - BWST LVL @ 11 FT

3.4.8.2 ACTUATES 7A & 7B BWST / SUMP

SWITCHOVER

FIGURE 11.2-4

3.5. DIGITAL CHANNEL

3.5.1 FIBER OPTICS FROM ANALOG

3.5.2 POR - RECIEVER

3.5.3 AND GATES

3.5.3.1 REPRESENT ALL POSSIBLE 2/3 LOGIC

3.5.4 OR GATE

3.5.4.1 ACTUATED BY ANY ~~OR~~ AND GATE

~~3.5.4.2 MANUAL FROM CONTROL BOARD~~

3.5.4.3 ENERGIZE UNIT CONTROL MODULES

3.5.5 UNIT CONTROL MODULES

3.5.5.1 ACTUATE COMPONENTS

3.5.5.2 ~~MAN~~ AUTO / MANUAL SWITCH

A) AUTO BACK LTS WHEN ACTUATED

B) MANUAL - REMOVES SIGNAL FROM ~~ONLY COMPONENT~~ SELECTED COMPONENT

3.5.6 MANUAL ACTUATION

3.5.6.1 ALLOWS OPERATOR ACTUATION

3.5.6.2 RESET SWITCH - RESET FOR MANUAL SIGNAL

A) EQUIPMENT STATUS DOES NOT CHANGE

~~3.6 BYPASS OPERATIO~~

3.6 INTEGRATED OPS

3.6.1 4# BLDG PRESS

3.6.1.1 OR GATES

A) OTSG ISOLATION 6A & 6B

B) HPI & LPI 1 & 2 A & B

C) RB ISOLATION & COOLING 3A & B

3.6.2 LOW OTSG PRESSURE

3.6.2.1 OR GATES

A) ~~LA~~ OTSG ISOLATION ~~D~~ 6A&B

B) ECC - HPI (1A&1B) LPI (2A&2B)

3.6.3 LOW RCS PRESSURE

3.6.3.1 OR GATES

A) ECC HPI (1A&1B); LPI (2A&2B)

B) RB ISOLATION & COOLING - 3A, 3B

FIGURE 11.2-4 3.7 BYPASS - ALLOWS COOLDOWN WITHOUT ACTUATION

3.7.1 BYPASS BISTABLES

3.7.1.1 LOW RCS PRESS - 1850

3.7.1.2 LOW OTSG PRESS - 750

3.7.1.3 COMMON BYPASS SW

3.7.1.4 ~~A~~ KEEPS POR ENERGIZED WHEN IN EFFECT

3.7.1.5 AUTO RESET WHEN > 1850 AND 750

FIGURE 11.2-5 3.8 FOGG

3.8.1 PURPOSE

3.8.1.1 PREVENTS FEEDING RUPTURED OTSG

3.8.1.2 MUST HAVE ECC PERMISSIVE

3.8.1.3 OR GATE ALLOWS FEEDING IF BOTH OTSGS < 600 PSIG

3.9 AUX/ESFAS/OUTPUTS

3.9.1 DHR SUCTION VALVES

3.9.2 CFT OUTLET VLV ALARM

3.9 Auxiliary ESF Outputs

3.9.1 DHR Suction Valves

3.9.1.1 Closes / and prevents the opening of 2 of the 4 DHR suction valves if RCS press ≥ 400 psig

3.9.1.2 The other two valves are controlled by ECI

3.9.2 CFT Valves

3.9.2.1 Sends an open signal to CFT valves if RCS press > 750 and outlet valve is closed. < 650 PSIG VLVS OPEN ⇒ ALARM

3.9.2.2 Valves procedurally opened at ~ 700psig

3.9.3 PORV Block Valve

3.9.3.1 If RCS press < 2100 and PORV not fully closed ⇒ Block Valve closes

3.9.3.2 Can be manually overridden

3.10 Abnormal Operations

3.10.1 RCS Press ↓, RB press ↑

3.10.1.1 SATISFIES 2/3 Logic

3.10.1.2 Digital Channels actuated

- Channels 1A & 1B - HPI
- Channels 2A & 2B - LPI
- channels 3A & 3B - RB Cooling / Isolation

3.10.2 OTSG Press↓, RB Press↑

3.10.2.1 Satisfies 2/3 Logic

3.10.2.2 Digital Channels Actuated

- Channels 1A & 1B - HPI
- Channels 2A & 2B - LPI
- Channels 6A & 6B - Steamline Isolation

3.10.3 OTSG Press↓, RCS Press↓

3.10.3.1 satisfies 2/3 Logic

3.10.3.2 Channels Actuated

- Channels 1A & 1B - HPI
- Channels 2A & 2B - LPI

3.10.4 Loss of Channel "A" Power

3.10.4.1 Loss of Power to "A" analog - deenergizes

⇒ trips

3.10.4.2 No power to energize "A" digital - loss of 1 trai

3.10.4.3 Digital "B" in a 1/2 logic

~~3.10.5 Integrated Testing~~

~~3.10.5.1 Test position allows ESF signal testing of individual component~~

~~3.10.5.2 select test / press manual button~~

3.6 Testing

3.6.1 Analog Subassemblies

3.6.1.1 To inject a test signal, from the calibrate test module module test switch is moved from the "operate" position which will initiate a subsystem trip. ∴ the system is in a 1/2 logic for testing

3.6.1.2 Note - the removal of any module necessary for a trip will generate a trip signal

3.6.2 Digital Subassemblies

3.6.2.1 2/3 logic relays are tested individually ∴ each relay is energized

3.6.2.2 2/3 logic matrix is tested

3.6.2.3 Finally the signal to UCM is tested

3.6.3 Component testing

3.6.3.1 Select test position #9 (10 position selector switch)

3.6.3.2 Press manual switch ⇒ device to ESF position

3.6.3.3 Press Auto to release signal