The Light company Houston Lighting & Power P.O. Box 1700 Houston, Texas 77001 (713) 228-9211

October 31, 1985
ST-HL-AE-1439
File No.: G9.17

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Responses to DSER/FSAR Items
On Chapter 6

Dear Mr. Knighton:

The attachments enclosed provide STP's response to Draft Safety Evaluation Report (DSER) or Final Safety Analysis Report (FSAR) items.

The item numbers listed below correspond to those assigned on STP's internal list of items for completion which includes open and confirmatory DSER items, STP FSAR open items and open NRC questions. This list was given to your Mr. N. Prasad Kadambi on October 8, 1985 by our Mr. M. E. Powell.

The attachments include mark-ups of FSAR pages which will be incorporated in a future FSAR amendment unless otherwise noted below.

The items which are attached to this letter are:

Attachment	Item No.*	Subject
1	Q440.040N-1	Deletion of Jockey Pumps Note: F 5.4-1, F 5.4-2, F 6.3-1, F 6.3-2, F 6.3-3, F 6-3.21, F 6.3-21, F 6.3-22 were previously submitted via letter ST-HL-AE-1397 on October 12, 1985.

* Legend
D - DSER Open Item C - DSER Confirmatory Item
F - FSAR Open Item Q - FSAR Question Response Item

L1/DSER/au

B001 1/1

Houston Lighting & Power Company

If you should have any questions concerning this matter, please contact Mr. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

REP/bl

Attachments: See above

L1/DSER/au

cc:

Hugh L. Thompson, Jr., Director
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Robert D. Martin
Regional Administrator, Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

N. Prasad Kadambi, Project Manager
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20814

Claude E. Johnson
Senior Resident Inspector/STP
c/o U.S. Nuclear Regulatory Commission
P.O. Box 910
Bay City, TX 77414

M.D. Schwarz, Jr., Esquire
Baker & Botts
One Shell Plaza
Houston, TX 77002

J.R. Newman, Esquire
Newman & Holtzinger, P.C.
1615 L Street, N.W.
Washington, DC 20036

Director, Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

E.R. Brooks/R.L. Range
Central Power & Light Company
P.O. Box 2121
Corpus Christi, TX 78403

H.L. Peterson/G. Pokorny
City of Austin
P.O. Box 1088
Austin, TX 78767

J.B. Poston/A. vonRosenberg
City Public Service Board
P.O. Box 1771
San Antonio, TX 78296

Brian E. Berwick, Esquire
Assistant Attorney General for the State of Texas
P.O. Box 12548, Capitol Station
Austin, TX 78711

Lanny A. Sinkin
3022 Porter Street, N.W. #304
Washington, DC 20008

Oreste R. Pirfo, Esquire
Hearing Attorney
Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Charles Bechhoefer, Esquire
Chairman, Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dr. James C. Lamb, III
313 Woodhaven Road
Chapel Hill, NC 27514

Judge Frederick J. Shon
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. Ray Goldstein, Esquire
1001 Vaughn Building
807 Brazos
Austin, TX 78701

Citizens for Equitable Utilities, Inc.
c/o Ms. Peggy Buchorn
Route 1, Box 1684
Brazoria, TX 77422

Docketing & Service Section
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555
(3 Copies)

Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
1717 H Street
Washington, DC 20555

Revised 9/25/85

L1/DSER/au

ATTACHMENT 1
ST-HL-AE-1439
PAGE 1 OF 28

Question 440.40N

Your list of actions initiated by the SI signal (Section 6.3.2.1) does not include diesel-generator start nor closure of the SI jockey pump inlet isolation valves. These actions should be included.

Response

Section 6.3.2.1 ~~will be~~ has been revised to clarify that the standby diesel generators (SBDGs), Engineered Safety Feature (ESF) load sequencers and other equipment needed to support the Emergency Core Cooling (ECCS) is also actuated by the safety injection (SI) signal.

The SI Jockey Pump System has been deleted (Section 6.3 ~~will be~~ has been revised).

are powered from separate buses which are energized from offsite power supplies.

In addition, the standby diesel generators (DGs) assure adequate redundant resources of auxiliary onsite power are available to meet all ECCS power requirements. Each diesel is capable of driving all pumps, valves and necessary instruments associated with one train of the ECCS. 36

In response to NRC Branch Technical Position ICSB-18, protection against spurious movement by power lockout has been included in the design of certain MOVs as described in Section 6.3.2.2 and 6.3.5.5. 30 Q32. 32

The elevated temperature of the sump solution during recirculation is well within the design temperature of all ECCS components. In addition, consideration has been given to the potential for corrosion of various types of metals exposed to the fluid conditions prevalent immediately after the accident or during long term recirculation operations.

Environmental qualification of ECCS equipment which is required to operate following a LOCA is discussed in Section 3.11. 36

6.3.2 System Design

The ECCS components are designed such that a minimum of two accumulators delivering to two unaffected loops, and one high head and one low head safety injection pump delivering to an unaffected loop will assure adequate core cooling in the event of a design basis LOCA. The redundant onsite standby diesels assure adequate emergency power to all electrically operated components in the event that a loss of offsite power occurs simultaneously with a LOCA, even assuming a single failure in the emergency power system such as the failure of one diesel to start. 6

6.3.2.1 <u>Schematic Piping and Instrumentation Diagrams</u>. Flow diagrams of the ECCS are shown on Figures 6.3-1 thru 6.3-5. Pertinent design and operating parameters for the components of the ECCS are given in Table 6.3-1. The codes and standards to which the individual components of the ECCS are designed are listed in Section 3.2.

The component interlocks used in different modes of system operation are listed below.

1. The safety injection (SI) signal is interlocked with the following components and in conjunction with the load sequencer initiates the indicated action: 36

   a. HHSI pumps start.

   b. LHSI pumps start.

   c. Any closed accumulator isolation valves open.

   d. RWST discharge isolation valves to Spent Fuel Pool Cooling and Cleanup System (SFPCCS) close. 36

ATTACHMENT 1
ST-HL-AE-1439
PAGE 3 OF 28

e. The normally closed LHSI and HHSI pump miniflow isolation valves open. △

e ~~f~~. The component cooling water system (CCWS) valves for the RHR HX open. 36

2. Switchover of one train from injection mode to recirculation mode involves an interlock where the suction valves from the sump open and the HHSI and LHSI pump mini-flow valves close when the level transmitter indicates a low-low level in the RWST, coincident with an SI signal. 3

3. Additionally, the system includes an interlock which prevents the RWST isolation valves from being opened unless the corresponding recirculation sump valves are closed. 36

6.3.2.2 Equipment and Component Descriptions. The component design and operating conditions are specified as the most severe conditions to which each respective component is exposed during either normal plant operation, or during operation of the ECCS. For each component, these conditions are considered in relation to the code to which it is designed. By designing the components in accordance with applicable codes, and with due consideration for the design and operating conditions, the fundamental assurance of structural integrity of the ECCS components is maintained. Components of the ECCS are designed to withstand the appropriate seismic loadings in accordance with their safety class as given in Section 3.2. Active, powered components required for ECCS operation are listed in Table 6.3-12. 26 Q211.22

The major mechanical components of the ECCS follow. ECCS component parameters are provided in Table 6.3-1.

Accumulators

The accumulators are pressure vessels partially filled with borated water and pressurized with nitrogen gas. During normal operation each accumulator is isolated from the RCS by two check valves in series. Should the RCS pressure fall below the accumulator pressure, the check valves open and borated water is forced into the RCS. One accumulator is attached to each of the cold legs of loops 1, 2 and 3 of the RCS. Mechanical operation of the swing-disc check valves is the only action required to open the injection path from the accumulators to the core via the cold leg.

Connections are provided for remotely adjusting the level and boron concentration of the borated water in each accumulator during normal plant operation as required. Accumulator water level may be adjusted by pumping borated water from the RWST to the accumulator. Samples of the solution in the accumulators are taken periodically for checks of boron concentration. 36

Accumulator pressure is provided by a supply of nitrogen gas, and can be adjusted as required during normal plant operation; however, the accumulators are normally isolated from this nitrogen supply. Gas relief valves on the accumulators provide protection from pressures in excess of design pressure.

The accumulators are located within the Containment but outside of the secondary shield wall thus providing missile protection.

Residual Heat Removal Heat Exchangers

The residual heat removal (RHR) heat exchangers (HXs) are conventional shell and U-tube type units. During normal cooldown operation, the RHR pumps recirculate reactor coolant through the tube side while component cooling water flows through the shell side. During ECCS operation, water from either the RWST or the containment sump flows, via the LHSI pumps, through the tube side while component cooling water flows through the shell side. Credit is taken for cooling provided by the RHR HXs only during long term recirculation operation. The tubes are seal welded to the tubesheet. 36

A further discussion of the RHR HXs is found in Section 5.4.7. Design parameters appear in Table 5.4-8. It should be noted the parameters are based on normal cooldown rather than the recirculation phase of ECCS operation following a LOCA. This is due to the relatively small ΔT that exists on the tube side of the HX during the latter part of normal cooldown. 36 Q440.12N

Valves

Closing times for motor operated of valves used in the ECCS are given in Table 6.3-1. 36 △

Design features employed to minimize valve leakage include:

1. Where possible, packless valves are used.

2. Other valves which are normally open, except check valves and those which perform a control function, are provided with backseats to limit stem leakage.

3. Normally closed globe valves are installed with recirculation fluid pressure under the seat to prevent stem leakage of recirculated (radioactive) water.

4. Relief valves are enclosed, i.e., they are provided with a closed bonnet.

5. Control and motor operated valves (2-1/2 in. and above) exposed to recirculation flow have double packed stuffing boxes and stem leakoff connections to a drain header if located inside containment and to the SIS cubicle sumps if located in the Fuel Handling Building (FHB). 36

Motor-Operated Gate Valves

The seating design of all MOVs is of the flexible wedge design. This design releases the mechanical holding force during the first increment of travel so that the motor operator works only against the frictional component of the hydraulic unbalance on the disc and the packing box friction. The disc is guided throughout the full disc travel to prevent chattering and to provide ease of gate movement. The seating surfaces are hard faced to prevent galling and to reduce wear.

Where a gasket is employed for the body to bonnet joint, it is either a fully trapped, controlled compression, spiral wound asbestos gasket with provisions for seal welding, or it is of the pressure seal design with provisions for

ATTACHMENT 1
ST-HL-AE-1939
PAGE 5 OF 28

been an increase in the leakage since the last test. When this test is completed, the accumulator discharge line motor-operated isolation valves are opened and the RCS pressure increase is continued. There should be no increase in leakage from this point on since increasing reactor coolant pressure increases the seating force and decreases the probability of leakage.

3. The experience derived from the check valves employed in the emergency injection systems indicate that the system is reliable and effective; check valve leakage has not been a problem. This is substantiated by the satisfactory experience obtained from operation of the Robert Emmett Ginna and subsequent plants where the usage of check valves is identical to this application.

4. The accumulators can accept some in-leakage from the RCS without affecting availability. Continuous inleakage would require, however, that the accumulator water volume be adjusted according to Technical Specification requirements.

Relief Valves

Relief valves are installed in various sections of the ECCS to protect lines which have a lower design pressure than the RCS. The valve stem and spring adjustment assembly are isolated from the system fluids by a bellows seal between the valve disc and spindle. The closed bonnet provides an additional barrier for enclosure of the relief valves. The accumulator relief valves are sized to pass nitrogen gas at a rate in excess of the accumulator gas fill line delivery rate. The relief valves will also pass water in excess of the expected accumulator inleakage rate, but this is not considered to be necessary, because the time required to fill the gas space gives the operator ample opportunity to correct the situation. Table 6.3-2 lists the system relief valves with their capacities and setpoints.

System Filling, Venting and Availability

The HHSI subsystem is gravity filled from the RWST. The subsystem is manually vented utilizing high point vents on the subsystem piping. Once the HHSI subsystem has been filled and vented, it is kept in this condition by the head of the RWST which is the high point of the subsystem. 31 Q211.26 Q211.39

The LHSI subsystem is initially filled utilizing the LHSI pumps. Subsystem piping is manually vented. The RHR heat exchanger tubes which are the subsystem high points are purged by the LHSI pump flow which is sufficient to sweep out entrapped air. ← Insert #1

~~The LHSI subsystem is maintained in a filled condition by a jockey pump system.~~ 36

Butterfly Valves

Each RHR HX discharge line has an air-operated butterfly valve which is normally open and is designed to fail in the open position. The air line to the valve contains a Class 1E solenoid to allow manual venting to its design failure position. The actuator is arranged such that air pressure on the diaphragm 36

Insert #1

The seal standpipes for Reactor Coolant Pumps A, B and C are used ~~utilized as head tanks~~ to maintain a static head on the RHR heat exchangers and keep the heat exchanger tubes filled. A line is vented from each of the seal standpipes to the corresponding inlet line of the RHR heat exchangers. This maintains the LHSI subsystem in a filled condition. Makeup to the seal standpipe is from the Reactor Makeup Water System, as discussed in Section 9.3.4.

The control circuit for the accumulator motor operated isolation valve provides protection against inadvertent closure of that valve due to safety signal override logic. 30 Q32. In addition, the electric power source is removed from the valve motor operator. 36 Although the valve is normally open, automatic opening is provided whenever RCS pressure exceeds the P-11 setpoint. 36 It is necessary with automatic opening of these valves with reactor coolant pressure to include an administratively controlled manual bypass circuit which must be actuated to allow for periodic testing of the check valves. 36 This manual bypass is overridden by an SI signal or a manual opening signal. 2 Therefore, in the event a valve is closed for accumulator maintenance or testing for 36 check valve leakage at the time the injection is required, an SI signal from 2 one train will open the valve, overriding the test closure.

For further discussions of the controls and instrumentation associated with 30 Q32. these valves, refer to Sections 6.3.5, 7.3.1.1.2, and 7.6.3. 29 Q430 18N

Safety Injection Hot Leg Recirculation Isolation Valves

The MOVs in the hot leg recirculation line of each high head and low head safety injection pump are normally closed valves. The valves may be opened by operator action to provide recirculation flow to the corresponding hot leg during the switchover from cold leg to hot leg recirculation, post-accident. 30 They are also opened during periodic SIS testing operations. Q32.

The testing procedures instruct the operator to energize and open these valves when required during testing, and to energize and close the valves again after the testing is complete. Monitoring lights in conjunction with an audible alarm will alert the operator when any of these valves are opened.

During normal operations, the electric power source is removed from the valve motor operator by power lockout capability from a control switch located at the main control panel. For further discussion of the controls and instrumentation associated with these valves, refer to Sections 6.3.5.5 and 7.6.7.

Motor-Operated Valves and Controls

Remotely operated valves for the injection mode which are under manual control are in their ready position and do not require an SI signal. The valve positions are indicated on a common portion of the control board. If a component is out of its proper position, its monitoring light will indicate this on the control panel. At any time during operation when one of these valves is not in the ready position for injection, this condition is shown visually on the 30 board, and an audible alarm is sounded in the control room. Q32.

Table 6.3-3 is a listing of MOVs in the ECCS showing interlocks, automatic features and position indications.

The ECCS delivery lag times are given in Chapter 15. The accumulator injection time varies as the size of the assumed break varies since the RCS pressure drop will vary proportionately to the break size.

6.3.2.3 Applicable Codes and Classifications. Applicable industry codes and classifications for the ECCS are discussed in Sections 3.9.3 and 6.3.2.2. 36

Loss of Reactor Coolant from Small Ruptured Pipes or from Cracks in Large Pipes Which Actuate Emergency Core Cooling System

A LOCA is defined as a rupture of the RCS piping or of any line connected to the system. Ruptures of small cross section will cause expulsion of the coolant at a rate which can be accommodated by the charging pumps which would maintain an operational water level in the pressurizer permitting the operator to execute an orderly shutdown.

For small breaks (less than 1.0 ft^2) causing a discharge rate greater than can be compensated by normal makeup, a safety injection signal will be generated. The SI signal will start the safety injection pumps, properly align valves which receive SI signals, stop normal feedwater flow by closing feedwater isolation valves and initiate emergency feedwater flow by starting auxiliary feedwater pumps. Analyses demonstrate that the HHSI pumps play an important role in the initial core recovery because of the slower depressurization of the RCS than would have occurred from a larger break. | 36 | 2

The analysis of the RCS depressurization and water level transients further shows that for a break of approximately 4.0 in equivalent diameter, the transient is turned around and the core is recovering prior to accumulator injection. For a 4.5 in equivalent diameter break, the core remains uncovered with a decreasing level until accumulator action. Thus, the maximum break size showing core recovery prior to accumulator injection is approximately 4.0 in equivalent diameter. Accumulator injection commences when pressure reaches approximately 600 psig, i.e., approximately 1100 seconds from the time of the break for the 4.0 in break size. | 36

Results and Conclusions from Analysis of Small Break LOCA

The analysis of this break has shown that the high head portion of the ECCS together with the accumulators provide sufficient core flooding to keep the calculated peak clad temperature below the required limits of 10CFR50.46. Hence, adequate protection is afforded by the ECCS in the event of a small break LOCA.

Major Reactor Coolant System Pipe Rupture (LOCA)

A major LOCA is defined as a rupture of the RCS piping with a total cross sectional area equal or greater than 1.0 ft^2 including the double ended rupture of the largest pipe in the RCS or of any line connected to that system. The boundary considered for loss of coolant accidents as related to connecting piping is defined in Section 3.6. | 36

Should a major break occur, depressurization of the RCS results in a pressure decrease in the pressurizer. Reactor trip occurs when the pressurizer low pressure trip setpoint is reached. The ECCS is actuated when the pressurizer low pressure ~~and low level~~ setpoints are reached. ~~Reactor trip and~~ ECCS actuation are also provided by a high Containment pressure signal. These countermeasures limit the consequences of the accident in two ways: | 36

1. Reactor trip and borated water injection provide additional negative reactivity insertion to supplement void formation in causing rapid reduction of power to a residual level corresponding to fission product decay heat.

5. After any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by long-lived radioactivity remaining in the core.

In addition to and as an extension of the Acceptance Criteria, two accidents have more specific criteria as shown below.

In the case of the accidental depressurization of the main steam system an additional Westinghouse imposed criterion for adequacy of the ECCS is: Assuming a stuck RCCA, with offsite power available, and assuming a single failure in the ESF there is no consequential damage to the core or RCS for a steam release equivalent to the spurious opening, with failure to close, of the larger of any single steam dump, relief, or safety valve. 2 36

For a major secondary pipe rupture the added criterion is: Assuming a stuck RCCA with or without offsite power, and assuming a single failure in the engineered safeguards the core remains in place and intact.

An evaluation of boron precipitation and single failure is provided in Section 6.3.2.5.

More detailed descriptions of above accidents including analysis methods, assumptions and results are provided in Chapter 15.

Analysis shows that ECCS MOV motors are above the maximum post-accident water level thereby preventing any submerged valve motors. 2

Use of Dual Function Components

The ECCS contains components which have no other operating function as well as components which are shared with other systems. Components in each category are as follows:

1. Components of the ECCS which perform no other function are:

   a. One accumulator for each (of ~~the~~ three) loops which discharges borated water into its respective cold leg of the reactor coolant loop piping △

   b. Three HHSI pumps, which supply borated water for core cooling to the RCS (May be used during check valve testing also.)

   c. Associated piping, valves and instrumentation

2. Components which also have a normal operating function are as follows:

   a. The LHSI pumps are used to transfer water from the RWST to the refueling cavity during refueling. At all other times, they remain aligned to deliver RWST water during ECCS operation.

   b. The RHR HXs are normally used during the latter stages of normal reactor cooldown and when the reactor is held at cold shutdown for core decay heat removal. However, during all other plant operating periods, they are aligned for ECCS injection. 36

and solenoid-operated valves (SOVs)

6.3.5.5 Valve Position Indication. Valve positions are indicated on the main control board for all MOVs, ~~and~~ air-operated valves (AOVs) by means of red (open) and green (closed) position indicating lights. These lights are located at the control switch for each valve. They are powered by valve control power and actuated by valve motor operator limit switches (for MOVs) or valve stem mounted limit switches (for AOVs). and SOVs 30 Q32.32, Q211.29 36

ESF status monitoring system described in Section 7.5.4.

Positions for these valves (all MOVs and AOVs) are also indicated (in the ~~Bypass and Inoperable Status Indication System~~) by a "normal off" system. Should the valve not be in its proper position, thus disabling safeguards operations, a bright white light will be lit and will thus give a highly visible indication to the operator. This light is energized from a separate monitor light supply and actuated by a valve motor operator limit switch or, for AOVs (and SOVs), a stem mounted limit switch. ~~An annunciator~~ light and alarm are provided at the system level to further alert the operator should any valve in the ECCS be improperly aligned during operation. A window 36

Certain ECCS valves are provided with more extensive control features, as described in Sections 6.3.5.5.1 and 6.3.5.5.2.

6.3.5.5.1 Accumulator Isolation Valve Position Indication and Power Lockout: These valves are required to remain in their aligned positions during certain phases of a LOCA or during plant shutdown, as described in Section 7.6.3. To ensure that no spurious movements of these valves can occur, the valves will be power locked-out from a control switch located at the main control panel or auxiliary shutdown panel. Indication is provided at the main control panel and auxiliary shutdown panel to monitor the position of the power lock-out breakers for these valves: red (power on) and green (power off). 30 Q32.32 29 Q430.18N 36

Redundant valve position indication is also provided at the main control panel and auxiliary shutdown panel to supplement the normal valve position indicators when the power lock-out is in operation. These redundant valve position indicating lights are powered independent of the valve operator control power, and are operated by valve stem-mounted limit switches to ensure complete independence from the normal valve position indication system. 30 Q32.32

An annunciator alarm point is activated by both a valve motor operator limit switch and by a valve position limit switch activated by stem travel whenever an accumulator valve is not fully open for any reason with the system at pressure (the pressure at which the safety injection block is unblocked is approximately 1900 psig). A separate annunciator point is used for each accumulator valve. This alarm is recycled at approximately one hour intervals to remind the operator of the improper valve lineup. 36

6.3.5.5.2 Hot Leg Recirculation Isolation Valve Position Indication and Power Lockout: The hot leg recirculation isolation valves for each LHSI pump and each HHSI pump are required to remain in the closed position during the injection and recirculation phases of a LOCA, until operator action is taken to switch to hot leg recirculation in two of the safety injection trains. To ensure that no spurious movement of these valves can occur, the power for these valves is locked-out from a control switch located at the main control panel. Indication is provided at the main control panel to monitor the position of the power lock-out breakers for each valve: red (power on) and green (power off). 30 Q32.32 36

ATTACHMENT 1
ST-HL-AE-1439
PAGE 10 OF 28

TABLE 6.3-1 (Continued)

EMERGENCY CORE COOLING SYSTEM
COMPONENT PARAMETERS

Low Head Safety Injection Pumps

Number	3
Design Pressure, psig	495
Design Temperature, °F	300
Design Flowrate, gal/min	1900
Design Head, ft.	560
Max. Flowrate, gal/min	2900
Head at Max. Flowrate, ft.	400
Differential Head at Shutoff, ft.	700
+Motor Rating, bhp	400
Required NPSH, ft. (Max)	15
Available NPSH, ft.	19.5

Safety Injection System Jockey Pumps

Number	2
Design Pressure, psig	700
Design Temperature, °F	300
Design Flowrate, gal/min	later
Design Head, ft.	later
Maximum Flowrate, gal/min	later
Head at Maximum Flowrate, ft.	later
Discharge Head at Shutoff, ft.	later
Motor Rating, bhp	later
Required NPSH, ft. (Max.)	later
Available NPSH, ft.	later

Δ 36

Residual Heat Exchangers

(See Section 5.4.7 for design parameters)

Refueling Water Storage Tank

Number	1
Total Volume, gal	531,609*
Minimum Volume, gal	443,893
Normal Pressure, psig	Atmospheric
Operating Temperature, °F	Above freezing (37°F min)
Design Pressure, psig	Atmospheric
Design Temperature, °F	120
Boron Concentration (as boric acid), ppm	2500-2700

36

3

+1.15 service Factor not included
*During normal power operation - includes 17,132 gal. of unusable volume

TABLE 6.3-3 (Continued)

MOTOR OPERATED VALVES IN ECCS

Location	Valve I.D.	Interlocks	Automatic Features	Position Indication	Alarms
HHSI cold leg Isolation	XSI0006 A,B&C	None	None	MCB	Out of Position
HHSI hot leg Isolation	XSI0008 A,B&C	None	None	MCB	Out of Position
LHSI cold leg Isolation	XRH0031 A,B&C	None	None	MCB	Out of Position
LHSI hot leg Isolation	XRH0019 A,B&C	None	None	MCB	Out of Position
HHSI Pump Miniflow	SI0011 A,B&C AND SI0012 A,B&C	Closes on RWST Lo-Lo Level with SI signal, prevents manual opening unless sump isolation valve is closed, valves SI0011 A,B,and C Open on SI Signal	Closes on RWST Lo-Lo Level with SI signal Valves SI0011 A, B, C Open on SI Signal	MCB	Out of Position
LHSI Pump Miniflow	SI0013 A,B&C AND SI0014 A,B&C	Closes on RWST Lo-Lo Level with SI signal, prevents manual opening unless sump isolation valve is closed, valves SI0014 A,B,C Open on SI Signal	Closes on RWST Lo-Lo Level with SI signal Valves SI0014 A,B,C Open On SI Signal	MCB	Out of Position

36

ATTACHMENT 1
ST-HL-AE-1434
PAGE 12 OF 28

TABLE 6.3-4

MATERIALS EMPLOYED FOR

EMERGENCY CORE COOLING SYSTEM COMPONENTS

Component	Material
Accumulators	Carbon Steel, Clad with Austenitic Stainless Steel
Pumps	
High Head Safety Injection	Austenitic Stainless Steel
Low Head Safety Injection	Austenitic Stainless Steel
Safety Injection System Jockey	Austenitic Stainless Steel
Residual Heat Removal Heat Exchangers	
Shell	Carbon Steel
Shell End Cap	Carbon Steel
Tubes	Austenitic Stainless Steel
Channel	Austenitic Stainless Steel
Channel Cover	Austenitic Stainless Steel
Tube Sheet	Austenitic Stainless Steel
Valves -	
Motor Operated Valves	
Containing Radioactive Fluids	
Pressure Containing Parts	Austenitic Stainless Steel or Equivalent
Body-to-bonnet Bolts & Nuts	Low alloy steel

36 △

TABLE 6.3-5

SINGLE ACTIVE FAILURE ANALYSIS FOR EMERGENCY CORE COOLING SYSTEM COMPONENTS

SHORT TERM PHASE

Component	Malfunction	Comments	
1. Pumps			
a. High Head Safety Injection	Fails to Start	Three provided, evaluation based on operation of two.	30
b. Low Head Safety Injection	Fails to start	Three provided, evaluation based on operation of two.	
2. Automatically Operated Valves			
a. LH & HH Safety Injection pumps suction line from containment sump	Fails to open	Three parallel lines; only two valves in any of three lines are required to open.	
b. High Head Safety Injection pump miniflow line	Fails to close	Two valves in series; only one valve required to close.	
c. Low Head Safety Injection pump miniflow line	Fails to close	Two valves in series; only one valve required to close.	
d. SISJ Pump suction line isolation	Fails to close	Two valves in series; only one valve required to operate	36

TABLE 6.3-5 (Continued)

SINGLE ACTIVE FAILURE ANALYSIS FOR EMERGENCY CORE COOLING SYSTEM COMPONENTS

LONG TERM PHASE

Component	Malfunction	Comments	
c. LHSI and HHSI pumps normally closed miniflow isolation valves	Fails to open	Pump may be deadheaded and damaged. Three parallel lines, evaluation based on operability of two.	36 △
3. Valves Operated Manually from the Control Room			
a. HHSI & LHSI pump common suction line to refueling water storage tank	Fails to close	Check valve in series with gate valve; operation of only one valve required.	
b. HHSI or LHSI hot leg isolation valve	Fails to open	Three flow paths available. Adequate flow to core is assured by any two.	
c. HHSI or LHSI cold leg isolation valve	Fails to close	Three flow paths available. Adequate flow to core is assured by any two.	36

ATTACHMENT 1
ST-HL-AE-1439
PAGE 15 OF 28

TABLE 6.3-10 (Continued)

EMERGENCY CORE COOLING SYSTEM - SAFEGUARDS OPERATIONS
FAILURE MODES AND EFFECTS ANALYSIS

Component	Failure Mode	Function	Effect on System Operation	Failure Detection Method	Comments
12. Motor operated PMD valve SI0011A (valves SI0011B and SI0011C analogous)	Fails to ~~open~~ close on demand.	Provides isolation of HHSI pump miniflow line to RWST.	Failure prevents use of line for HHSI pump miniflow. Pump failure may occur if RCS pressure remains above pump shutoff pressure. Adequate injecflow is provided by redundant high head pumps and, for lower RCS pressures by three low head pumps.	Valve position indication and ESF monitoring at MCB.	Valve is normally closed and opens automatically on receipt of an SI signal.
	~~Fails to close on demand.~~		Failure reduces redundancy of providing miniflow line isolation during recirculation phases. Isolation will be provided by redundant valve SI0012A (SI0012B and C).		Valve is automatically closed during switchover from injection to recirculation (see Section 6.3.2.2 and logic diagram Figure 7.6-4).
13. Motor operated PMD valve SI012A (valves SI012B and SI012C analogous)	Fails to close on demand.	Provides isolation of HHSI pump miniflow line to RWST.	Failure reduces redundancy of providing miniflow line isolation during recirculation phases. Isolation will be provided by redundant valve SI011A (SI0011B and C).	Valve position indication and ESF monitoring at MCB.	Valve is automatically closed during switchover from injection to recirculation (see Section 6.3.2.2 and logic diagram Figure 7.6-4).
14. Motor operated ~~PMD~~ valve SI0013A (valves SI00013B and SI0013C analogous)	Fails to close on demand.	Provides isolation of LHSI pump miniflow line to RWST.	Failure reduces redundancy of providing miniflow line isolation during recirculation phases. Isolation will be provided by redundant valve SI0014A (SI0014B and C).	Valve position indication and ESF monitoring at MCB.	Valve is automatically closed during switchover from injection to recirculation (see Section 6.3.2.2 and logic diagram Figure 7.6-4).
15. Motor operated ~~PMD~~ valve SI0014A (valves SI0014B and SI0014C analogous)	Fails to ~~open~~ close on demand.	Provides isolation of LHSI pump miniflow line to RWST.	Failure prevents use of line for LHSI pump miniflow. Pump failure may occur if RCS pressure remains above pump shutoff pressure. Adequate injection flow is provided by redundant low head pumps and by three high head pumps.	Valve position indication and ESF monitoring at MCB.	Valve is normally closed and opens automatically on receipt of an SI signal.
	~~Fails to close on demand.~~		Failure reduces redundancy of providing miniflow line isolation during recirculation phases. Isolation will be provided by redundant valve SI0013A (SI0013B and C).		Valve is automatically closed during switchover from injection to recirculation (see Section 6.3.2.2 and logic diagram Figure 7.6-4).

TABLE 6.3-12

ECCS ACTIVE POWERED COMPONENTS (Cont'd)

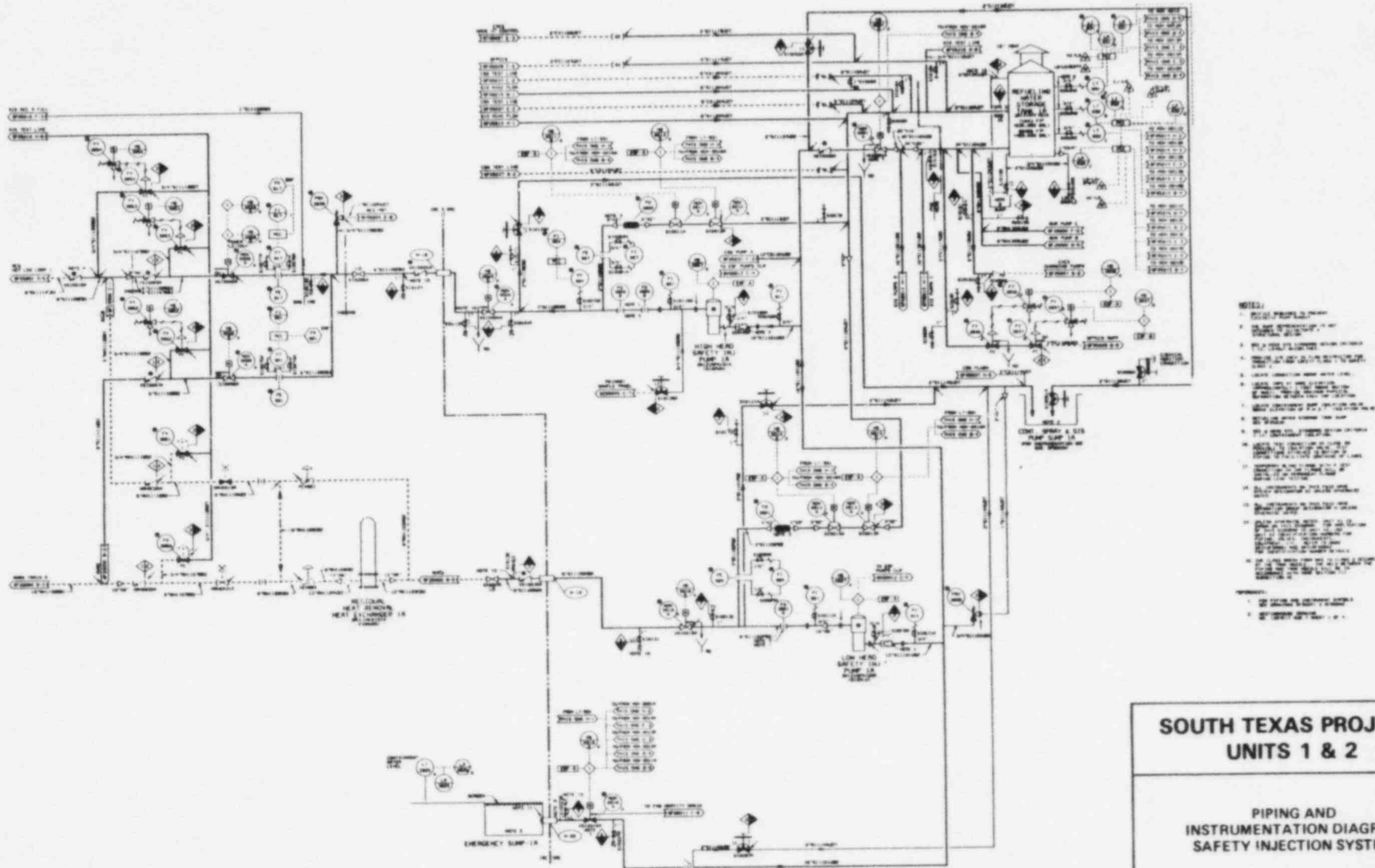
Valve Number	Type	Safety/Seismic Class		Actuated by	Electrical Train Services
PV-3928, 3930, 3929	Globe	2	I	Solenoid	A, B, C
FV-3983	Globe	2	I	Air	A
HV-899	Globe	2	I	Solenoid	B
HCV-900	Globe	2	I	Solenoid	A
SI0216	PMD	2	I	Motor	A
SI0217	PMD	2	I	Motor	C

36

26
Q211.22N

△

ATTACHMENT 1
ST-HL-AE-1439
PAGE 18 OF 28



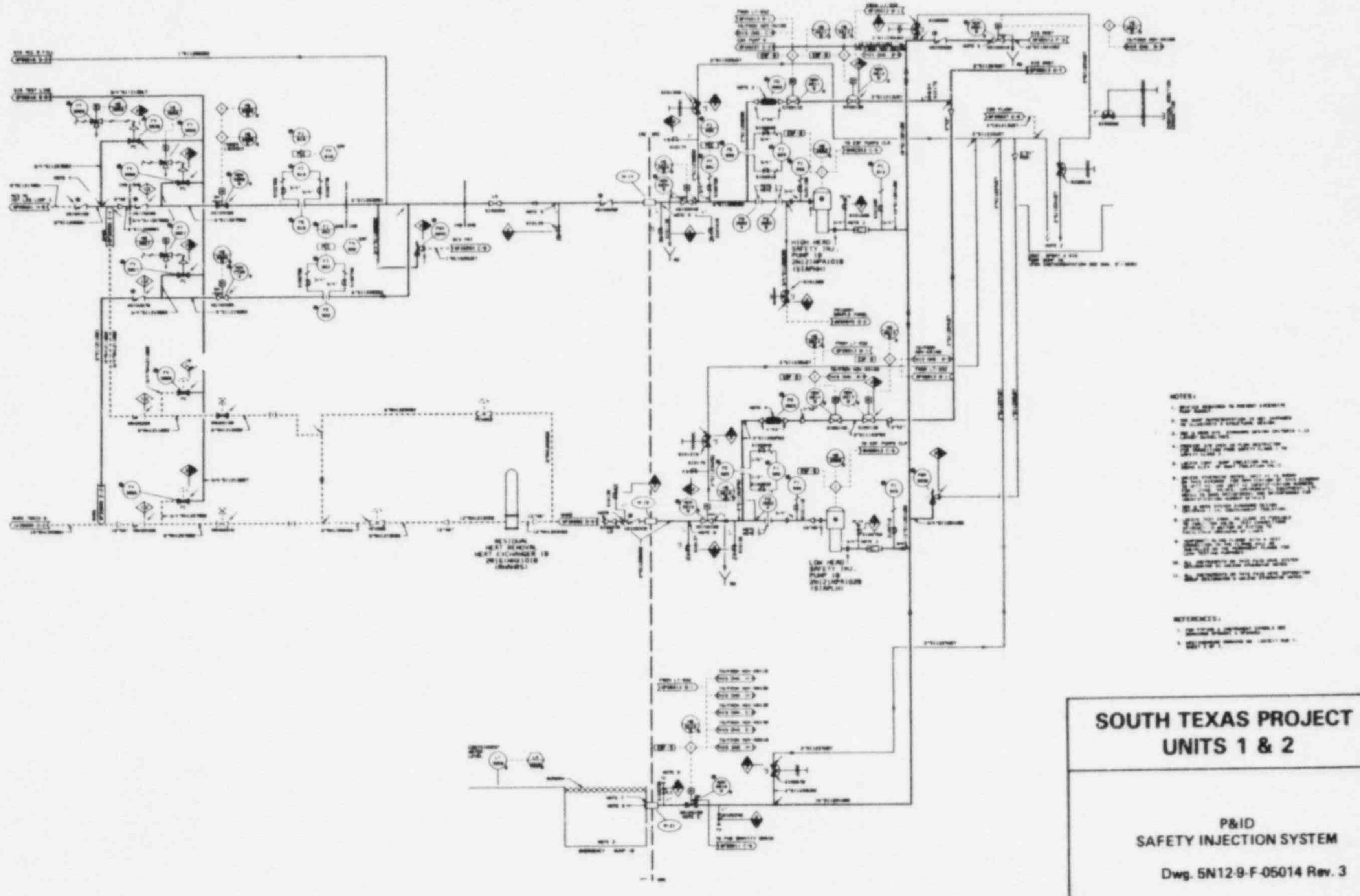
SOUTH TEXAS PROJECT
UNITS 1 & 2

PIPING AND
INSTRUMENTATION DIAGRAM
SAFETY INJECTION SYSTEM

Dwg. 5N12-9-F-05013 Rev. 3

Figure 6.3-1

Amendment 51



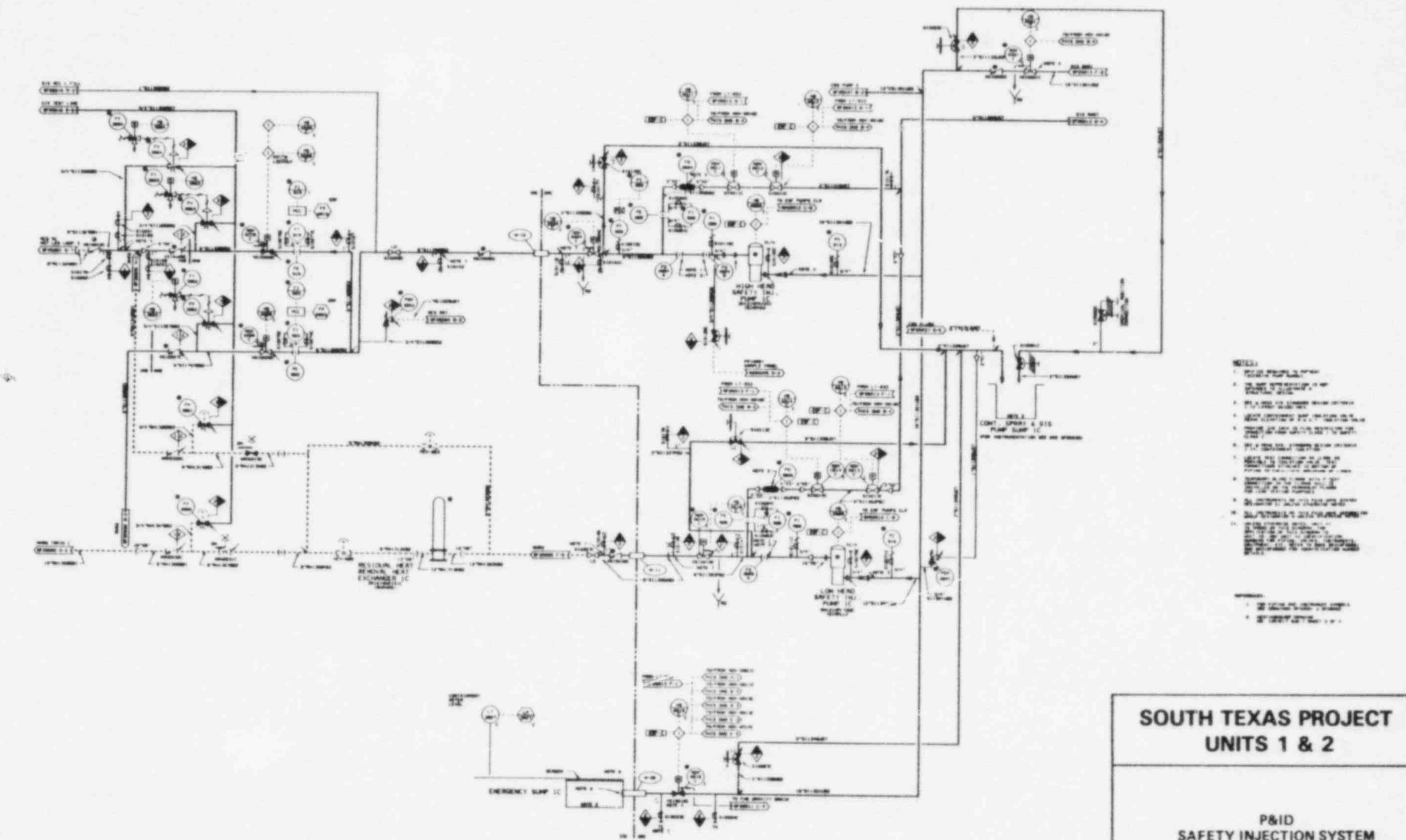
SOUTH TEXAS PROJECT
UNITS 1 & 2

P&ID
SAFETY INJECTION SYSTEM

Dwg. 5N12-9-F-05014 Rev. 3

Figure 6.3-2

Amendment 51



SOUTH TEXAS PROJECT
UNITS 1 & 2

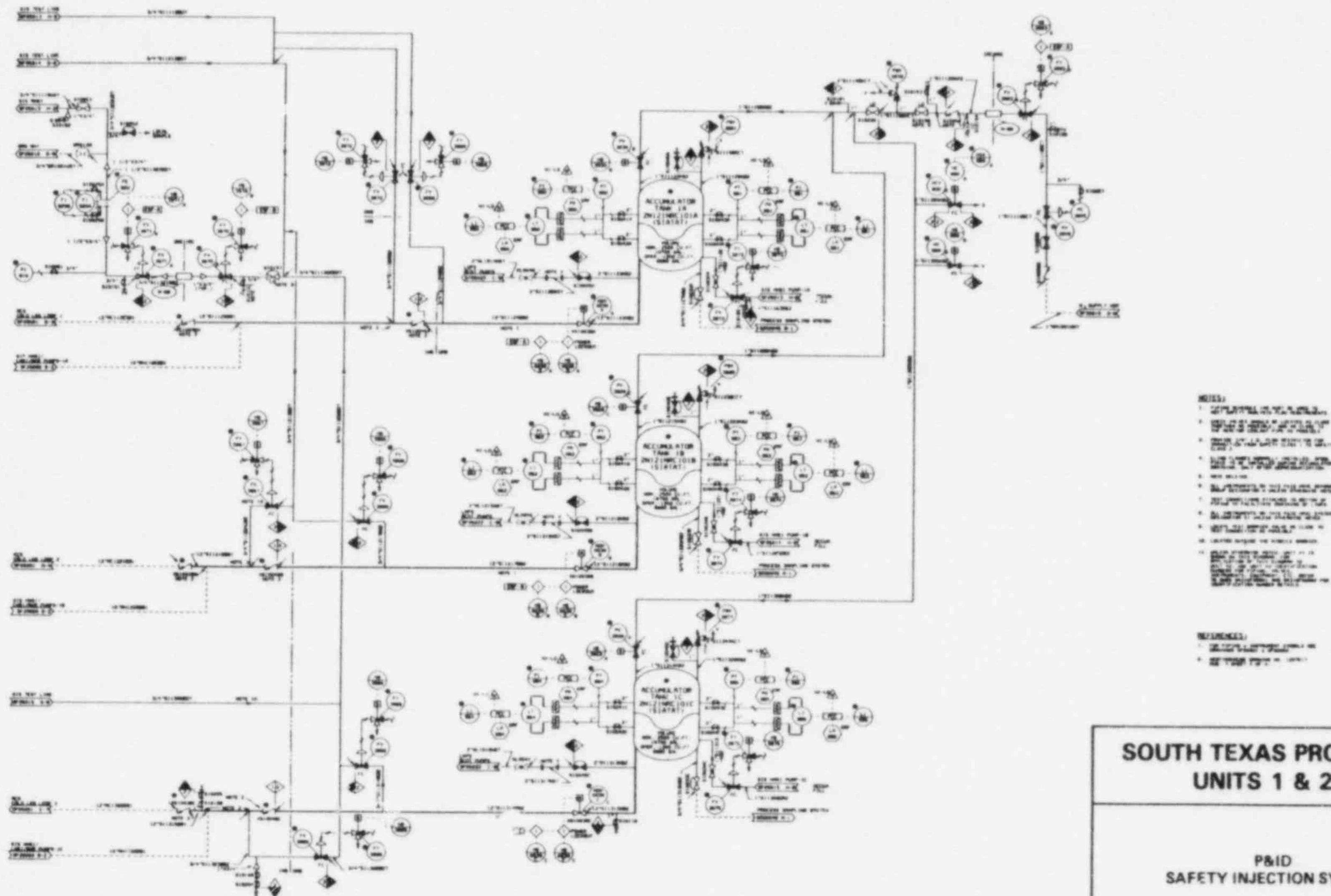
P&ID
SAFETY INJECTION SYSTEM

Dwg. 5N12-9-F-05015 Rev. 3

Figure 6.3-3

Amendment 51

ATTACHMENT 1
ST-HL-AE-1439
PAGE 37 OF 38



SOUTH TEXAS PROJECT
UNITS 1 & 2

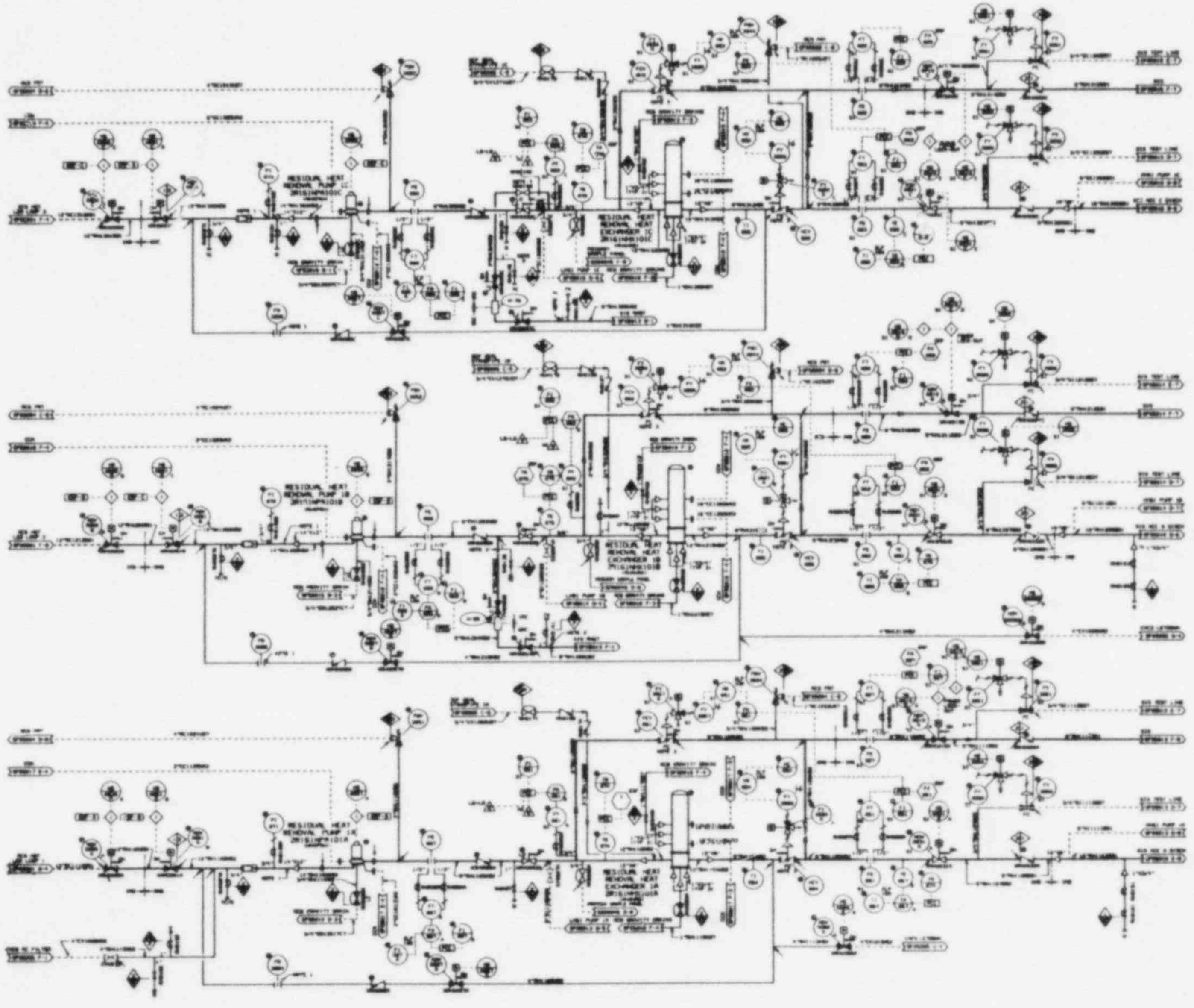
P&ID
SAFETY INJECTION SYSTEM

Dwg. 5N12-9-F-05016 Rev. 3

Figure 6.3-4

Amendment 51

ATTACHMENT 1
ST-HL-AE-1439
PAGE 22 OF 28



SOUTH TEXAS PROJECT
UNITS 1 & 2

RESIDUAL HEAT
REMOVAL SYSTEM P&ID
5R169F2000

Figure 5.4-6 Amendment 49

ATTACHMENT 1
ST-HL-AE- 1439
PAGE 23 OF 28

Question 211.29

It is the staff position that position indication for any valve (including local manually operated valves) that could degrade the performance of the ECCS should be available in the control room. Identify all the ECCS valves that have position indication in the control room and confirm that South Texas meets the above position.

; position indication is provided in the control room for each of these MOVs.

Response

-operated, solenoid-operated

Motor and air-operated valves in the Emergency Core Cooling System (ECCS) are provided with position indication and "out of normal" position alarms as described in revised section 6.3.5.5. The ~~All~~ ECCS motor-operated valves ~~having control room indication~~ are listed in Table 6.3-3. ~~All~~ air-operated valves ~~with position indication in the control room~~ which could degrade performance if left open are listed in the attached Table Q211.29-1. ~~Note that, as shown in the referenced figures for valves FV 3950 through FV 3975, two valves in series per train are required to be left open in order to degrade ECCS performance.~~

The ECC add INSERT 'A'

There are six air-operated valves currently without position indication. HCV 864, 865, and 866 (Heat Exchanger Flow Control Valves) and FCV 851, 852, and 853 (Heat Exchanger Bypass Valves) are being analyzed for safety implication and the necessity of control room position indication. (now have lights)

replace with INSERT 'B'

The following manually operated valves do not have control room position indication and could degrade the performance of the ECCS: 29

1) XRH0063 B, C and XRH0064 B, C located in the RHRS return line to the RWST. However, as shown in figures ~~6.3-2 and 3~~ 5.4-6, both valves in series are required to be left open in order to degrade ECCS performance.

2) SI0206 A, B, C and SI0207 A, B, C, could degrade ECCS performance if one were left closed. The SI0206 series are in the high head injection lines downstream from the check valve in order to facilitate leak testing. The SI0207 series are similarly located in the low head injection lines.

Accumulator gas pressure is monitored by indicators and alarms and therefore, no discussion has been provided for manual valves that could affect pressurization of the accumulators.

For the manual valves listed above administrative controls, procedures, and checklists are employed to assure they are always restored and locked in their correct position for operation. The ECCS design precludes the degradation of more than one train as a result of mispositioning any manual valve. The above design and

administrative provisions are adequate to ensure ECCS valves are maintained in the correct position. 29

INSERT 'A'

; position indication is provided in the control room for each of these AOVs.

INSERT 'B'

The ECCS solenoid-operated valves are listed in the attached Table Q211.29-2; position indication is provided in the control room for each of these SOVs.

ATTACHMENT 1
ST-HL-AE-1439
PAGE 25 OF 28

TABLE Q211.29-1

Air-Operated Valves in the ECCS

Valve No.	FSAR Figure No.	Valve No.	FSAR Figure No.
PV 3976	6.3-4	FY 3962	6.3-3
PV 3979	6.3-4	FY 3963	6.3-3
PV 3982	6.3-4	FY 3964	6.3-3
FY 3950	6.3-1	FY 3965	6.3-4
FY 3951	6.3-1	FY 3966	6.3-4
FY 3952	6.3-1	FY 3967	6.3-4
FY 3953	6.3-1	FY 3968	6.3-4
FY 3954	6.3-1	FY 3969	6.3-4
FY 3955	6.3-2	FY 3970	6.3-4
FY 3956	6.3-2	FY 3971	6.3-4
FY 3957	6.3-2	FY 3972	6.3-4
FY 3958	6.3-2	FY 3973	6.3-4
FY 3959	6.3-2	FY 3974	6.3-4
FY 3960	6.3-3	FY 3975	6.3-4
FY 3961	6.3-3	FV-3936	6.3-1
		FV-3937	6.3-1
		FV-3983	6.3-4
		HCV-864	5.4-6
		HCV-865	5.4-6
		HCV-866	5.4-6
		FCV-851	5.4-6
		FCV-852	5.4-6
		FCV-853	5.4-6

29

TABLE Q211.29-2

SOLENOID-OPERATED VALVES IN THE ECCS

Valve No.	FSAR Figure No.
HCV-900	6.3-4
HV-899	6.3-4
PV-3928	6.3-4
PV-3929	6.3-4
PV-3930	6.3-4

TABLE 7.3-5 (Continued)

SAFETY INJECTION ACTUATED EQUIPMENT LIST

Equipment Identification	Description	ESF Train	Function	Figure Number	P&ID Number
TV-9476	EAB/Control room essential chilled water cooling coils	A	Open	9.4.1-4	9V10002
TV-9486	EAB/Control room essential chilled water cooling coils	B	Open	9.4.1-4	9V10002
TV-9496	EAB/Control room essential chilled water cooling coils	C	Open	9.4.1-4	9V10002
TV-9477	EAB/Control room essential chilled water cooling coils	A	Open	9.4.1-4	9V10002
TV-9487	EAB/Control room essential chilled water cooling coils	B	Open	9.4.1-4	9V10002
TV-9497	EAB/Control room essential chilled water cooling coils	C	Open	9.4.1-4	9V10002
11A	EAB battery room exhaust air fan	A	Start	9.4.1-1	9V25000
11B	EAB battery room exhaust air fan	B	Start	9.4.1-1	9V25000
11C	EAB battery room exhaust air fan	C	Start	9.4.1-1	9V25000
CC0643	CCW heat exchanger throttle valve	A	Open	9.2.2-1	9F05017
CC0645	CCW heat exchanger throttle valve	B	Open	9.2.2-2	9F05018
CC0647	CCW heat exchanger throttle valve	C	Open	9.2.2-3	9F05019
CC0642	CCW heat exchanger bypass valve	A	Close	9.2.2-1	9F05017
CC0644	CCW heat exchanger bypass valve	B	Close	9.2.2-2	9F05018
CC0646	CCW heat exchanger bypass valve	C	Close	9.2.2-3	9F05019
FV-4531	CCW discharge from RHR HX valve	A	Open	9.2.2-1	9F05017
FV-4548	CCW discharge from RHR HX valve	B	Open	9.2.2-2	9F05018
FV-4565	CCW discharge from RHR HX valve	C	Open	9.2.2-3	9F05019
SI0014A	LHSI pump recirculation valve	A	Open	6.3-1	9F05013
SI0014B	LHSI pump recirculation valve	B	Open	6.3-2	9F05014
SI0014C	LHSI pump recirculation valve	C	Open	6.3-3	9F05015

43

TABLE 7.3-5 (Continued)

SAFETY INJECTION ACTUATED EQUIPMENT LIST

Equipment Identification	Description	ESF Train	Function	Figure Number	P&ID Number
SI0011A	HHSI pump recirculation valve	A	Open	6.3-1	9F05013
SI0011B	HHSI pump recirculation valve	B	Open	6.3-2	9F05014
SI0011C	HHSI pump recirculation valve	C	Open	6.3-3	9F05015
FV-7659	Reactor makeup water non-essential services isolation valve	C	Close		9F05033
FV-7663	Reactor makeup water non-essential services isolation valve	B	Close		9F05033
Group 1A	Pressurizer backup heater	A	Off	-	--
Group 1B	Pressurizer backup heater	C	Off	-	--
-	ECW intake structure shunt trip space heater panel breaker	A	Trip	-	--
-	ECW intake structure shunt trip space heater panel breaker	B	Trip	--	--
-	ECW intake structure shunt trip space heater panel breaker	C	Trip	--	--
-	EAB shunt trip space heater panel breaker	A	Trip	--	--
-	EAB shunt trip space heater panel breaker	B	Trip	--	--
-	EAB shunt trip space heater panel breaker	C	Trip	--	--
-	Control room and EAB HVAC outside reheat coil breaker	A	Trip	9.4.1-2	9V25003

43

ATTACHMENT 1
ST-HL-AE-1439
PAGE 28 OF 28