GSE-B-2-2 FORM	PREPARED BY LKG CHECKED BY CGK APPROVED SJS REV. 1 DATE 12-1-79	Alternate Shutdown Capability Final Design Description SH. ___ CONT. ON SH. ___
MR NO. FC-78-56		OMAHA PUBLIC POWER DISTRICT GENERATING STA. ENG.

FORT CALHOUN STATION

ALTERNATE SHUTDOWN CAPABILITY

FINAL DESIGN DESCRIPTION

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FORT CALHOUN STATION

ALTERNATE SHUTDOWN CAPABILITY

FINAL DESIGN DESCRIPTION

1.0 INTRODUCTION

This report details the design modifications necessary to satisfy the NRC requirements (see SER Section 3.1.21) for an alternate shutdown capability following a control room fire as outlined in the NRC staff position, received per September 18, 1979 letter addressed to Mr. Ted Short. Description of the systems or portions thereof used to provide alternate shutdown capability is also included. To facilitate the NRC review, this report follows the staff position outline.

Appendix "A" provides cross reference between the staff position and this report.

This report addresses only the hot shutdown condition since this involves equipment modification with consequent material procurement lead times. Cold shutdown will be addressed in a report to be submitted at a later time.

2.0 DESIGN BASIS EVENT

The design basis for this analysis is a fire in the control room and/or the cable spreading room which results in evacuation of these areas. Safe shutdown capability will be preserved with (1) off-site power available; and (2) with off-site power not available.

3.0 DESIGN CRITERIA

The criteria for the design modification to achieve an alternate shutdown capability are:

3.1 The reactor will be maintained for an extended time within temperature and pressure limits associated with hot shutdown condition with the control room available. This will ensure that the fission product boundary integrity is maintained.

3.2 Control room evacuation does not occur simultaneously with or subsequent to any other accident condition.

3.3 The single-failure criteria does not apply.

3.4 The modifications need not be seismic Class I except where they interface with existing Class 1E equipment.

3.5 The hot shutdown can be maintained by a minimum crew of two. (Reactor operator and turbine building operator).

3.6 Off-site power is assumed to be lost.

4.0 SYSTEMS REQUIRED FOR ALTERNATE SHUTDOWN

The following is a summary of the processes required for maintaining hot shutdown and the equipment and instrumentation needed to perform these processes. Most of the equipment and their controls required for these functions are already available from areas outside of the control room. Where necessary, additional controls and instrumentation to perform these functions will be located on the alternate shutdown panel (AI-185) which will be located adjacent to the present auxiliary feedwater control panel in the electrical penetration room.

4.1 Reactivity Control: The primary means of achieving and maintaining subcriticality is the control rod system. Before evacuating the control room the operator will scram the reactor. As a further assurance the reactor operator will trip the turbine from the front standard which in turn will provide a backup scram signal.

The control rod system is sufficient to maintain the reactor subcritical at hot shutdown. In addition, the boron concentration in the reactor coolant system will be increased by aligning the suction of the charging pump to the gravity-fed boric acid tank.

4.2 Reactor Coolant Makeup: Makeup will be required to compensate for the shrinkage and the reactor coolant pump seals leakage. Charging pump CH-1B will be used to maintain reactor coolant inventory. Suction will be from the concentrated boric acid storage tank and after depletion of the boric acid tank the volume control tank will be used. The discharge rate for the charging pump is 40 GPM. This will be sufficient to provide the required make up.

To avoid any possibility of coolant loss through the letdown system by inadvertent opening of letdown control valves, this system will be immediately isolated.

The charging system was chosen over the high pressure safety injection (HPSI) system for maintaining the primary inventory because the maximum head of the HPSI pumps is lower than primary system pressure at hot shutdown. Charging pump CH-1B was chosen because it is powered by train 4 (bus 1A4, diesel generator number D2).

Diesel Generator D2 will be run locally; the power supply will be unaffected by a loss of the Control Room or Cable Spreading Room.

4.3 Reactor Coolant System Pressure Control: The primary method to maintain pressure will be to use the Auxiliary Feedwater System to remove heat from the primary system via the steam generators. Valves HCV- 1107B and HCV-1108B will be manually positioned to

adjust feedwater flow to the steam generators. If required, the operator will also manually open valve FCV-1369 and allow partial recirculation of the auxiliary feedwater flow. As the decay heat drops with time the operator can use one bank of the backup pressurizer heaters and intermittant charging pump operation to maintain system pressure.

4.4 Decay Heat Removal: The auxiliary feedwater system will be used to remove the decay heat from the primary system via the steam generators. The secondary cycle steam will be dumped to the atmosphere via the main steam safety relief valves which lift initially when the steam system pressure rises above 1000 psia and reset at about 950 psia.

4.5 Process Monitoring: The following instrumentation will be required to enable the operator to monitor the reactor conditions.

a. Primary Loop Hot Leg Temperature Indicator
b. Primary Loop Cold Leg Temperature Indicator
c. Volume Control Tank Level Indicator
d. Pressurizer Level Indicator
e. Steam Generator RC-2A Level Indication
f. Steam Generator RC-2B Level Indication
g. Pressurizer Pressure Indicator

Items a to d will be provided on the alternate shutdown panel. Items e to g are already existing at the auxiliary feedwater panel.

NOTE: In the conceptual design submitted to the NRC, it was stated that steam generator RC-2A and 2B pressure indication is available at AI-179. During detailed design it was discovered that no provision exists for isolation of these instrument loops from the control room. Since steam generator pressure control will be through operation of main steam safety valves, we feel that pressure indication is not required and no modifications will be done.

4.6 Supporting Systems and Equipment: The supporting systems and equipment required for hot shutdown are Diesel Generator D2 and associated electrical distribution system; and AC and DC control power systems. The only operating equipment is a charging pump and the steam driven auxiliary feedwater pump. During normal operation component cooling water is provided for cooling of charging pumps. According to the data received from the manufacturer the pump can, however, be operated with no significant overheating without component cooling water. Also, no external lubrication is required for operation of this pump. The auxiliary feedwater pump can also be operated, without external cooling and lubrication.

5.0 DETAILED SYSTEM DESCRIPTIONS

This section describes in detail the functions performed by the systems and equipment listed in Section 4.0.

5.1 Reactivity Control: As discussed in Section 4.1, the prime method of reactivity control is for the operator to scram the reactor from the control room. The control rod system is of fail safe design. Faulting or open circuit in this system trips the reactor. Reactor trip can also be initiated by simulating loss of load i.e. by tripping the turbine. No modifications are required for this system.

5.1.2 As a further assurance necessary modifications will be made to provide emergency boration.

Suction for emergency boration will be from the concentrated boric acid tank CH-11B. Please see drawings E-23866-210-121 and E-23866-210-120 Sh. 1. The flow path will be as follows.

Boric acid tank CH-11B, valves CH-167* (locked open), HCV-258, CH-155**, CH-173*, charging pump CH-1B, CH-188**, CH-192*, CH-198**, regenerative heat exchanger CH-6, HCV-239, CH-204**.

Valve numbers with one asterick indicates that it is a manually operated valve and can be placed in desired position by operator action. Valve number with two astericks indicate that it is a check valve and no operator action will be required.

HCV-258 is a motor operated valve and can be placed in the desired position by manual operation. Spurious closing can be avoided by opening the manually operated breaker at MCC-4A2.

HCV-239 is an air operated valve and fails open. Control circuit for this valve will be modified to provide isolation from the control room and to place it in open position.

Control circuit for charging pump CH-1B will be modified to provide isolation from the control room.

To avoid bypass flow through the inactive charging pumps, valves CH-174 and CH-172 should be closed. Both these valves can be placed in the closed position by manual action. In addition, to allow full flow without dilution, valves LCV 218-2 and HCV-240 should be in closed position. LCV 218-2 is motor operated valve and can be closed by operator action, spurious operation can be avoided by opening the manually operated breaker at MCC-3A2.

HCV-240 is located inside the containment and fails closed. It's control circuit will be modified, to place it in closed position and to isolate it from the control room. A new set of limit switches will also be added, to provide open/closed indication.

Boric acid gravity feed line is a heat traced line. Because boration will be done soon after reactor trip, loss of heat tracing will not effect plant shutdown.

After initial boration, charging pump suction will be aligned to volume control tank by manually opening valve LCV 218-2. Level indication for volume control tank level will be provided on the alternate shutdown panel.

5.2 Reactor Coolant Makeup: The charging system will be used to maintain the reactor coolant inventory.

The panel operator will be able to start and stop charging pump CH-1B directly from the panel and will also be provided with indication if the pump is operating. The valve line up was discussed in Section 5.1. The turbine building operator will align the CH-1B suction and discharge lines to the pump from the volume control tank to loop 2A of the primary system. This will require checking that valves LCV-218-2, CH-173, CH-192 and CH-194 are open and, if necessary, manually open them. He will then proceed to manually close valves CH-172 and CH-174 to prevent bypass flow through the other two inactive charging pumps. The only valve, HCV-239, which is inaccessible to the turbine building operator, is inside the containment. Provision will be made to open this valve from the alternate shutdown panel.

5.3 Reactor Coolant System Pressure Control: The basic aim during the hot shutdown phase is to maintain the primary system pressure at or near the normal operating value. Systems which are not required to function during this phase will therefore be isolated from the primary system. This will require closing the following valves:

TCV-202: this will isolate the letdown system
PCV-103-1 and 2: these will isolate the pressurizer spray system
HCV-240: this will isolate the auxiliary spray system
PCV-102-1 and PCV-102-2: this will avoid any inadvertent depressurization

The method to ensure that these valves are closed is discussed in Section 6.2.2.

Primary system pressure will be maintained by removing sufficient decay heat via the steam generators and auxiliary feedwater system (see Section 5.4). If the reactor residual heat decays with time to where it will not maintain reactor pressure within the limits, a bank of backup pressurizer heaters can be placed in service.

If required, pressurizer backup heater groups 10, 11, and 12 (Bank 4) will be used for this purpose.

Control and power for the backup pressurizer heaters is supplied by MCC 4C1 located in the electrical penetration room near the auxiliary feedwater panel, and can be operated from that motor control center.

There are seven cables associated with the control of the Pressurizer Backup heater groups 10, 11, and 12 that could be lost with the Control Room. To isolate these cables from the Control Room and allow local operation, control circuit wires at the MCC would be locally isolated at the MCC. Should the heaters be required during shutdown, these will be operated locally at the MCC.

Because pressurizer heaters will not be required for several hours, no modifications will be made.

5.4 Decay Heat Removal: The auxiliary feedwater system will be the method used to remove the decay heat via the steam generators. Soon after the reactor trip, the operator will verify the turbine trip and make sure that the main steam stop valves are closed. The secondary side steam will then be dumped to the atmosphere via the main steam safety valves. These valves will automatically lift at about 1000 psia and then reset when the secondary side pressure is reduced to about 950 psia. No operator action is required.

Following a reactor trip there is sufficient water in the steam generators to provide heat removal from the primary system for a period of 12 minutes. There is, therefore, sufficient time before any operator action on the AFS is required. A steam driven auxiliary feedwater pump (FW-10) is proposed to be used for pumping feedwater.

The steam driven feedwater pump (FW-10) was chosen for alternate shutdown rather than the motor driven feed pump. The FW-10 turbine is supplied with steam from the main steam system via valves YCV-1045A and B and YCV-1045. See Drawing 11405-M-252. The controls for these valves are already on panel AI-179. The Alternate Shutdown Panel will be located adjacent to this panel.

Valves HCV-1107A and B and HCV-1108A and B (see drawing 11405-M-253) will be opened to supply feedwater to the steam generators. Valves 1107A and 1108A are located within the containment while 1107B and 1108B are located in the auxiliary building and can be operated manually. The valves are fail-open and can be placed in the desired position from panel AI-179. In addition, if the compressed air is not available, HCV-1107B and 1108B will be operated manually.

The valves are redundantly fed by 125VDC from control room panel CB-10 (D.C. Bus 1) and auxiliary feedwater panel AI-179 (D.C. Bus 2). Upon loss of the control room power and control for these valves, control will be transferred to panel AI-179 from the control room panel CB-10 using the transfer switch presently installed in panel AI-179. In addition, the transfer switch isolates control from the control room preventing spurious signals, therefore, no modification is required for the circuitry of valves HCV-1107A and B and HCV-1108A and B.

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Initially, full feedwater flow is required from the Auxiliary Feedwater System. It will therefore be necessary to manually close the recirculation valve FCV-1369. As the residual heat decreases, HCV-1107B and HCV-1108B will be manually positioned to reduce the feedwater flow. In addition, if required FCV-1369 can be manually opened to increase the recirculation based on the instrumentation read out of primary system pressure and temperature. The actual values to be used in determining when to increase and decrease the feedwater flow will be incorporated in the revised emergency procedures for shutdown from outside the control room.

Steam Generators RC-2A and RC-2B level indicators and power supply for these indicators is available at panel AI-179. Both these instrument loops are independent of the control room.

5.5 Support Systems: The only support systems required to preserve shutdown capability are AC and DC power sources and the associated distribution systems.

Fire in the control room and/or cable spreading room may cause inadvertant opening and closing of 161 KV and 4.16 KV breakers feeding bus 1A4. (Please see Figure 8.1.1) and may cause loss of offsite power. Because of unreliability of the offsite power, modifications discussed in Section 6.2.5 will be made to assure availability of power from the following sources.

AC Power - Diesel Generator #D2
DC Power - DC Bus #2
AC Control Power - Instrument Inverter "D"

Diesel Generator #D2: Diesel Generator D2 can be started from local panel AI-133B which includes a master key-operated switch (183 MES), which disconnects all external sources of supply from the station bus, sheds all non-essential loads, disconnects all engine and generator protective devices, except over speed trip and isolates control from the safeguard panel AI-30B located in the control room. Operation of the master switch allows the key to be released and used to operate the diesel breaker emergency switch to connect the generator to the station bus. Diesel generator is also provided with an integral panel which permits starting the unit and isolating control of the engine from the control room.

Modifications discussed in Section 6.2.4 will be made to avoid spurious tripping of the diesel generator breaker 1AD2.

Before closing the Diesel Generator Breaker 1AD2, Breakers 1A24 and 1A44 (see Figure 8.1.1) will be manually opened and racked out to avoid any inadvertent operation.

Load shed on buses 1A4, 1B4A, 1B4B and 1B4C will be required before diesel breaker 1AD2 could be closed.

Load shed on 4160V buses is done through relays located in CB-20. Since CB-20 is located in the control room, these relays may be lost. The operator will verify load shed on bus 1A4, before closing breaker 1AD2.

For 480V buses, load shed is done through panel AI-109B located in the switchgear room.

Modifications discussed in 6.2.6 will be made to isolate AI-109B from the control room. Load shed will be initiated by master emergency switch (183 MES) located at Diesel Generator D2 local panel AI-133B.

DC Bus #2 is located in the switchgear room. All circuits feeding control power to the control room are properly protected. Cable failure due to fire may cause protective devices to clear the fault. Fire in the control room will not affect the operation of this bus. Control power connection for the alternate shutdown panel will be from one of the existing spare breakers.

Instrument inverter "D" will provide AC control power for panel AI-185. Fire in the control room may trip the breaker located at inverter "D". Connection to panel AI-185 will be from the line side of this breaker.

6.0 MODIFICATIONS

To ensure availability of the equipment and instruments required for hot shutdown from outside the control room (see Sections 4 and 5) the following modifications are required:

a) Provide an Alternate Shutdown Panel.
b) Modify existing circuits for the following.

- Instrument Loop 121 (Primary Loop Temperature Indication)
- Instrument Loop 219 (Volume Control Tank Level)
- Instrument Loop 101Y (Pressurizer Level)
- Letdown Control Valve (TCV-202)
- Pressurizer Spray Valve PCV-103-1, 2
- Auxiliary Spray Valve HCV-240
- Power Operated Relief Valve PCV-102-2
- Breaker Controls for 4160V Breakers 1AD2, T1B4A, T1B4B and T1B4C
- Breaker Controls for 480V Breakers CH 1B, 1B4A, 1B4B and 1B4C
- Load Shed Circuit for 480V Buses

6.1 Alternate Shutdown Panel: An Alternate Shutdown Panel (ASP) will be added and installed next to the auxiliary feedwater panel AI-179 in the electrical penetration room at Elevation 1013'-0". Drawing 13007.42-EE-42A shows the layout for this panel.

The following instruments and controls will be provided on this panel:

- Primary Loop Hot Leg Temperature Indicator (TI-121C-1)
- Primary Loop Cold Leg Temperature Indicator (TI-121H)
- Volume Control Tank Level Indicator (LI-219)
- Pressurizer Level Indicator (LI-101Y)
- Control Switch "Open-Close" With One Set of Indicating Lights for HCV-239
- Open/Close Indication for: HCV-240, PCV-102-2, PCV-103-1, PCV-103-2 and TCV-202
- Control Switch "Close-Trip" with One Set of Indicating Lights for CH-1B

In addition, a key locked transfer switch and lockout relays as shown on drawing 13007.42-ESK-11A will be provided. The relay coils for lockout relays will be constantly supervised and actuation of the transfer switch will provide annunciation in the control room. These relays, when, actuated will perform the following functions.

- Isolate Instrument Loops 121, 219, and 101Y from the Control Room
- Isolate CH-1B Controls from the Control Room
- Close letdown control valve (TCV-202), pressurizer spray valve (PCV-103-1, PCV-103-2) and auxiliary spray valves HCV-240 power operated relief valve (PCV-102-2). Control circuits for these valves will also be isolated from the control room and open/close indication will appear at the Alternate Shutdown Panel.

The panel has been designed per IEEE 420-1973. The panel itself and the components such as lockout relays which interface with or impact existing safety systems are classified as Class IE and will meet seismic criteria (per IEEE 344-1971) for the plant and will be qualified per IEEE 323-1971. Bill of Material sheets, drawing 13007.42-ESK-4A identify the Class IE components. The provision has also been made to test the indicating lights, without transferring controls to this panel.

6.1.1 DC control power for this panel will be from DC Bus #2 and AC control power will be tapped from panel AI-179, which will be connected to inverter "D". See Figure 8.1.1 and Drawing 11405-E-8.

6.2 Modification of the Existing Circuits: The following modifications will be made to provide required isolation, indication and controls at the Alternate Shutdown Panel or other panels located outside of the control room. The changes proposed have been backcircled on the drawings referenced below.

6.2.1 Loops 121, 219 and 101Y: Interconnection diagram for these loops is shown on Drawings 161F561, Sheets 8, 58, and 27, respectively. As shown on the revised drawings, TI-121C-1, TI-121H, LI-219 and LI-101Y will be added to the existing loops. A new multiple power supply will be installed in the Alternate Shutdown Panel and power supply connections for all these loops will be changed from the control room to this power supply. As shown, lockout relay "43A", "43B" or "43C" contacts will be added. These contacts, when actuated, will isolate these loops from the control room and will add additional resistance to avoid any calibration error.

Range of new indicators will be as follows.

TI-121C-1	515-615°F
TI-121H	515-615°F
LI-219	0-100%
LI-101Y	0-100%

During normal operation none of these loops is used for performing reactor protective function and as such modifications in these loops will not pose any unreviewed safety problem.

6.2.2 TCV-202, PCV-103-1 and 2, and HCV-240: As explained in Section 5.3, these valves are required to be in the closed position. All these are non-safety related fail-closed valves.

TCV-202 is an air operated valve, and the solenoid should be energized to open the valve. As shown on the G.E. Drawing 136B2431, Sheet 69, additional "43A" contacts will be added. These, when actuated, will close the valve and make sure that any spurious signal from the control room will not cause a false operation. Similar modifications will be made for HCV-240 and PCV-103-1 and 2. See Stone & Webster Drawings 13007.42-ESK-11C, and 11B and GE Drawing 161F561 Sh. 19.

Control power, which will be required to obtain open/close indication for these valves is from DC Bus #1. Because this bus may be lost, the control power for indication will be obtained from DC Bus #2 and a new set of limit switches will be added. This will avoid the possibility of any accidential tying together of both DC buses.

This modification will not pose any safety problem.

6.2.3 Power Operated Relief Valves PCV 102-1 and 2.

PCV-102-1: This valve fails closed and is connected to MCC 3C1. Spurious opening can be avoided by opening the manually operated breaker at MCC 3C1. No modifications will be made.

PCV 102-2: This valve also fails closed and is fed from MCC 4B1. The elementary diagram for this valve is shown on Drawing 13007.42-ESK-11E. The circuits would be modified to provide indication at the Alternate Shutdown Panel. When "43C" relay contacts are actuated, the circuits for PCV-102-2 will be isolated from the control room. This will avoid any spurious opening of this valve.

This modification will not pose any safety problem.

6.2.4 Breaker Controls for the 4160V Breakers 1AD2, T1B4A, T1B4B and T1B4C: Gibbs, Hill, Durham & Richardson Drawing 11405-E-27 shows schematic for diesel breaker 1AD2. As shown on this drawing, "183 X 3" contacts will be added to isolate the control circuit for 1AD2 from the control room. This will avoid the possibility of spurious tripping because of fire in the control room. "183 X 3" will be installed in 1AD2 breaker cubicle. "183 X 3" is energized through a spare contact of 183 MES switch (see Drawing 11405-E-45).

Similar modifications will be made in control circuit for breakers T1B4A, T1B4B and T1B4C. Isolation devices and controls will be mounted locally. The revised schematic is shown on Drawing 11405-E-16.

Because all these circuits are safety related, electrical components which interface with the existing system are classified as Class IE equipment.

Modifications proposed will not pose any safety problem.

6.2.5 Breaker Controls for the 480V Breakers CH-1B, 1B4A, 1B4B, and 1B4C: Revised schematic for charging pump CH-1B is shown on Drawing 11405-E-143. As shown, "43D" contacts will be added to achieve isolation from the control room. A new key locked control switch will be added to the Alternate Shutdown Panel to start and stop this pump. Test feature has also been provided to test the operability of this pump from the Alternate Shutdown Panel. After the control is transferred to the ASP, all pump protection will be cut off. This will avoid the possibility of any spurious trip. The emergency procedure will provide for manual checks.

Similar modifications will be made in control circuits for breakers 1B4A, 1B4B and 1B4C. Isolation devices and controls will be mounted locally. The revised schematic is shown on Drawing 11405-E-19.

Electrical components interfacing with the existing system are classified as Class IE.

Modifications proposed will not pose any safety problem.

6.2.6 Load Shed: As shown on Drawing 11405-E-45, 480V load shed circuit will be modified to provide isolation from the control room.

Modification proposed will not pose any unreviewed safety problem.

7.0 TESTS

The detailed test procedures are being developed. The following is a summary of the tests which will be done to verify that the modification meets the design intent.

7.1 Equipment Testing: All Class 1E equipment will be qualified per IEEE 323-1971.

7.2 Installation Tests: The intent of these tests will be to verify that the installation is in accordance with the detailed design and no equipment was damaged during installation. Typical of such tests are continuity and insulation resistance measurement on wires and cables, verification that the safety related cables are routed and terminated per conduit and cable schedule and drawings.

7.3 Preoperation Tests: The operation of individual equipment will be verified to assure that equipment operates from the local control station when the transfer or isolation switch is placed in local and the equipment cannot be operated from the control room; and that the equipment operates from the control room but cannot be operated at the local control station when the transfer or isolation switch is in the "remote" position. The operation of the individual equipment will be verified.

7.4 Surveillance Tests

The following is a summary of surveillance tests proposed for the equipment earmarked for alternate shutdown capability.

Sl. No.	Equipment	Proposed Surveillance Requirements For Alternate Shutdown
(1)	(2)	(3)
	Reactivity Control and Reactor Coolant Makeup	
1	Control Rods	See Note 1
2	Charging Pump CH-1B	Every 3 Months (See Note 2)
3	HCV-239	Every Refueling (See Note 2)
4	a) TCV-202 b) PCV-103-1 & 2 c) HCV-240 d) PCV-102-1 & 2	Every Refueling (See Note 3)

Reactor Coolant Pressure & Decay Heat Removal		
5	Aux. Feedwater System	See Note 1
Process Monitoring		
6	New Instrumentation	Check Calibration Every Refueling
Supporting System		
7	Diesel Generator D2	Check Operation of 183 MES Switch Every Refueling

NOTES:

(1) No modifications are proposed to systems referred to this note and as such surveillance requirements will not change.

(2) Verify that: equipment operates from the local control station when the transfer or isolation switch is placed in the "local" position and that the equipment cannot be operated from the control room; and that equipment operates from the control room but cannot be operated at the local control station when the transfer or isolation switch is in the "remote" position.

(3) Transfer control to AI-185 and verify that:

(1) All valves referred to this note close, (2) indication appears at AI-185, (3) any operator action in the control room cannot open these valves.

8.0 MANPOWER REQUIREMENTS AND SUMMARY OF HOT SHUTDOWN PROCEDURES

8.1 Manpower: During normal plant operation a minimum crew of six persons is maintained in all shifts. This includes Shift Supervisor, Reactor Operator, Assistant Reactor Operator, Turbine Building Operator, Auxiliary Operator and Water Treatment Plant Operator.

In the event of fire in the Control Room and or Cable Spreading Room, the Reactor Operator and Turbine Building Operator will be responsible for plant shutdown. The actions required are summarized in Section 8.2.

The Assistant Reactor Operator and Water Treatment Plant Operator, under the direction of Shift Supervisor, will be responsible for fighting fire.

Auxiliary Building Operator will also be available to help plant shutdown. The exact responsibilities of Auxiliary Building Operator will be assigned when detailed procedures are developed.

8.2 Summary of Hot Shutdown Procedures: The following is an outline of sequence of events and actions required following loss of the control room and/or the cable spreading room. This is not a detailed procedure, which are being developed. The intent here is to demonstrate the feasibility of maintaining a hot shutdown condition with the two man crew.

Time	Reactor Operator (RO)	Turbine Bldg. Operator (TBO)
0	Initiates scram before leaving control room.	-
0-5 Mins.	Provides backup scram by tripping turbine from front standard and proceeds to Alternate Shutdown Panel (AI-185)	Proceeds to Diesel No. 2 room.
5-10 Mins.	Starts auxiliary feedwater flow from panel AI-179.	Isolates Diesel Generator No. D2 from control room using 183 MES switch. Starts the Diesel Generator. Proceeds to the switchgear room. Verifies all breakers except 480V bus feeders on buses 1A4A, 1B4B & 1B4C are open. Closes breaker 1AD2. Opens 480V tie breakers. Proceeds to charging pump area.

Time	Reactor Operator (RO)	Turbine Bldg. Operator (TBO)
10-30 Mins.	Takes Over Control at AI-185. Monitors reactor coolant process variables from AI-185. Starts charging pump CH-1B when TBO has performed correct alignment.	Performs valve alignment for charging pump CH-1B and gravity-fed boric acid system.
30 Mins.-1 Hour	Continues to monitor process variables and operate charging pump as necessary. Will be available to assist TBO in isolating equipment for cold shutdown.	Performs procedures to protect equipment required for cold shutdown from inadvertant operation.
1 Hour-Indefinite	Monitors reactor process variables. Maintains reactor coolant system pressure using Auxiliary Feedwater System.	Aligns diesel fire pump to provide water to the emergency auxiliary feedwater tank. Throttles auxiliary feedwater valves 1107B and 1108B.

9.0 DRAWINGS

The following is a list of drawings referenced in the previous sections.

Combustion Engineering

E23866-210-110
E23866-210-120 Sh. 1
E23866-413-102
E23866-413-204

Gibbs, Hill, Durham & Richardson

11405-M-252
11405-M-253
Figure 8.1.1
11405-E-8
11405-E-27
11405-E-45
11405-E-143
11405-E-16
11405-E-19

General Electric

161F561 Sh. 8
161F561 Sh. 19
161F561 Sh. 27
161F561 Sh. 58
13682431 Sh. 69

Stone and Webster

13007.42-EE-42A
13007.42-ESK-11A
13007.42-ESK-11B
13007.42-ESK-11C
13007.42-ESK-11D
13007.42-ESK-11E
13007.42-ESK-11F
13007.42-ESK-4A

*These drawings show systems necessary for plant shutdown. Equipment necessary for operation of these systems has been highlighted.

APPENDIX A

Cross Reference Between the Staff Position and this Report

Staff Position	Report
Design Basis Event (1.0)	Section 2.0
Limiting Safety Consequences & Required Shutdown Functions (2.0)	Section 3.0
Performance Goals (3.0)	
3.1 Reactivity Control	Section 4.1
3.2 Reactor Coolant Makeup	Section 4.2
3.3 Reactor Heat Removal	Section 4.3
3.4 Process Monitoring	Section 4.4
3.5 Supporting Equipment	Section 4.5
3.6 Hot Shutdown Requirements	Sections 4.0, 5.0 and 6.0, plus detail drawings.
3.7 Cold Shutdown Requirements	Will be addressed in a report submitted later.
3.8 Design Criteria	Section 3.0
PWR Equipment (4.0)	
4.1 Reactivity Control	Section 5.1
4.2 Reactor Coolant Makeup	Section 5.2
4.3 Reactor Coolant System Pressure Control	Section 5.3
4.4 Decay Heat Removal	Section 5.4
4.5 Process Monitoring	Section 4.5
4.6 Supporting System and Equipments	Section 5.5
5.0 Cold Shutdown	Will be addressed later.
6.0 BWR	Not applicable
7.0 BWR	Not applicable.

Staff Position	Report
8.0 Information for Staff Review	
a)	Description of the systems required for hot shutdown is included in this report. (See Section 5.0). Cold shutdown will be addressed later.
b)	Drawings submitted with report.
c)	Discussed in Sections 6.2.1 to 6.2.6
d)	Discussed in Section 6.1.1 and 6.2.1 to 6.2.6
e)	Discussed in Sections 6.2.4 and 6.2.5
f)	Section 8.0 provides a summary of these procedures. Detailed procedures are being developed.
g)	The detailed procedure will list the requirements for spare fuses to be stored at the site.
h)	Discussed in 8.1
i)	Section 7.0 provides a summary of such tests. Detailed procedures are being developed. The systems will be tested, after the installation is complete.
j)	This will be addressed, after the detailed procedures are developed.
k)	This is discussed in Section 4.0. Equipment used for shutdown is presently installed and has been verified by test or analysis. Modifications will be made to either control or monitor this equipment from a separate location.
l)	Repair procedures for cold shutdown are being developed and will be submitted later.