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NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

SHEARON HARRIS

50-400

Editor: Peter Lobner
Author: Stephen Finn

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CAUTION

The information in this report has been developed over an extended period of time based on a site visit, the Final Safety Analysis Report, system and layout drawings, and other published information. To the best of our knowledge, it accurately reflects the plant configuration at the time the information was obtained, however, the information in this document has not been independently verified by the licensee or the NRC.

NOTICE

This sourcebook will be periodically updated with new and/or replacement pages as appropriate to incorporate additional information on this reactor plant. Technical errors in this report should be brought to the attention of the following:

Mr. Mark Rubin
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Engineering and Systems Technology
Mail stop 7E4
Washington, D.C. 20555

With copy to:

Mr. Peter Lobner
Manager, Systems Engineering Division
Science Applications International Corporation
10210 Campus Point Drive
San Diego, CA 92131
(619) 458-2673

Correction and other recommended changes should be submitted in the form of marked up copies of the affected text, tables or figures. Supporting documentation should be included if possible.

SHEARON HARRIS
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	11/89	Original report

SHEARON HARRIS SYSTEM SOURCEBOOK

This sourcebook contains summary information on the Shearon Harris nuclear power plant. Summary data on this plant are presented in Section 1, and similar nuclear power plants are identified in Section 2. Information on selected reactor plant systems is presented in Section 3, and the site and building layout is illustrated in Section 4. A bibliography of reports that describe features of this plant or site is presented in Section 5. Symbols used in the system and layout drawings are defined in Appendix A. Terms used in data tables are defined in Appendix B.

1. SUMMARY DATA ON PLANT

Basic information on the Shearon Harris nuclear power plant is listed below:

- Docket number	50-400
- Operator	Carolina Power and Light Company
- Location	New Hill, NC
- Commercial operation date	5/87
- Reactor type	PWR
- NSSS vendor	Westinghouse
- Number of loops	3
- Power (MWt/MWe)	2775/860
- Architect-engineer	Ebasco
- Containment type	Reinforced concrete cylinder with steel liner

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

Shearon Harris utilizes a Westinghouse PWR three-loop nuclear steam supply system (NSSS). Other three-loop Westinghouse plants in the United States include:

- Beaver Valley 1 and 2
- Farley 1 and 2
- North Anna 1 and 2
- H. B. Robinson 2
- San Onofre 1
- Virgil C. Summer 1
- Surry 1 and 2
- Turkey Point 3 and 4

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at Shearon Harris in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at Shearon Harris is presented in Table 3-1. In the "Report Section" column of this table, a section reference (i.e. 3.1, 3.2, etc.) is provided for all systems that are described in this report. An entry of "X" in this column means that the system is not described in this report. In the "FSAR Section Reference" column, a cross-reference is provided to the section of the Final Safety Analysis Report where additional information on each system can be found. Other sources of information on this plant are identified in the bibliography in Section 5.

Several cooling water systems are identified in Table 3-1. The functional relationships that exist among cooling water systems required for safe shutdown are shown in Figure 3-1. Details on the individual cooling water systems are provided in the report sections identified in Table 3-1.

Table 3-1. Summary of Shearon Harris Systems Covered in this Report

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor Heat Removal Systems			
- Reactor Coolant System (RCS)	Same	3.1	5
- Auxiliary Feedwater (AFW) and Secondary Steam Relief (SSR) Systems	Same	3.2	7.4.1, 10.4.9
- Emergency Core Cooling Systems (ECCS)	Same		
- High-Pressure Injection & Recirculation	Safety Injection System, CVCS	3.3	6.3
- Low-pressure Injection & Recirculation	Residual Heat Removal System	3.3	6.3
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Residual Heat Removal (RHR) System	3.3	5.4.7, 6.3
- Main Steam and Power Conversion Systems	Main Steam Supply System	X	10.3
	Condensate and Feedwater System, Circulating Water System		10.4
- Other Heat Removal Systems	None identified	X	
Reactor Coolant Inventory Control Systems			
- Chemical and Volume Control System (CVCS) (Charging System)	Same	3.4	9.3.4
- ECCS	See ECCS, above	-	-

Table 3-1. Summary of Shearon Harris Systems Covered in this Report (Continued)

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Containment Systems			
- Containment	Same	X	6.2.1
- Containment Heat Removal Systems	Post Accident Heat Removal Systems	3.9	6.2.2, 6.5.2
- Containment Spray System	Same	3.9	6.2.2, 6.5.2
- Containment Fan Cooler System	Containment Ventilation System	3.9	6.2.2, 9.4.7
- Containment Normal Ventilation Systems	Containment Penetration Ventilation Subsystem	X	9.4.7
- Combustible Gas Control Systems	Same	X	6.2.5
Reactor and Reactivity Control Systems			
- Reactor Core	Same	X	4.1
- Control Rod System	Control Rod Drive System	X	4.6
- Boration Systems	See CVCS, above	-	-
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Reactor Trip System	3.5	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Same	3.5	7.3
- Remote Shutdown System	Auxiliary Shutdown Panel	3.5	7.4
- Other I&C Systems	Various systems	X	7.5, 7.6, 7.7

Table 3-1. Summary of Shearon Harris Systems Covered in this Report (Continued)

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Support Systems			
- Class 1E Electric Power System	Same	3.6	8.1.3, 8.3.1, 8.3.2
- Non-Class 1E Electric Power System	Same	X	8.1.2, 8.2.1
- Diesel Generator Auxiliary Systems	Same	3.6	9.5.4 thru 9.5.8
- Component Cooling Water (CCW) System	Same	3.7	9.2.2
- Service Water System (SWS)	Essential Water System, Non-essential Service Water System	3.8	9.2.1
- Other Cooling Water Systems	None Identified	-	-
- Fire Protection Systems	Same	X	9.5.1
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Same	X	9.4.1 thru 9.4.8
- Instrument and Service Air Systems	Compressed Air Systems	X	9.3.1
- Refueling and Spent Fuel Systems	Fuel Pool Cooling and Cleanup System, Fuel Handling System	X	9.1.3, 9.1.4
- Radioactive Waste Systems	Radioactive Waste Management Systems	X	11
- Radiation Protection Systems	Same	X	12

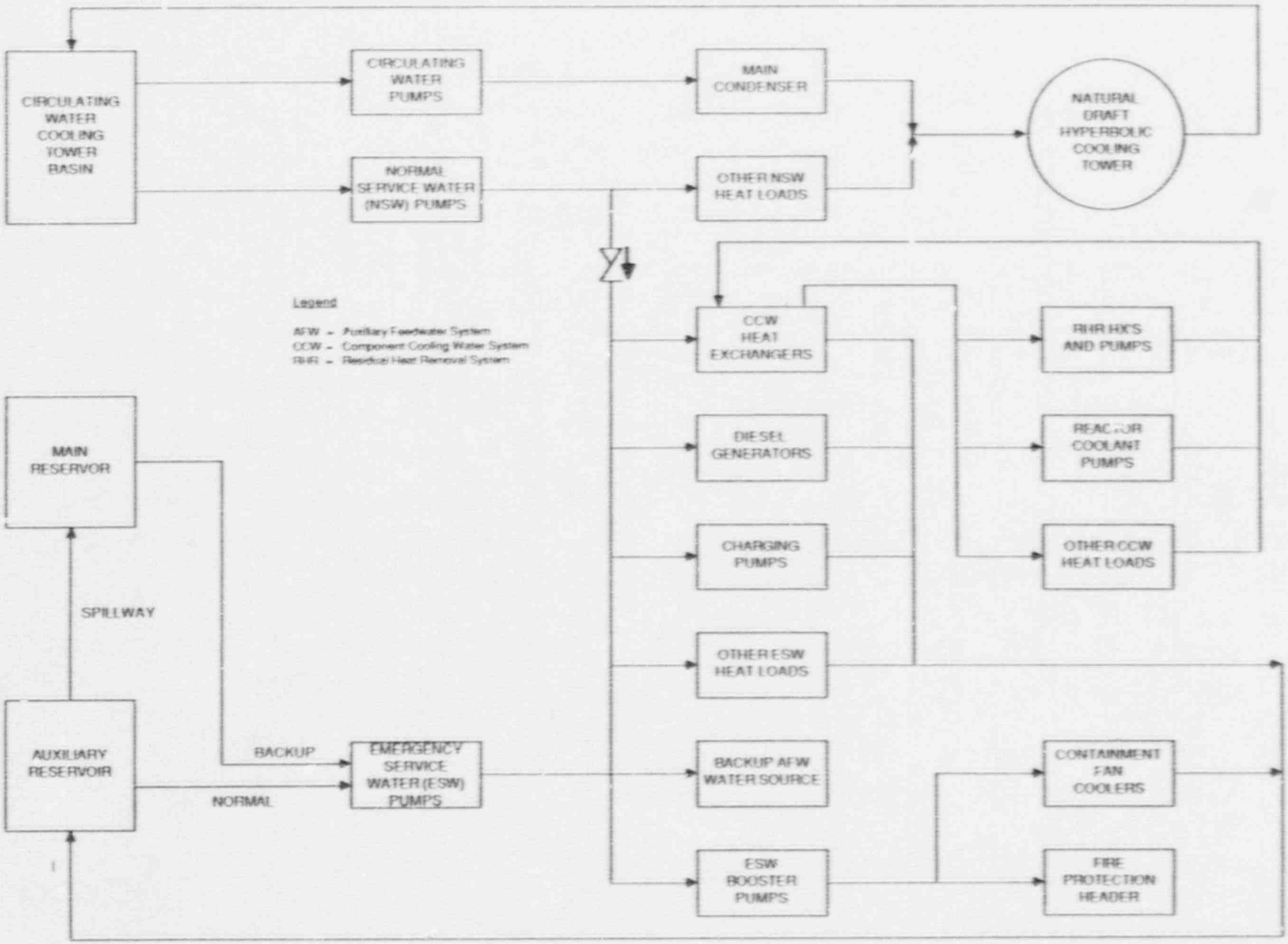


Figure 3-1. Cocling Water Systems Functional Diagram For Shearon Harris

3.1 REACTOR COOLANT SYSTEM (RCS)

3.1.1 System Function

The RCS transfers heat from the reactor core to the secondary coolant system via the steam generators. The RCS pressure boundary also establishes a boundary against the uncontrolled release of radioactive material from the reactor core and primary coolant.

3.1.2 System Definition

The RCS includes: (a) the reactor vessel, (b) four parallel reactor coolant loops, (c) reactor coolant pumps, (d) the primary side of the steam generators (e) a pressurizer, and (f) connected piping out to a suitable isolation valve boundary. Simplified diagrams of the RCS and important system interfaces are shown in Figures 3.1-1 and 3.1-2. A summary of data on selected RCS components is presented in Table 3.1-1.

3.1.3 System Operation

During power operation, circulation in the RCS is maintained by one reactor coolant pump in each of the three reactor coolant loops. RCS pressure is maintained within a prescribed band by the combined action of pressurizer heaters and pressurizer spray. RCS coolant inventory is measured by pressurizer water level which is maintained within a prescribed band by the chemical and volume control system (CVCS).

At power, core heat is transferred to secondary coolant (feedwater) in the steam generators. The heat transfer path to the ultimate heat sink is completed by the main steam and power conversion system and the circulating water system.

Following a transient or small LOCA (if RCS inventory is maintained), reactor core heat is still transferred to secondary coolant in the steam generators. Flow in the RCS is maintained by the reactor coolant pumps or by natural circulation. The heat transfer path to the ultimate heat sink can be established by using the secondary steam relief system to vent main steam to atmosphere when the power conversion and circulating water systems are not available. If reactor core heat removal by this alternate path is not adequate, the RCS pressure will increase and a heat balance will be established in the RCS by venting steam or reactor coolant to the quench tank through the pressurizer relief valves. There are three power-operated relief valves (each in series with a motor-operated block valve) and three safety valves on the pressurizer. A continued inability to establish adequate heat transfer to the steam generators will result in a LOCA-like condition (i.e., continuing loss of reactor coolant through the pressurizer relief valves). Repeated cycling of these relief valves has resulted in valve failure (i.e., relief valve stuck open).

Following a large LOCA, reactor core heat is dumped to the containment as reactor coolant and ECCS makeup water spills from the break. For a short period, the containment can act as a heat sink; however, the containment cooling systems must operate in order to complete a heat transfer path to the ultimate heat sink.

3.1.4 System Success Criteria

The RCS "success" criteria can be represented in terms of LOCA and transient mitigation, as follows:

- An unmitigatable LOCA is not initiated.
- If a mitigatable LOCA is initiated, then LOCA mitigating systems are successful.
- If a transient is initiated, then either:
  - RCS integrity is maintained and transient mitigating systems are successful, or

- RCS integrity is not maintained, leading to a LOCA-like condition (i.e. stuck-open safety or relief valve, reactor coolant pump seal failure), and LOCA mitigating systems are successful.

3.1.5 Component Information

A. RCS
1. Total system volume, including pressurizer: 9375 ft^3
2. Normal operating pressure: 2235 psig

B. Pressurizer
1. Water volume, full power: 840 ft^3
2. Steam volume, full power: 560 ft^3

C. Reactor Coolant Pumps (3)
1. Rated flow: 103,000 gpm @ 277 ft. head (120 psid)
2. Type: Vertical single-stage centrifugal

D. Power-Operated Relief Valves (3)
1. Set pressure: 2335 psig
2. Relief capacity: 210,000 lb/hr (each)

E. Safety Valves (3)
1. Set pressure: 2485 psig
2. Relief capacity: 380,000 lb/hr (each)

F. Steam Generators (3)
1. Type: Vertical shell and U-Tube
2. Heat Transfer Rate: unknown

3.1.6 Support Systems and Interfaces

A. Motive Power
1. The reactor coolant pumps are supplied from Non-Class 1E switchgear.
2. The pressurizer heaters are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.6.

B. Reactor Coolant Pump Seal Injection Water System
The chemical and volume control system supplies seal water to cool the reactor coolant pump shaft seals and to maintain a controlled in leakage of seal water into the RCS. Loss of seal water flow may result in RCS leakage through the pump shaft seals which will resemble a small LOCA. If loss of seal injection flow should occur, the thermal barrier heat exchanger, which is cooled by the component cooling water system, cools the reactor coolant to an acceptable level before it enters the pump bearing and seal area (Ref. 1).

3.1.7 Section 3.1 References

1. Shearon Harris FSAR, Section 5.4.1.2.2.

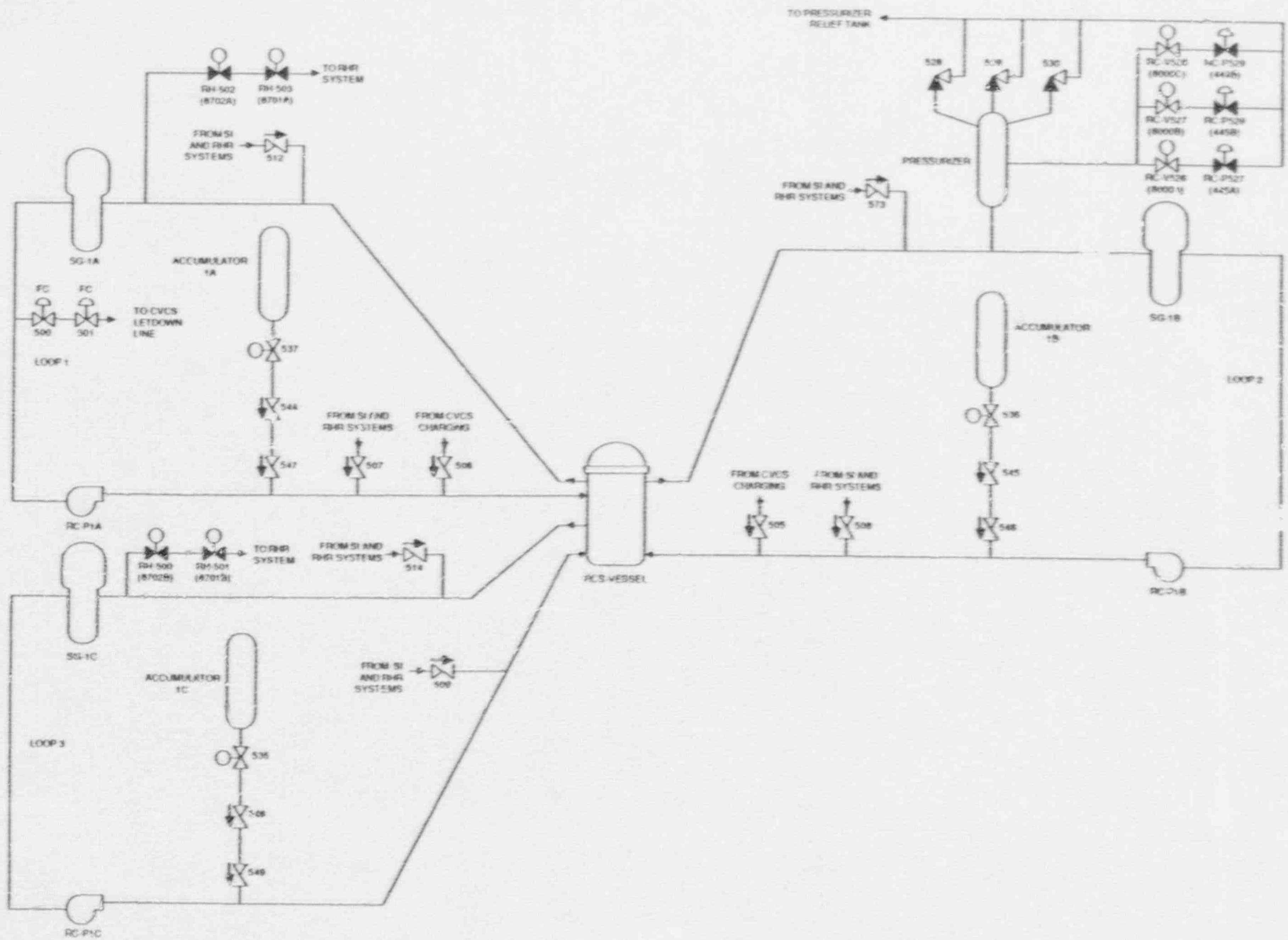


Figure 3.1-1. Shearon Harris Reactor Coolant System

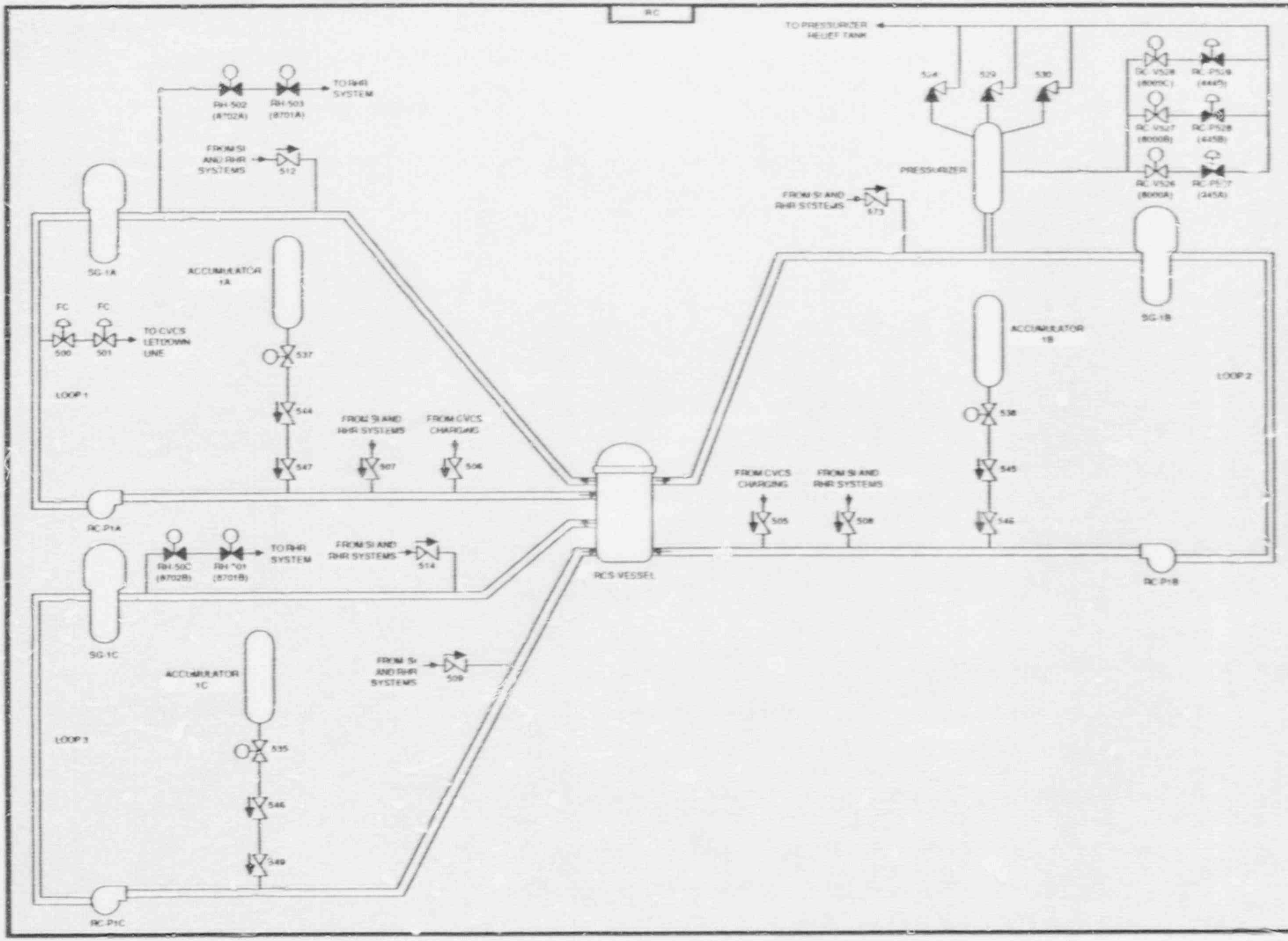


Figure 3.1-2. Shearon Harris Reactor Coolant System Showing Component Locations

Table 3.1-1. Shearon Harris Reactor Coolant System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
PNL-A	PNL	261PENA	BUS-1A1	480	UNK-1A1	AC/A
PNL-B	PNL	261PENB	BUS-1B1	480	UNK-1B1	AC/B
RC-500(8702B)	MOV	RC	MCC-1B21	480	286MCB	AC/B
RC-501(8701B)	MOV	RC	MCC-1A21	480	286MCA	AC/A
RC-502(8702A)	MOV	RC	MCC-1B21	480	286MCB	AC/B
RC-P527 (44[illegible])	NV	RC				
RC-P528 (445B)	NV	RC				
RC-P529 (444B)	NV	RC				
RC-V526 (8000A)	MOV	RC	MCC-1B24	480	261PENB	AC/B
RC-V527 (8000B)	MOV	RC	MCC-1B24	480	261PENB	AC/B
RC-V528 (8000C)	MOV	RC	MCC-1A24	480	261PENA	AC/A
RH-503(8701A)	MOV	RC	MCC-1A21	480	286MCA	AC/A

3.2 AUXILIARY FEEDWATER SYSTEM (AFS) AND SECONDARY STEAM RELIEF SYSTEM (SSRS)

3.2.1 System Function

The AFS provides a source of feedwater to the steam generators to remove heat from the reactor coolant system (RCS) when: (a) the main feedwater system is not available, and (b) RCS pressure is too high to permit heat removal by the residual heat removal (RHR) system. The Secondary Steam Relief System (SSRS) provides a steam vent path from the steam generators to the atmosphere, thereby completing the heat transfer path to an ultimate heat sink when the main steam and power conversion systems are not available. Together the AFS and SSRS constitute an open-loop fluid system that provides for heat transfer from the RCS following transients and small-break LOCAs.

3.2.2 System Definition

The AFS consists of two motor-driven pumps and one turbine-driven pump. All three pumps can deliver feedwater to all three steam generators. Motor-driven pump 1A is normally aligned to supply feedwater to steam generator 1A, and motor-driven pump 1B is normally aligned to supply steam generator 1B. However, both pumps can be aligned to supply lines to all three steam generators. Each of these lines contains check valves, motor-operated isolation valves, flow control valves, and recirculation (bypass) valves. The turbine-driven pump supplies three additional lines, one for each steam generator. The turbine-driven pump can be supplied with steam for motive power from either steam line B or C.

The water supply for the pumps is the condensate storage tank (CST). As a backup, the service water system can supply water to the AFS pumps suction.

The SSRS consists of five safety valves and one hydraulically operated atmospheric dump valve on each of the three main steam lines.

Simplified drawings of the AFS and the SSRS are shown in Figures 3.2-1 and 3.2-2. A summary of data on selected AFS components is presented in Table 3.2-1.

3.2.3 System Operation

During normal operation the AFS is in standby. The motor-driven pumps are started on either a safety injection signal, a low-low level in any steam generator, loss of both main feedwater pumps, or a loss of offsite power. The turbine-driven pump will start on either a low-low level in any two steam generators or a loss of offsite power. The AFS can also be started or shutdown remote manually from the Main Control Board (MCB) and from the Auxiliary Control Panel (ACP).

Suction to the pumps is normally provided by the CST, with the service water system as a back-up. The capacity of the CST is 415,000 gallons, with a minimum of 252,000 gallons reserved for AFS use. Makeup to the CST is provided by the demineralized water system. When the CST is depleted, switchover to the service water system is performed manually from the main control board or the auxiliary control board.

The flow rate to each steam generator can be controlled remote manually from the MCB or ACP by modulating the appropriate flow control valve in the supply line and by isolating the recirculation line (for the motor-driven pumps). The turbine-driven pump is capable of supplying 900 gpm to the steam generators. The two motor-driven pumps each have a design capacity of 450 gpm, but can provide more than 475 gpm with their recirculation lines open. Should one of the two motor-driven pumps be unavailable, the motor-operated valve on the recirculation line of the other motor-driven pump will close automatically to provide approximately 490 gpm to the steam generators at the setpoint pressure.

Steam for the AFS turbine-driven pump is supplied from steam lines B and C, upstream of the main steam isolation valves. The turbine steam supply valves are DC-powered. The steam supply valves are normally closed and receive a signal to open at the same time that the turbine pump actuation signal is initiated.

3.2.4 System Success Criteria

For the decay heat removal function to be successful, both the AFS and the SSRS must operate successfully. The AFS success criteria are the following:

- The turbine driven pump or either of the motor driven pumps can provide adequate flow to the steam generators.
- The condensate storage tank or the service water system is an adequate source of water for the AFS pumps.
- Flow to 2 of 3 steam generators is required (Ref. 1).

3.2.5 Component Information

A. Motor-driven AFS pumps 1A, 1B
   1. Rated flow: 450 gpm @ 2917 ft. head (1265 psid)
   2. Rated capacity: 100%
   3. Type: Horizontal centrifugal

B. Turbine-driven AFS pump 1X
   1. Rated flow: 900 gpm @ 2917 ft. head (1265 psid)
   2. Rated capacity: greater than 100%
   3. Type: Horizontal centrifugal

C. Condensate Storage Tank
   1. Capacity: 415,000 gallons
   2. Reserved for AFS use: 252,000 gallons

3.2.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The AFS motor-driven pumps are automatically actuated on either a safely injection signal, a low-low level in any steam generator, loss of both main feedwater pumps, or a loss of offsite power. The AFS turbine-driven pump is automatically actuated on either a low-low level in any two steam generators or a loss of offsite power.
   2. Remote manual
      The AFS can be operated from the main control board and from the auxiliary control panel.

B. Motive Power
   1. The motor driven AFS pumps and motor operated valves are Class 1E loads that can be supplied from the standby diesel generators as described in Section 3.6.

2. The turbine-driven pump is supplied with steam from the main steam lines of either steam generator B or C upstream of the main steam line isolation valves. The power and controls for the steam supply valves are supplied from the Class 1E DC system.

C. Other
1. Lubrication and cooling are assumed to be provided locally for the AFS pumps.
2. Systems for AFS pump room cooling have not been identified.

3.2.7 Section 3.2 References

1. Fresco, A., Youngblood, R., and Papazoglou, I. A., "Review of the Shearon Harris Unit 1 Auxiliary Feedwater System Reliability Analysis", NUREG/CR-4311, Brookhaven National Laboratory, February 1986.

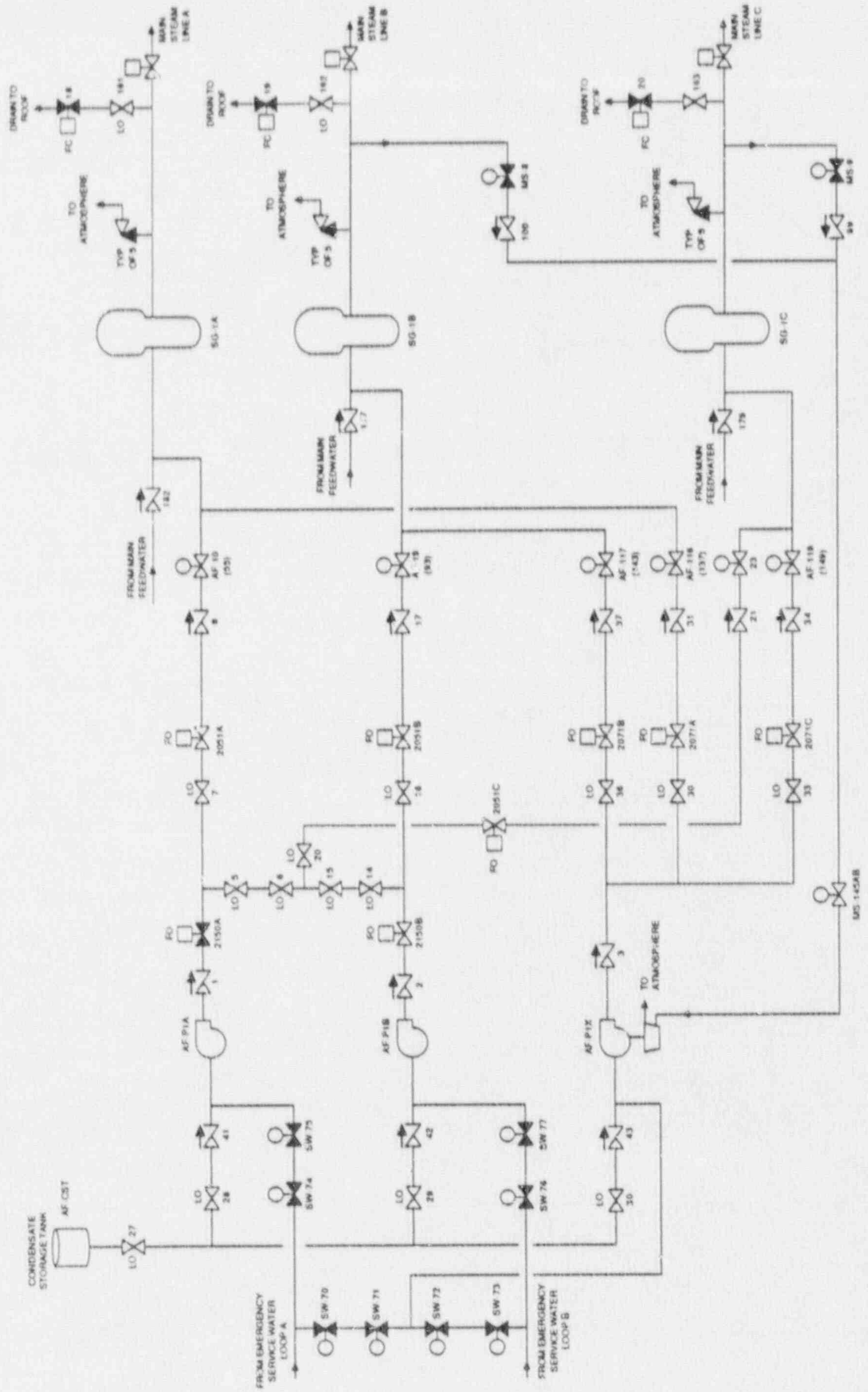


Figure 3.2-1. Shearon Harris Auxiliary Feedwater System

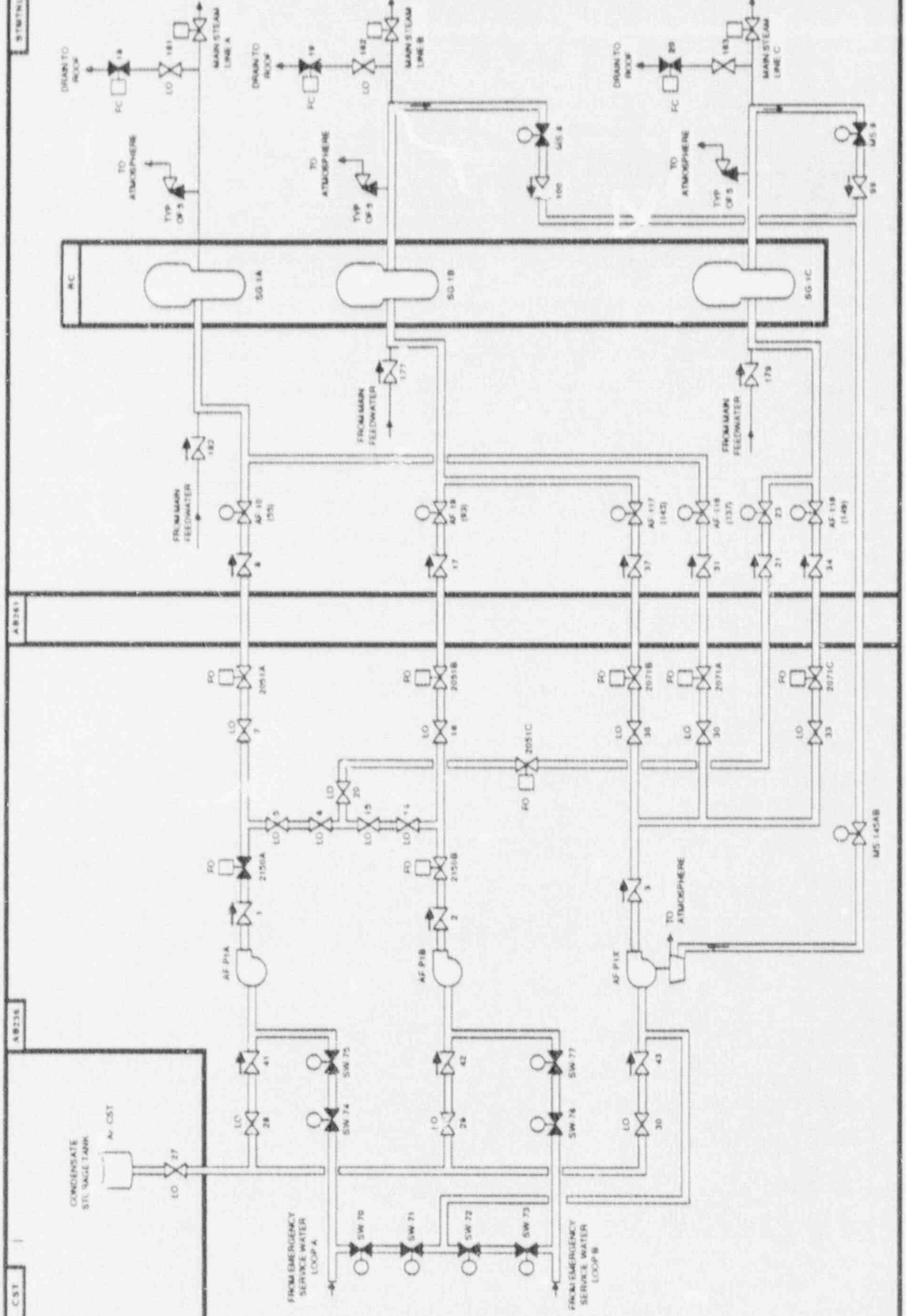


Figure 3.2-2. Shearon Harris Auxiliary Feedwater System Showing Component Locations

Table 3.2-1. Shearon Harris Auxiliary Feedwater System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
AF-10 (55)	MOV	STMTNL	UNKNOWN			
AF-116 (137)	MOV	STMTNL	MCC-1A2	125	286MCA	DC/A
AF-117 (143)	MOV	STMTNL	MCC-1A2	125	286MCA	DC/A
AF-118 (149)	MOV	STMTNL	MCC-1A2	125	286MCA	DC/A
AF-19 (93)	MOV	STMTNL	MCC-1B31	480	286MCB	AC/B
AF-CST	TANK	CST				
AF-P1A	MDP	AB236	BUS-1A	6900	SGRMA	AC/A
AF-P1B	MDP	AB236	BUS-1B	6900	SGRMB	AC/B
AF-P1X	TDP	AB236				
MS-145AB	MOV	AB236	UNKNOWN			
MS-8	MOV	STMTNL	MCC-1A2	125	286MCA	DC/A
MS-9	MOV	STMTNL	MCC-1B2	125	286MCB	DC/B

3.3 EMERGENCY CORE COOLING SYSTEM (ECCS)

3.3.1 System Function

The ECCS, or Safety Injection System (SIS), is an integrated set of subsystems that perform emergency coolant injection and recirculation functions to maintain reactor core coolant inventory and adequate decay heat removal following a LOCA. The coolant injection function is performed during a relatively short-term period after LOCA initiation, followed by realignment to a recirculation mode of operation to maintain long-term, post-LOCA core cooling. Heat from the reactor core is transferred to the containment. The heat transfer path to the ultimate heat sink is completed by the containment heat removal systems.

3.3.2 System Definition

The emergency coolant injection (ECI) function is performed by the following subsystems:

- Accumulators
- Safety Injection System (charging system, see also Section 3.4)
- Residual Heat Removal System

There are three accumulators, one attached to each cold leg, that discharge their contents when RCS pressure drops below the tank pressure. The safety injection system utilizes the three centrifugal charging pumps of the charging system (CVCS). There are no separate high pressure injection pumps. The charging pumps feed a common header which injects directly into the RCS cold legs and hot legs and another header which injects via the boron injection tank. The charging pumps can also inject into the RCS through the normal charging path via the regenerative heat exchanger. The RHR system consists of two motor driven pumps that deliver water to the three cold legs and to two hot legs. During the recirculation phase the RHR pumps can also deliver water from the containment sumps directly to the RCS for low-pressure recirculation, or to the suctions of the charging pumps for high-pressure recirculation. The RHR pumps also provide the shutdown cooling function. The Refueling Water Storage Tank (RWST) is the water source for the ECCS pumps during the injection phase. During recirculation the RHR pumps take suction on the containment sump.

Simplified drawings of the safety injection system are shown in Figures 3.3-1 and 3.3-2. The RHR system is shown in Figures 3.3-3 and 3.3-4. The charging system is discussed in Section 3.4. A summary of data on charging system components also is presented in Section 3.4.

3.3.3 System Operation

During normal operation, the ECCS is in standby. The ECCS pumps are automatically actuated by a Safety Injection Signal, which is generated on any of the following conditions:

- Low pressurizer pressure
- High differential steam line pressure
- High steam line flow in coincidence with either low T_{avg} or low steam line pressure
- High containment pressure
- Manual actuation

The accumulators constitute a passive injection system, discharging their contents automatically when RCS pressure drops below the tank pressure. Sufficient borated water is supplied in the three tanks to rapidly fill the volume outside of the core barrel below the nozzles, the bottom plenum, and a portion of the core with the contents of one tank assumed to be lost through the break. During injection, the charging and RHR pumps take suction on the RWST and deliver borated water to the three cold legs. The relative importance of the charging pumps is increased for small breaks when the RCS is still at high pressure, while the RHR pumps are important in responding to large breaks.

When the RWST reaches a low level alarm setpoint, the recirculation phase is initiated. This phase of operation has two modes, cold leg recirculation and hot leg recirculation. In both modes the RHR pumps take suction on their respective containment sump, and deliver water through the RHR heat exchangers directly to the RCS and to the suction of the charging pumps. Initially, the discharge of charging and RHR pumps flows to the same cold leg injection points used during the injection phase. Later, pumps are realigned for hot leg injection. The switch to hot leg recirculation is made in order that subcooling of the core may be completed.

3.3.4 System Success Criteria

The success criteria for the ECCS is not clearly defined in the Shearon Harris FSAR (Ref. 1). LOCA mitigation requires both the emergency coolant injection (ECI) and emergency coolant recirculation (ECR) functions. The three accumulators, three centrifugal charging pumps, and two residual heat removal pumps are all utilized to respond to both large and small LOCAs, with the accumulators and RHR pumps more important for large LOCAs and the charging pumps more important for small LOCAs. The ECCS is designed to be successful with a single active failure and one RCS loop assumed to be out of service due to the break.

The RWST is required for system success during the injection phase. The containment sump and one of two RHR pumps is required for system success during the recirculation phase.

3.3.5 Component Information

A. Centrifugal charging pumps P1, P2, P3
   1. Rated flow: 150 gpm @ 5800 ft. head (2515 psid)
   2. Maximum flow: 650 gpm @ 3100 ft. head (1344 psid)
   3. Type: Horizontal centrifugal

B. Residual Heat Removal pumps 1A, 1B
   1. Rated flow: 3750 gpm @ 240 ft. head (104 psid)
   2. Type: Vertical centrifugal

C. Accumulators (3)
   1. Volume, Total: 1450 ft^3
   2. Normal operating water volume: 1025 ft^3
   3. Normal operating pressure: 660 psig

D. Refueling Water Storage Tank
   1. Capacity: 432,727 gallons
   2. Operating pressure: atmospheric

E. RHR Heat Exchangers (2)
   1. Type: Vertical shell and U-tube
   2. Heat removal capacity: 30.3×10^6 Btu/hr

3.3.6 Support Systems and Interfaces

A. Control Signals

1. Automatic

The ECCS subsystems are automatically actuated on a safety injection signal, which is generated on any of the following conditions.

- Low pressurizer pressure
- High differential pressure between any two steam lines
- High steam flow in two of four lines in coincidence with either low T_{avg} or low steam line pressure
- High containment pressure
- Manual actuation

The safety injection signal automatically initiates the following actions:

- reactor trip
- starts the diesel generators
- starts the charging and RHR pumps
- opens the boron injection tank isolation valves and charging pump RWST suction valves

Switchover from the injection mode to recirculation is initiated on two out of four RWST low level signals in conjunction with a safety injection signal. This causes the suction valves from the containment sump to open. Operator action is required to complete the switchover.

2. Remote manual

A safety injection signal can be initiated by remote manual means from the control room. ECCS operation can be initiated by remote manual means.

B. Motive Power

All ECCS motor driven pumps and motor operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.6.

C. Other

1. Cooling water for the charging pumps is provided by the Service Water System (see Section 3.8).
2. Cooling water for the RHR pumps and heat exchangers is provided by the Component Cooling Water System (see Section 3.7).
3. Systems for ECCS pump room cooling have not been identified.

3.3.7 Section 3.3 References

1. Shearon Harris Final Safety Analysis Report, Section 6.3.

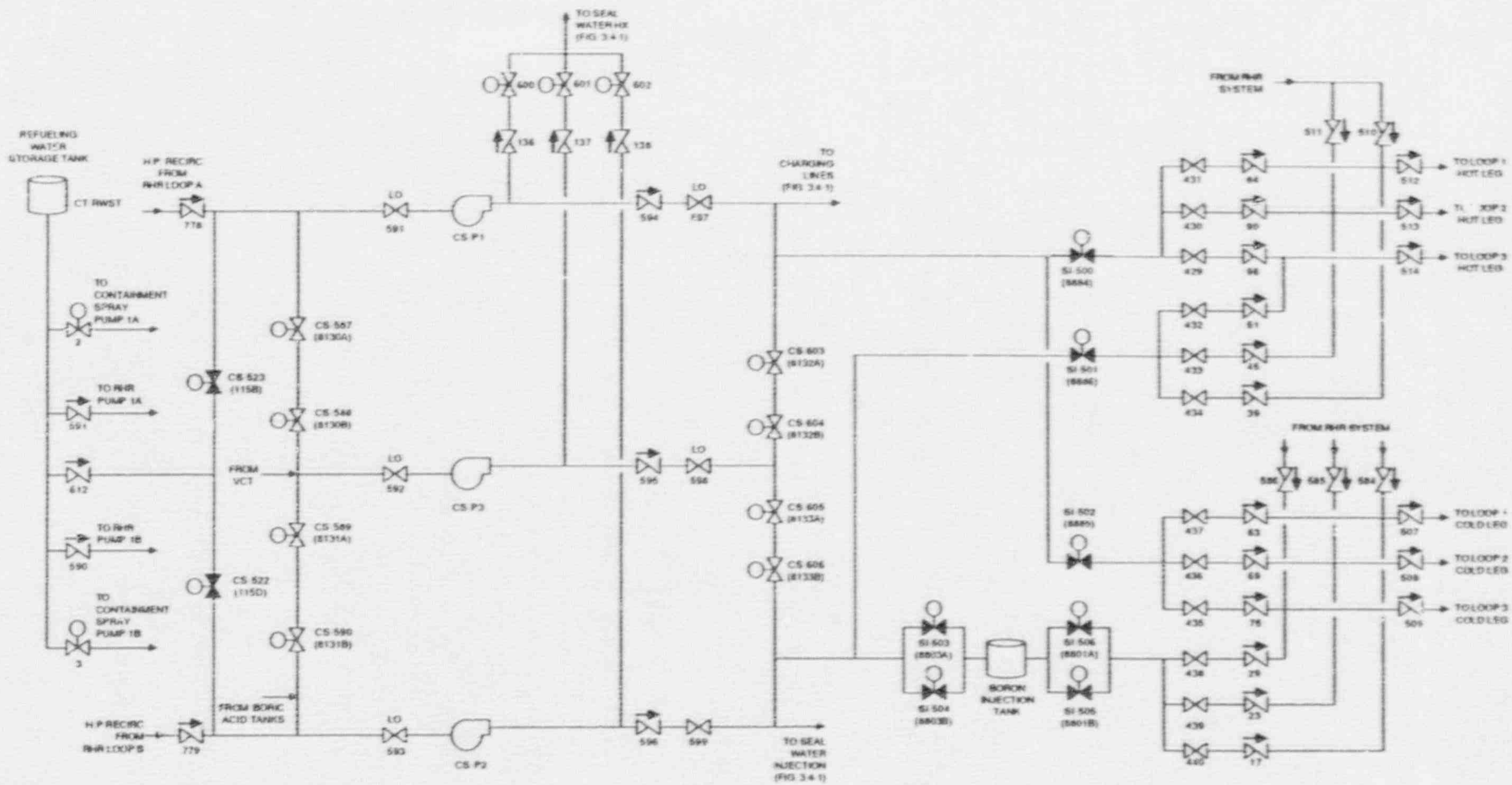


Figure 3.3-1. Shearon Harris Charging System (Safety Injection Mode)

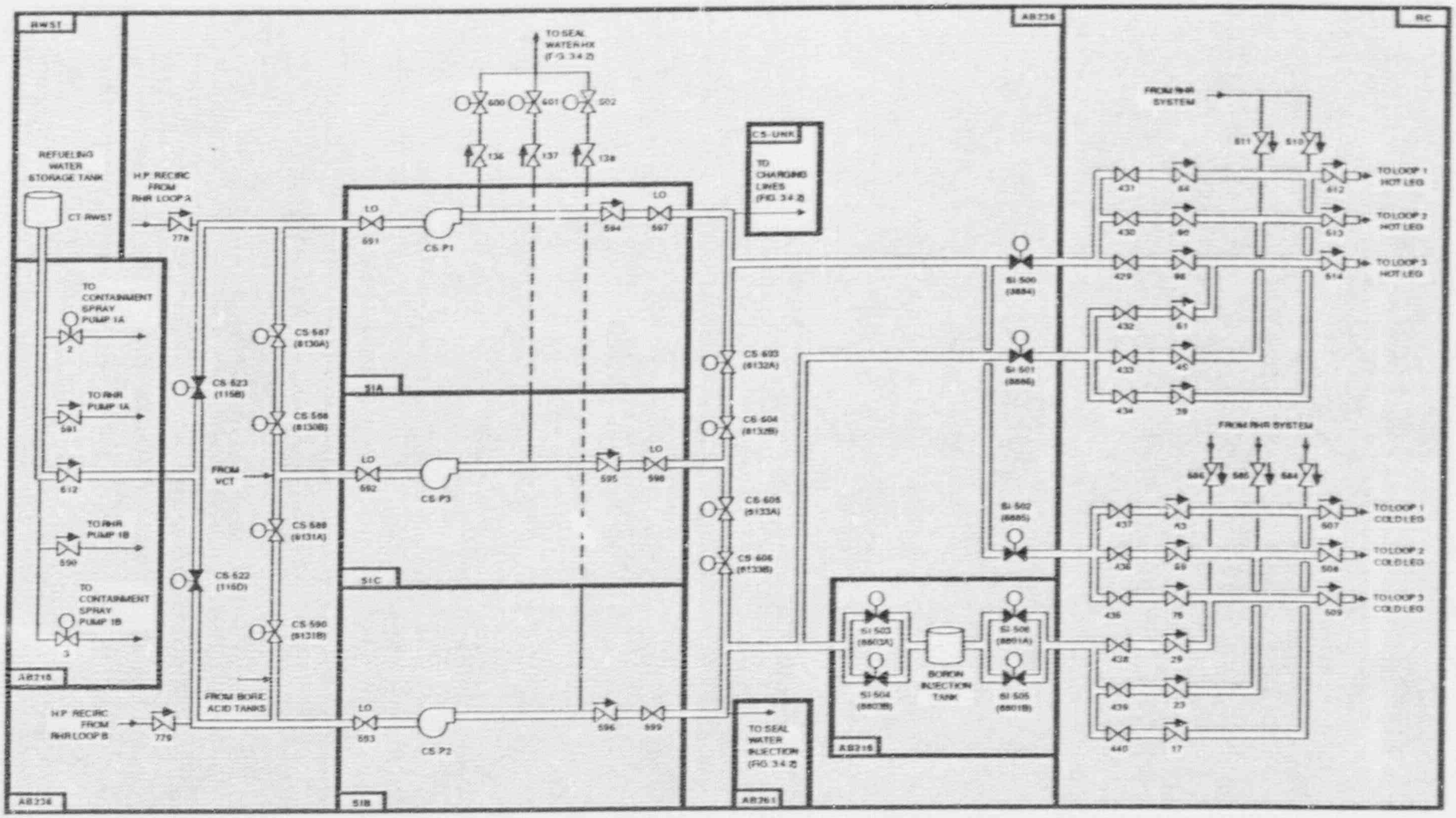


Figure 3.3-2. Shearon Harris Charging System (Safety Injection Mode) Showing Component Locations

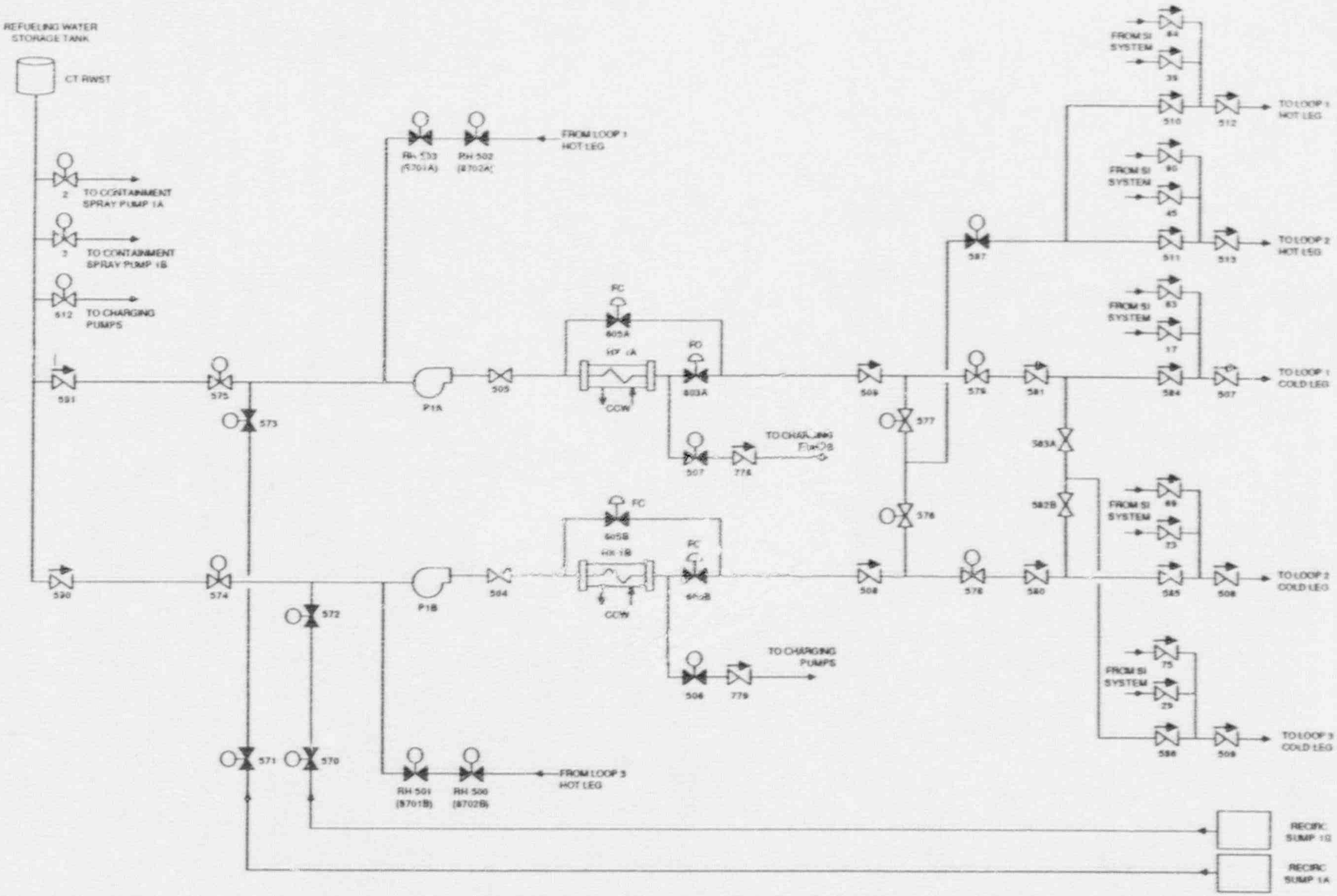


Figure 3.3-3. Shearon Harris Residual Heat Removal System

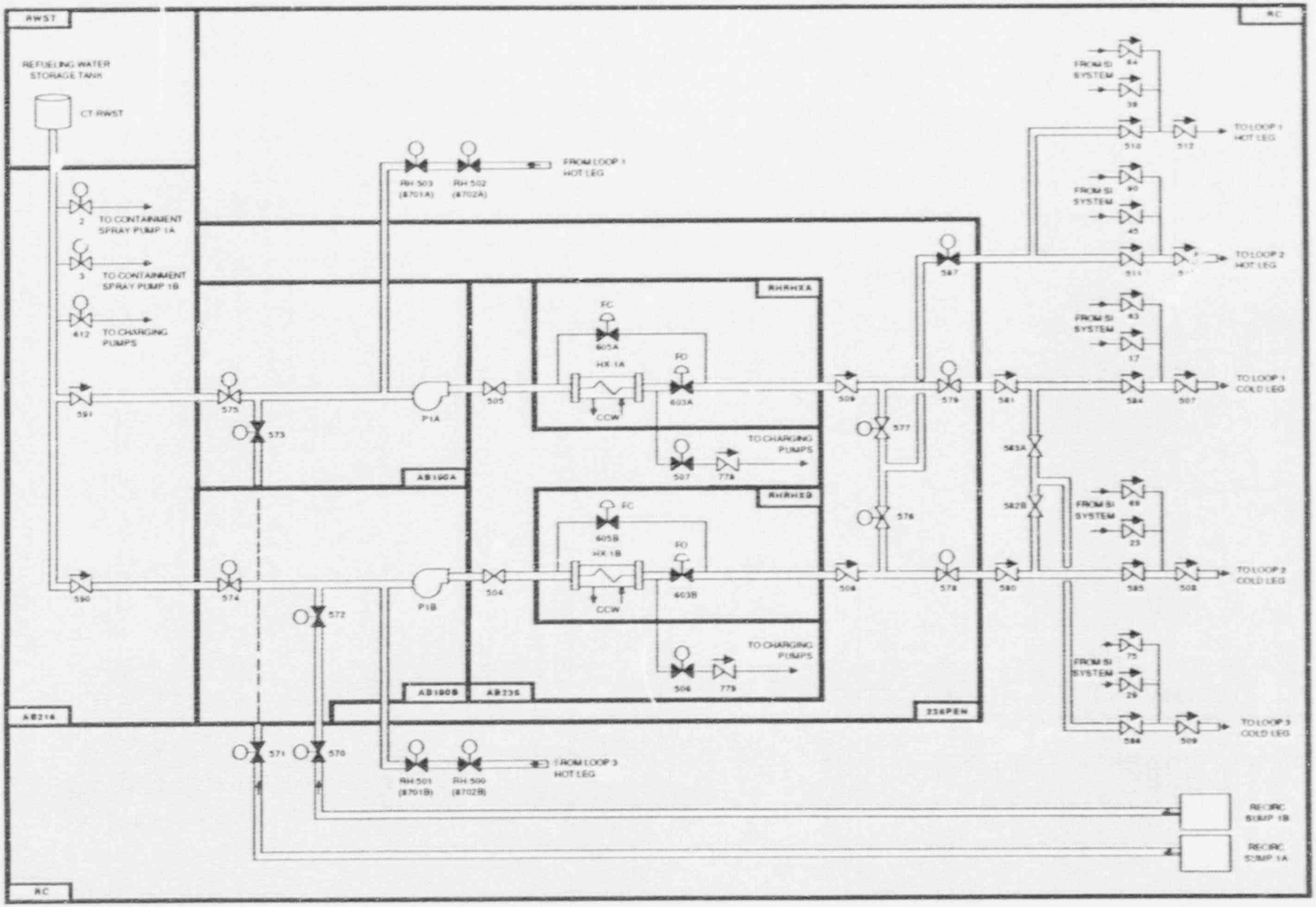


Figure 3.3-4. Shearon Harris Residual Heat Removal System Showing Component Locations

3.4 CHEMICAL AND VOLUME CONTROL SYSTEM (CVCS)

3.4.1 System Function

The CVCS is responsible for maintaining the proper water inventory in the Reactor Coolant System, providing required seal water flow to the reactor coolant pump seals, and maintaining water purity and the proper concentration of neutron absorbing and corrosion inhibiting chemicals in the reactor coolant. The centrifugal charging pumps perform as part of the emergency core cooling system (ECCS, see Section 3.3) and provide injection flow to the RCS following a LOCA. The makeup function of the CVCS (charging system) is required to maintain the plant in an extended hot shutdown condition following a transient.

3.4.2 System Definition

The CVCS consists of several subsystems that perform the functions of maintaining RCS coolant inventory control, coolant chemistry and purity control, and reactivity control. The charging system consists of three centrifugal charging pumps that, during normal operation, take suction from the volume control tank (VCT) and inject into the RCS. The normal charging path is through the regenerative heat exchanger. The charging pumps also provide the high pressure safety injection function, as described in Section 3.3. In this mode the charging pumps are aligned to take suction from the refueling water storage tank (RWST) and inject either through the boron injection tank or via direct paths into the RCS following a LOCA.

A portion of the charging flow is directed to the reactor coolant pumps through a seal water injection filter.

Simplified drawings of the CVCS are shown in Figures 3.4-1 and 3.4-2. A summary of data on selected CVCS components is presented in Table 3.4-1.

3.4.3 System Operation

During normal operation, a side-stream of reactor coolant flows through the letdown line to the purification system and is returned to the RCS by a single normally-operating charging pump. Letdown flow from RCS loop 1 cold leg passes through the shell side of the regenerative heat exchanger for an initial temperature reduction. The pressure is then reduced by a letdown orifice. The cooled, low pressure water then undergoes a second temperature reduction in the tube side of the letdown heat exchanger, followed by a second pressure reduction by the low pressure letdown valve. Flow is then directed through various filters and ion exchangers before being sprayed into the volume control tank where it is returned to the RCS by the charging pumps.

The charging flow passes through the tube side of the regenerative heat exchanger for recovery of heat from the letdown flow before being returned to the RCS. Charging flow is split into two charging lines, to cold legs 1 and 2. A portion of the charging flow is filtered and injected into the reactor coolant pump seals (nominally 8 gpm per pump).

The centrifugal charging pumps serve as high-head safety injection pumps in the ECCS following a LOCA. Other than the charging pumps and associated piping and valves, the CVCS is not required to operate during a LOCA. During a LOCA, the CVCS is isolated except for the charging pumps and the piping in the safety injection path and the reactor coolant pump seal injection path.

3.4.4 System Success Criteria

The following success criterion is assumed for CVCS makeup following a transient:

- 1 of 3 charging pumps taking suction on the RWST is required for adequate post-transient makeup to the RCS.

The following success criterion is assumed for reactor coolant pump seal injection:

- 1 of 3 charging pumps taking suction on either the VCT or RWST and providing seal injection flow to all three reactor coolant pump seals.

The charging pump success criteria for LOCA mitigation is discussed with the ECCS in Section 3.3.

3.4.5 Component Information

A. Centrifugal charging pumps P1, P2, P3
   1. Rated flow: 150 gpm @ 5800 ft. head (2515 psid)
   2. Maximum flow: 650 gpm @ 3100 ft. head (1344 psid)
   3. Type: Horizontal centrifugal

B. Refueling Water Storage Tank
   1. Capacity: 432,727 gallons
   2. Operating pressure: atmospheric

C. Volume control tank
   1. Volume: 300 ft^3
   2. Design pressure: 75 psig

3.4.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      a. During normal operation, CVCS letdown flow and RCS makeup flow are modulated by the pressurizer level control system.
      b. A safety injection signal automatically starts all 3 charging pumps, causes pump suction to change from the VCT to the RWST, and opens the boron injection tank isolation valves.
   2. Remote manual
      The charging pumps and associated motor operated valves can be actuated by remote means from the control room.

B. Motive Power
   The charging pumps and motor operated valves of the CVCS are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.6.

C. Other
   1. Cooling water for the charging pumps is provided by the service water system (see Section 3.8)
   2. Charging pump room cooling systems have not been identified.
   3. Charging pump lubrication is assumed to be provided locally.

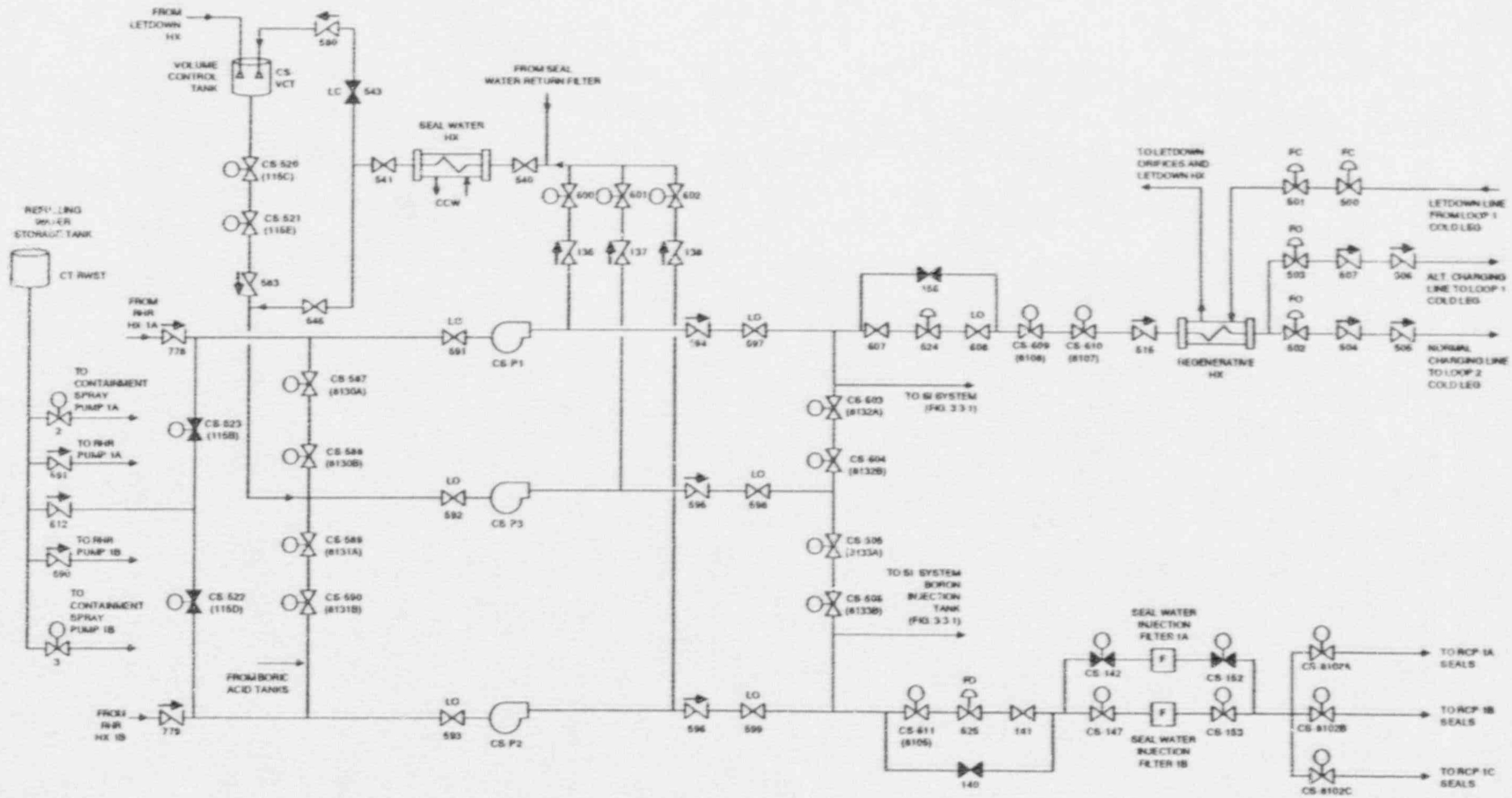


Figure 3.4-1. Shearon Harris Charging System (Normal Charging Mode)

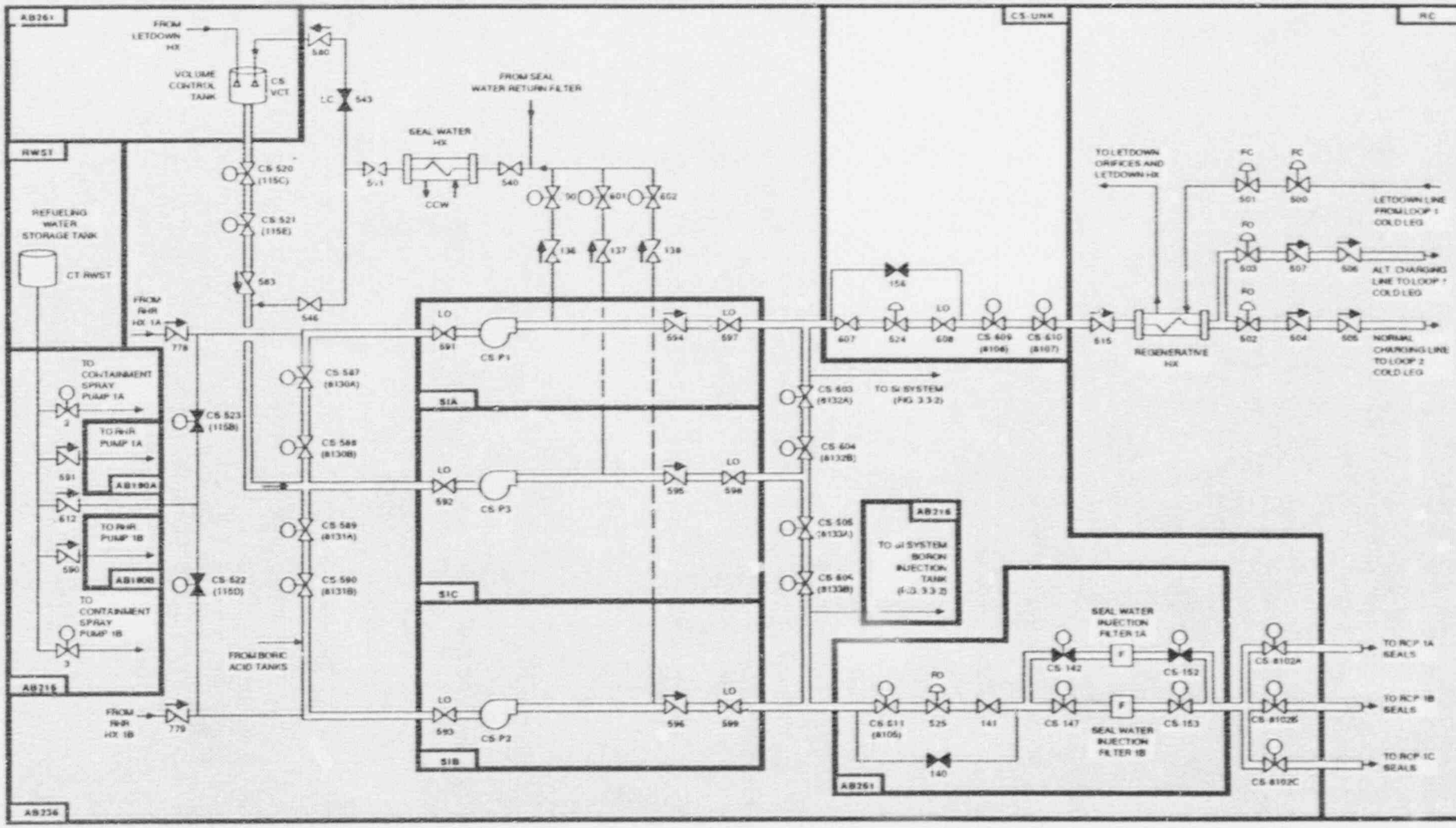


Figure 3.4-2. Shearon Harris Charging System (Normal Charging Mode) Showing Component Locations

Table 3.4-1. Shearon Harris Chemical and Volume Control System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CS-142	MOV	AB261	UNKNOWN			
CS-147	MOV	AB261	UNKNOWN			
CS-152	MOV	AB261	UNKNOWN			
CS-153	MOV	AB261	UNKNOWN			
CS-520 (115C)	MOV	AB236	MCC-1A31	480	286MCA	AC/A
CS-521(115E)	MOV	AB236	MCC-1B35	480	AB261	AC/B
CS-522 (115D)	MOV	AB236	MCC-1B35	480	AB261	AC/B
CS-523 (115B)	MOV	AB236	MCC-1A35	480	AB261	AC/A
CS-587(8130A)	MOV	AB236	MCC-1A35	480	AB261	AC/A
CS-588(8130B)	MOV	AB236	MCC-1B35	480	AB261	AC/B
CS-589(8131A)	MOV	AB236	MCC-1A35	480	AB261	AC/A
CS-590(8131B)	MOV	AB236	MCC-1B35	480	AB261	AC/B
CS-603(8132A)	MOV	AB236	MCC-1A35	480	AB261	AC/A
CS-604(8132B)	MOV	AB236	MCC-1B35	480	AB261	AC/B
CS-605(8133A)	MOV	AB236	MCC-1A35	480	AB261	AC/A
CS-606(8133B)	MOV	AB236	MCC-1B35	480	AB261	AC/B
CS-609 (8108)	MOV	CS-UNK	MCC-1B31	480	286MCB	AC/B
CS-610 (8107)	MOV	CS-UNK	MCC-1A31	480	286MCA	AC/A
CS-611 (8105)	MOV	AB261	MCC-1B35	480	AB261	AC/B
CS-8102A	MOV	AB236	MCC-1B31	480	286MCB	AC/B
CS-8102B	MOV	AB236	MCC-1B31	480	286MCB	AC/B
CS-8102C	MOV	AB236	MCC-1B31	480	286MCB	AC/B
CS-P1	MDP	SIA	BUS-1A	6900	SGRMA	AC/A
CS-P2	MDP	SIB	BUS-1B	6900	SGRMB	AC/B
CS-P3	MDP	SIC	BUS-1B	6900	SGRMB	AC/B
CS-VCT	TANK	AB261				
CT-RWST	TANK	RWST				

Table 3.4-1. Shearon Harris Chemical and Volume Control System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SI-500 (8884)	MOV	AB236	MCC-1A31	480	286MCA	AC/A
SI-501 (8886)	MOV	AB236	MCC-1B31	480	286MCB	AC/B
SI-502 (8885)	MOV	AB236	MCC-1A31	480	286MCA	AC/A
SI-503 (8803A)	MOV	AB216	MCC-1A31	480	286MCA	AC/A
SI-504 (8803B)	MOV	AB216	MCC-1B31	480	286MCB	AC/B
SI-505 (8801B)	MOV	AB216	MCC-1B31	480	286MCB	AC/B
SI-506 (8801A)	MOV	AB216	MCC-1A31	480	286MCA	AC/A

3.5 INSTRUMENTATION AND CONTROL (I & C) SYSTEMS

3.5.1 System Function

The instrumentation and control systems consist of the Reactor Trip System (also known as the Reactor Protection System, RPS), the Engineered Safety Features Actuation System (ESFAS), and systems for the display of plant information to the operators. The RPS and the ESFAS monitor the reactor plant and alert the operator to take corrective action before specified limits are exceeded. The RPS will initiate an automatic reactor trip (scram) to rapidly shutdown the reactor when plant conditions exceed one or more specified limits. The ESFAS will automatically actuate selected safety systems based on the specific limits or combinations of limits that are exceeded. A remote shutdown capability is provided to ensure that the reactor can be placed in a safe condition in the event that the main control room must be evacuated.

3.5.2 System Definition

The RPS includes sensor and transmitter units, logic units, and output trip relays that generate a reactor trip signal. The reactor trip signal de-energizes the control rod magnetic latch mechanisms, allowing all control rod assemblies to drop into the core. The ESFAS includes independent sensor and transmitter units, logic units, and relays that interface with the control circuits for the many different sets of engineered safety features components that can be actuated. Operator instrumentation display systems consist of display panels in the control room and at local control stations that are powered by the 120 VAC electric power system (see Section 3.6)

3.5.3 System Operation

A. RPS

The RPS has two to four redundant input instrument channels for each sensed parameter. Two reactor trip breakers are actuated by two separate RPS logic matrices. The reactor trip breakers interrupt power to the control rod drive power supply. Bypass breakers are provided to permit testing of the trip breakers. Certain reactor trip channels are automatically bypassed at power levels where they are not required for safety. The following conditions result in reactor trip:

- High neutron flux
- High neutron flux rate
- Negative neutron flux rate
- Overtemperature delta T
- Overpower delta T
- Low pressurizer pressure
- High pressurizer pressure
- High pressurizer water level
- Low reactor coolant flow
- Reactor coolant pump undervoltage
- Reactor coolant pump underfrequency
- Safety injection system actuation
- Turbine trip
- Low feedwater flow
- Low-low steam generator water level
- Manual

3.6.4 System Success Criteria

Basic system success criteria for mitigating transients and loss-of-coolant accidents are defined by front-line systems, which then create demands on support systems. Electric power system success criteria are defined as follows, without taking credit for cross-ties that may exist between independent load groups:

- Each Class 1E DC load group is supplied initially from its respective battery (also needed for diesel starting)
- Each Class 1E AC load group is isolated from the non-Class 1E system and is supplied from its respective emergency power source (i.e. diesel generator)
- Power distribution paths to essential loads are intact
- Power to the battery chargers is restored before the batteries are exhausted

3.6.5 Component Information

A. Standby diesel generators 1A, 1B
   1. Rated load: 6500 kW
   2. Rated voltage: 6900 VAC
   3. Manufacturer: Unknown

B. Batteries 1A, 1B
   1. Rated voltage: 125 VDC
   2. Rated capacity: approximately 2 hours with design loads

3.6.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The standby diesel generators are automatically started based on loss of offsite power or a safety injection signal.
   2. Remote manual
      The diesel generators can be started, and many distribution circuit breakers can be operated, from the control room.

B. Diesel Generator Auxiliary Systems
   1. Diesel Cooling Water System
      Each diesel generator can be cooled by the service water system (see Section 3.8).
   2. Diesel Starting System
      Each diesel has an independent air starting system.
   3. Diesel Fuel Oil Transfer and Storage System
      A "day tank" supplies short-term fuel needs of each diesel. The capacity of each day tank is 3000 gallons. Each day tank can be replenished from a separate 175,000 gallon fuel oil storage tank. The long-term storage tanks are located underground in the yard.
   4. Diesel Lubrication System
      Each diesel generator has an independent lubrication system.
   5. Diesel Room Ventilation System
      This system consists of exhaust fans which maintain the environmental conditions in the diesel room within limits for which the diesel generator and switchgear have been qualified. This system may be needed for long-term operation of the diesel generator.

3.6 ELECTRIC POWER SYSTEM

3.6.1 System Function

The electric power system supplies power to various equipment and systems needed for normal operation and/or response to accidents. The onsite Class 1E electric power system supports the operation of safety class systems and instrumentation needed to establish and maintain a safe shutdown plant condition following an accident, when the normal electric power sources are not available.

3.6.2 System Definition

All of the engineered safety features receive power from two 6900 volt buses, designated 1A and 1B. The emergency source of power for these buses are diesel generators 1A and 1B, respectively. Each 6900 VAC bus feeds three emergency 480 VAC buses through transformers. The 480 VAC buses in turn supply power to various motor control centers.

The 125 VDC system provides power for control and instrumentation and other loads. The system consists of two buses. Each 125 VDC bus is powered by a dedicated battery, with two battery chargers that are supplied by a 480 VAC bus.

The 120 VAC system consists of four instrument buses. Each bus is supplied from an inverter/rectifier which can convert both 125 VDC and 480 VAC to 120 VAC.

Simplified one-line diagrams of the station electric power system are shown in Figures 3.6-1 and 3.6-2. The 6900 and 480 VAC systems are shown in Figures 3.6-3 and 3.6-4, and the 125 VDC and 120 VAC systems are shown in Figures 3.6-5 and 3.6-6. A summary of data on selected electric power system components is presented in Table 3.6-1. Selected loads and components supplied by the Class 1E electric power system are listed in Table 3.6-2.

3.6.3 System Operation

During normal operation, the Class 1E electric power system is supplied from the switchyard through the unit auxiliary transformers. Under startup and shutdown conditions power is supplied through the startup transformers. The emergency sources of AC power are the diesel generators. The transfer from the preferred power source to the diesel generators is accomplished automatically by opening the normal source circuit breakers and then reenergizing the Class 1E portion of the electric power system from the diesel generators.

The DC power system normally is supplied through the battery chargers, with the batteries "floating" on the system, maintaining a full charge. Upon loss of AC power, the entire DC load draws from the batteries. The batteries are rated for approximately 2 hours of operation without assistance from the battery chargers, based on the length of time they can supply the inverters following loss of AC power (Ref. 1, Section 8.3.2.1.1).

Each 120 VAC instrumentation bus receives power from an inverter/rectifier, which normally is supplied through its rectifier from a 480 VAC motor control center (MCC). Should this voltage drop below the required level the inverter is supplied automatically from a 125 VDC battery (through its 125 VDC bus).

Redundant safeguards equipment such as motor driven pumps and motor operated valves are supplied by different VAC buses. For the purpose of discussion, this equipment has been grouped into "load groups". Load group AC/A contains components powered either directly or indirectly from 6900 bus 1A. Load group AC/B contains components powered either directly or indirectly by bus 1B. Components receiving DC power are assigned to load groups DC/A or DC/B, based on the battery power source.

scram usually is implemented by the scram circuit breakers which must open in response to a scram signal. Typically, there are two series scram circuit breakers in the power path to the scram rods. In this case, one of two circuit breakers must open. Details of the scram system for Shearon Harris have not been determined.

B. ESFAS
A single component usually receives a signal from only one ESFAS output train. ESFAS Trains A and B must be available in order to automatically actuate their respective components. ESFAS typically uses hindrance input logic (normal = 1, trip = 0) and transmission output logic (normal = 0, trip = 1). In this case, an input channel will be in a trip state when input signals are lost, when control power is lost, or when the channel is temporarily removed from service for testing or maintenance (i.e. the channel has a fail-safe failure mode). Control power is needed for the ESFAS output channels to send an actuation signal. Note that there may be some ESFAS actuation subsystems that utilize hindrance output logic. For these subsystems, loss of control power will cause system or component actuation, as is the case with the RPS. Details of the ESFAS system for Shearon Harris have not been determined.

C. Manually-Initiated Protective Actions
When reasonable time is available, certain protective actions may be performed manually by plant personnel. The control room operators are capable of operating individual components using normal control circuitry, or operating groups of components by manually tripping the RPS or an ESFAS subsystem. The control room operators also may send qualified persons into the plant to operate components locally or from some other remote control location (i.e., the remote shutdown panel or a motor control center). To make these judgments, data on key plant parameters must be available to the operators.

3.5.5 Support Systems and Interfaces

A. Control Power
Operator instrumentation displays are powered from the 120 VAC instrument buses (see Section 3.6)

C. Switchgear and Battery Room Ventilation Systems
These systems maintain acceptable environmental conditions in the switchgear and battery rooms, and may bc needed for long-term operation of the electric power systems. Details of these systems have not been determined.

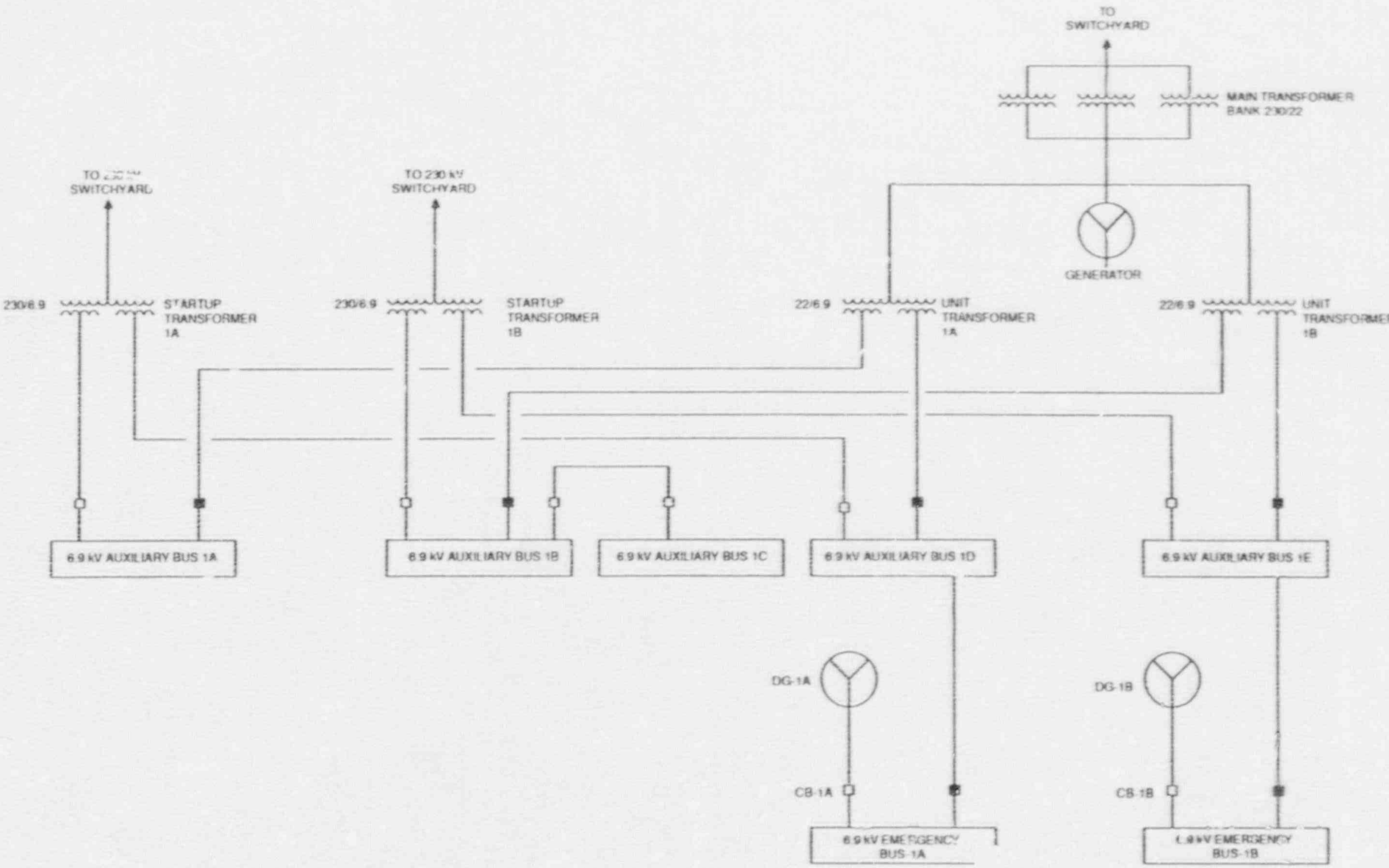
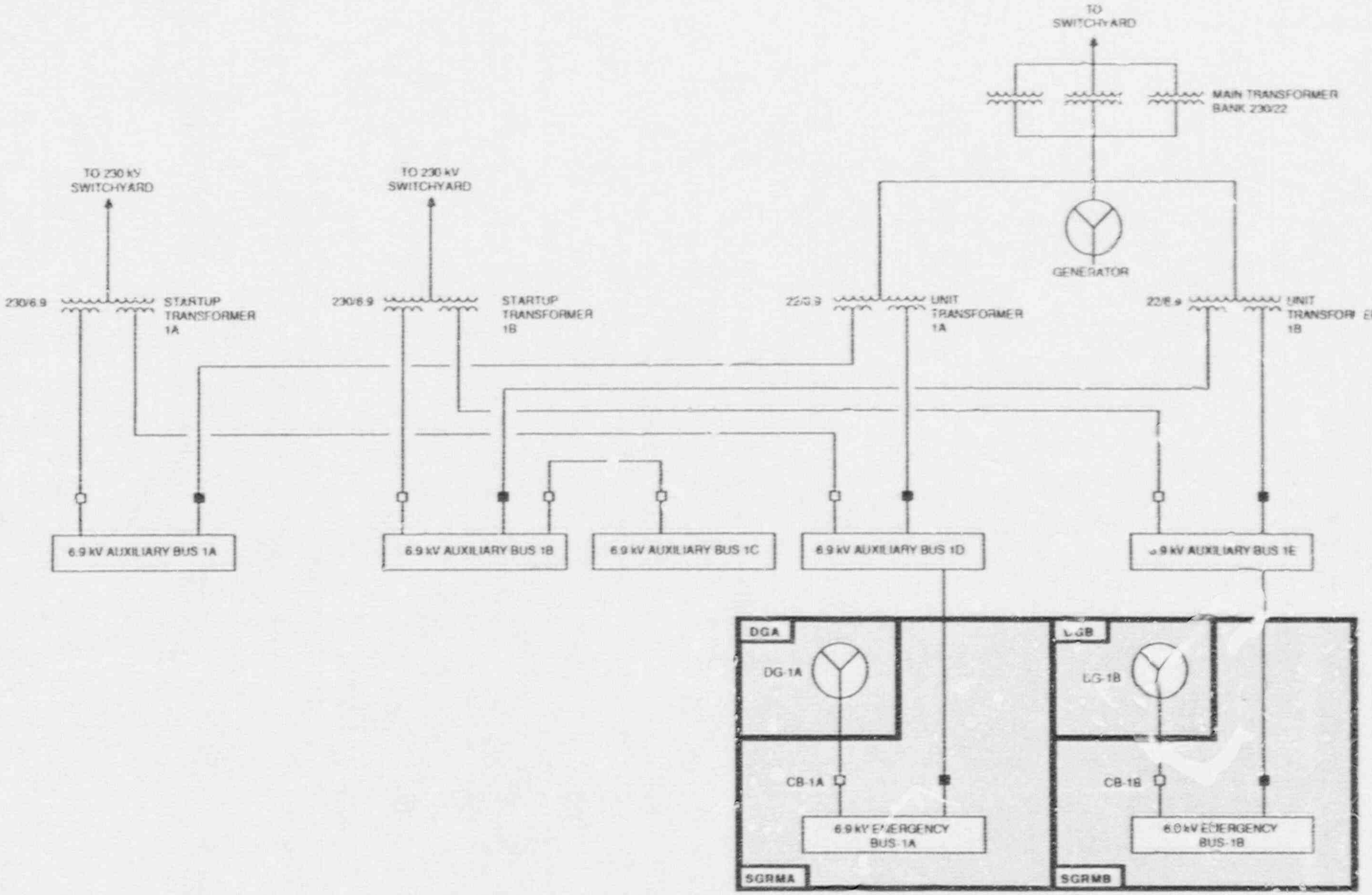


Figure 3.6-1. Shearon Harris Station Electric Power System



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.6-2. Shearon Harris Station Electric Power System Showing Component Locations

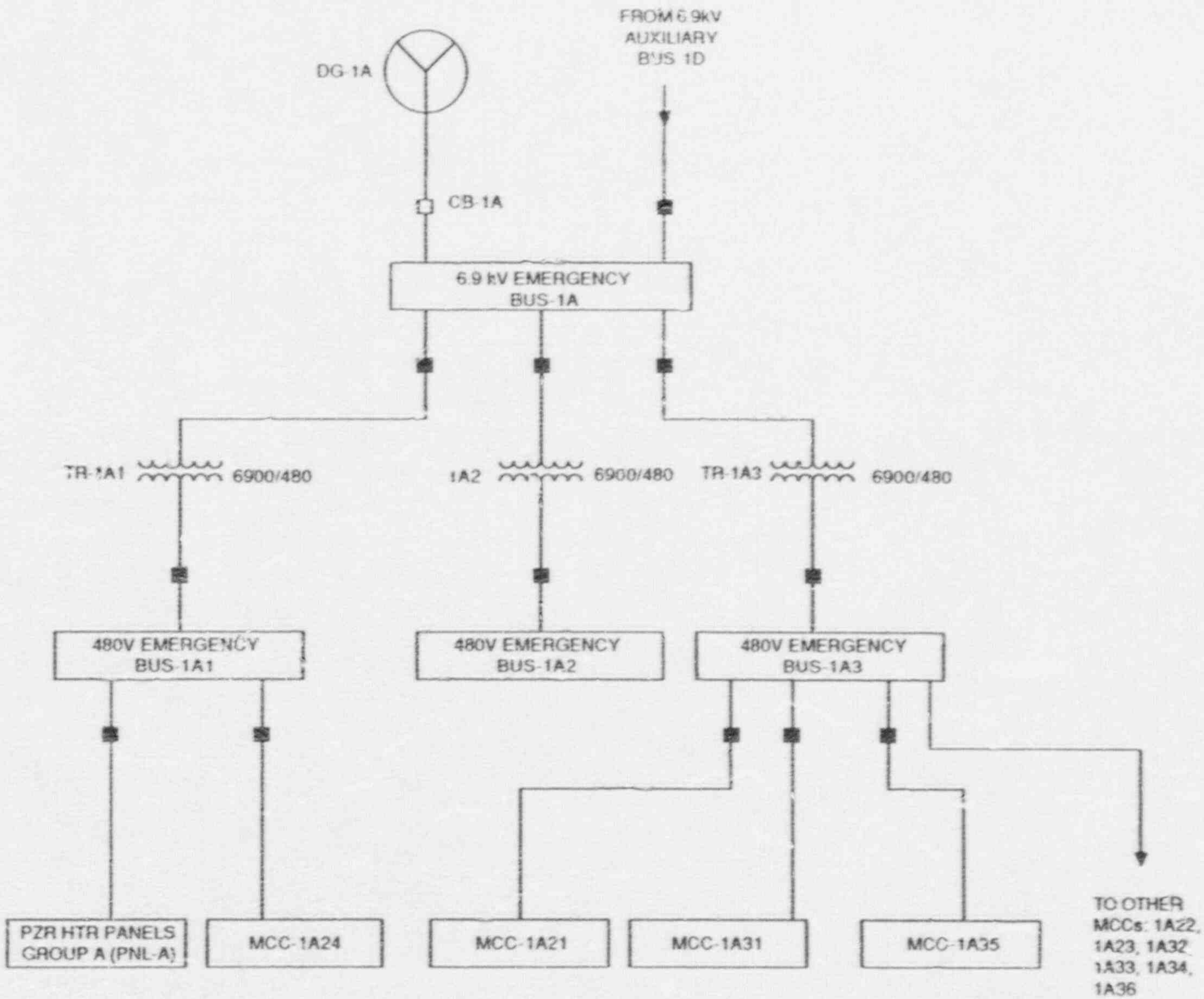


Figure 3.6-3. Shearon Harris 6900 and 480 VAC Electric Power Systems (Page 1 of 2)

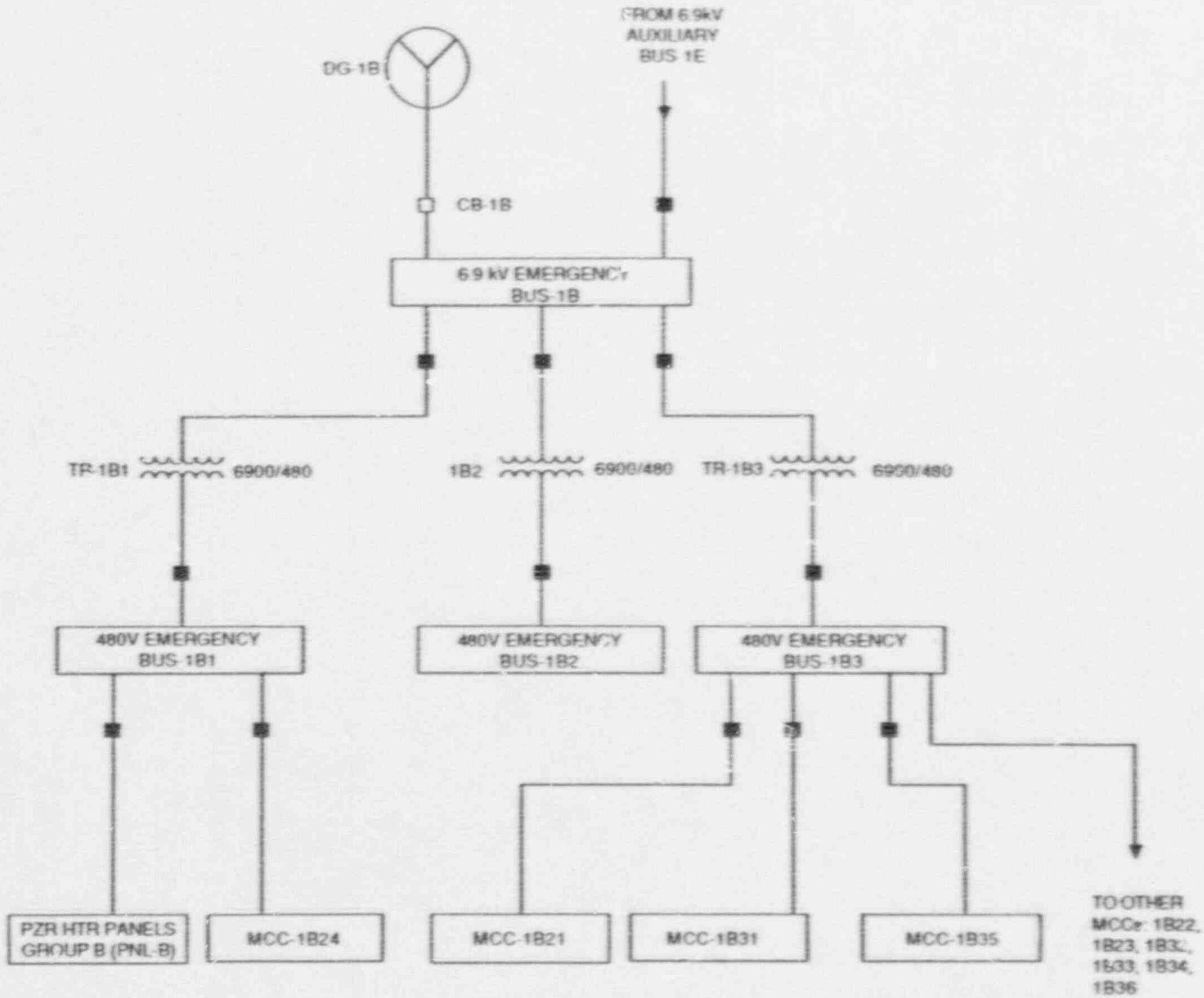


Figure 3.6-3. Shearon Harris 6900 and 480 VAC Electric Power Systems (Page 2 of 2)

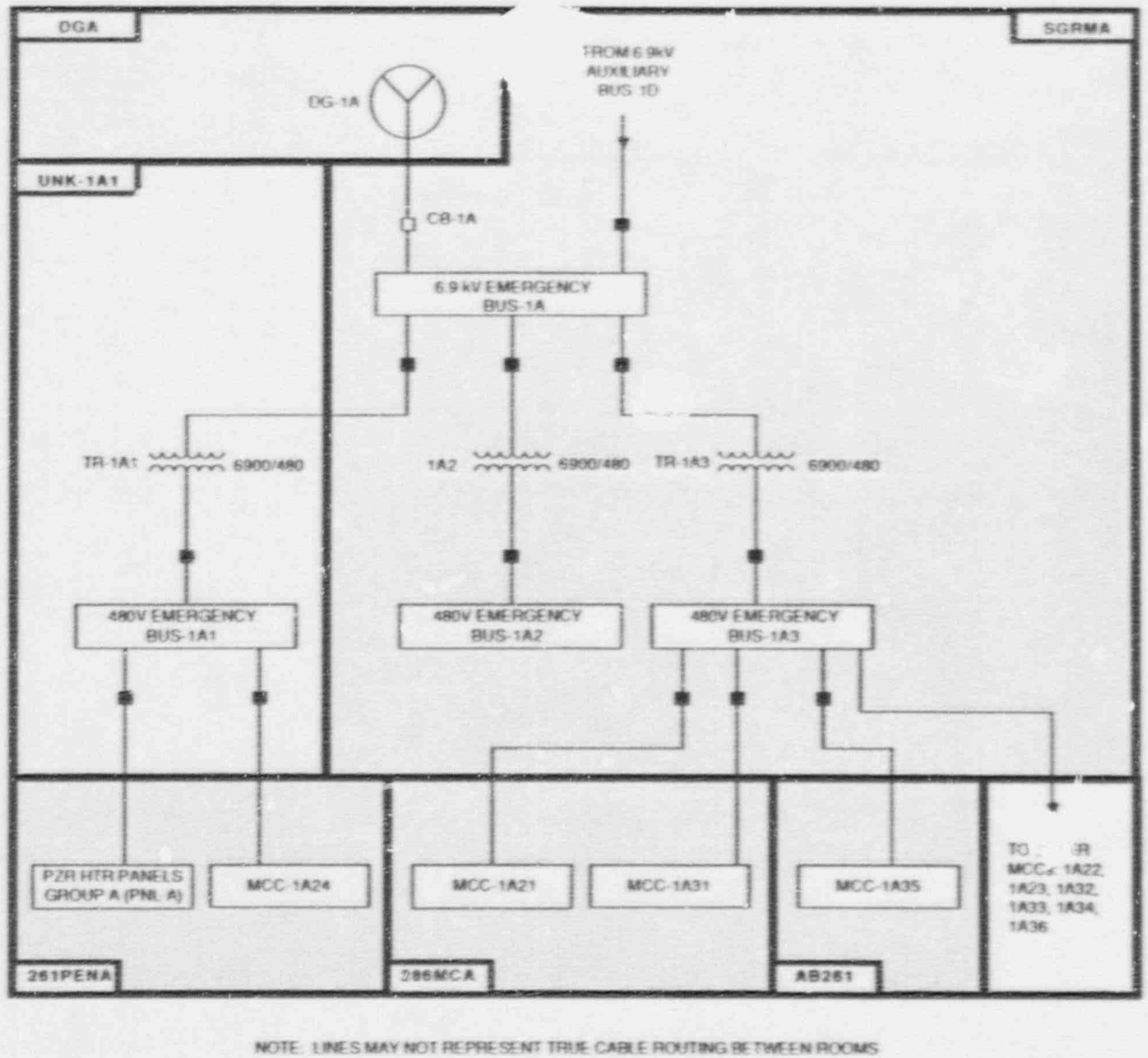


Figure 3.6-4. Shearon Harris 6900 and 480 VAC Electric Power Systems Showing Component Locations (Page 1 of 2)

B. ESFAS
The ESFAS consists of two distinct portions of circuitry: (1) an analog portion consisting of three to four redundant channels per parameter, and (2) a digital portion consisting of two redundant logic trains which receive inputs from the analog channels and perform the logic needed to actuate the appropriate engineered safety features (ESF) equipment. The following vital functions are actuated by the ESFAS:

- Safety injection system actuation
- Containment isolation
- Main steam line isolation
- Feedwater isolation
- Containment spray system actuation
- Control room ventilation isolation
- Containment ventilation isolation

The ESFAS provides an actuation signal to each individual component in the required engineered safety features system.

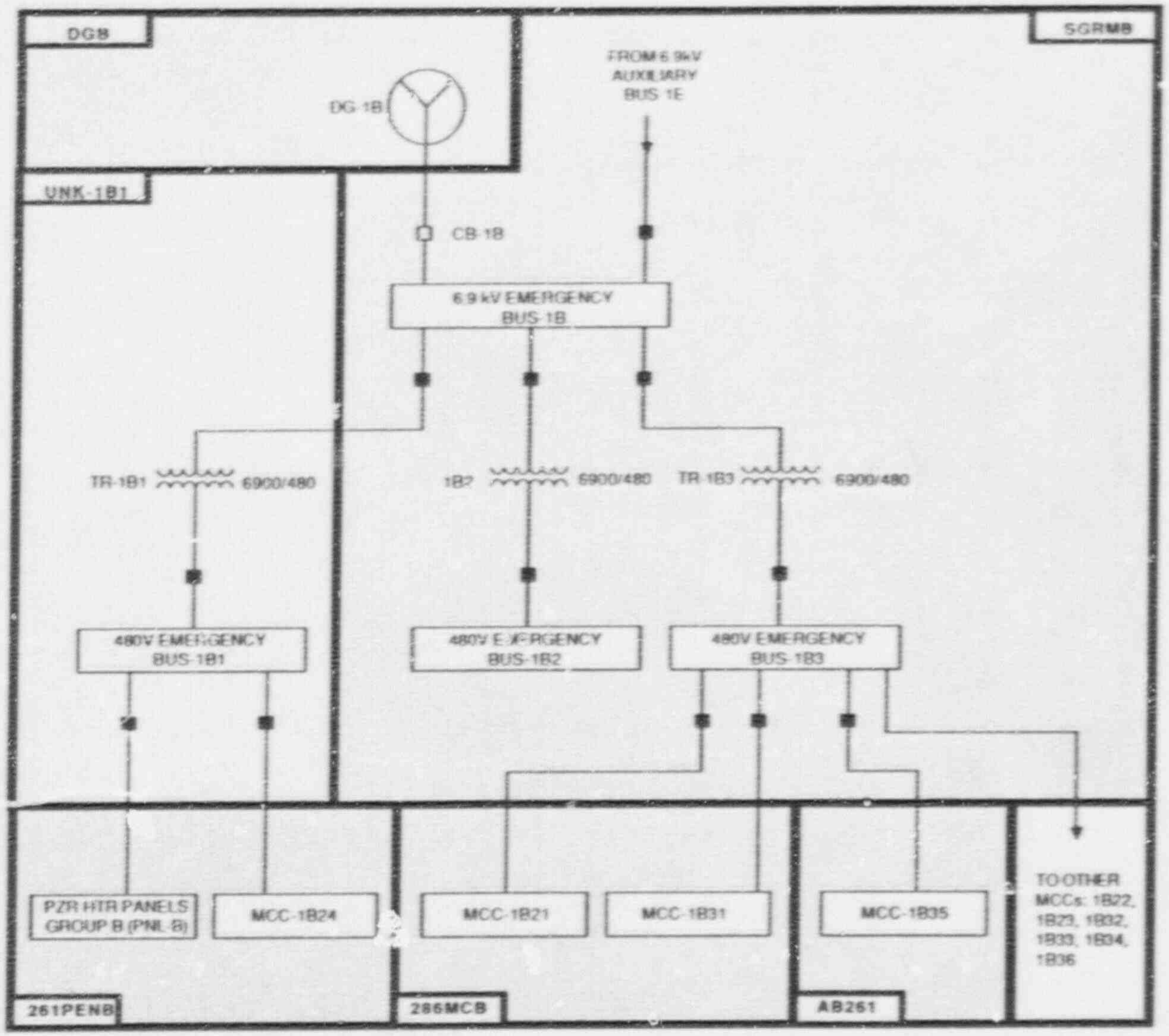
C. Remote Shutdown
If temporary evacuation of the Control Room is required, the operator can establish and maintain the station in a safe shutdown condition from outside the Control Room from the auxiliary control panel (ACP). The prime intent of the ACP is to enable the operators to achieve and maintain a hot standby condition. Two transfer panels are provided for the two electrical safety trains, SA and SB. Their function is to transfer control by isolating the controls at the main control board (MCB) and activating the controls of the respective safety equipment on the ACP. The transfer is initiated manually by transfer switches provided on the ACP, only after the permissive switch at the transfer panel is turned on. To isolate the control circuitry of the Control Room and transfer control to the ACP, the operator must trip the reactor before leaving the Control Room.

The ACP contains controls and/or indicators for equipment in the following systems required for safe shutdown:

- Reactor Coolant System
- Main Steam System
- Auxiliary Feedwater System
- Safety Injection System
- Residual Heat Removal System
- Chemical and Volume Control System
- Component Cooling Water System
- Service Water System
- Electrical System

3.5.4 System Success Criteria

A. RPS
The RPS uses hindrance logic (normal = 1, trip = 0) in both the input and output logic. Therefore, a channel will be in a trip state when input signals are lost, when control power is lost, or when the channel is temporarily removed from service for testing or maintenance (i.e. the channel has a fail-safe failure mode). A reactor scram will occur upon loss of control power to the RPS. A reactor



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.6-4. Shearon Harris 6900 and 480 VAC Electric Power Systems Showing Component Locations (Page 2 of 2)

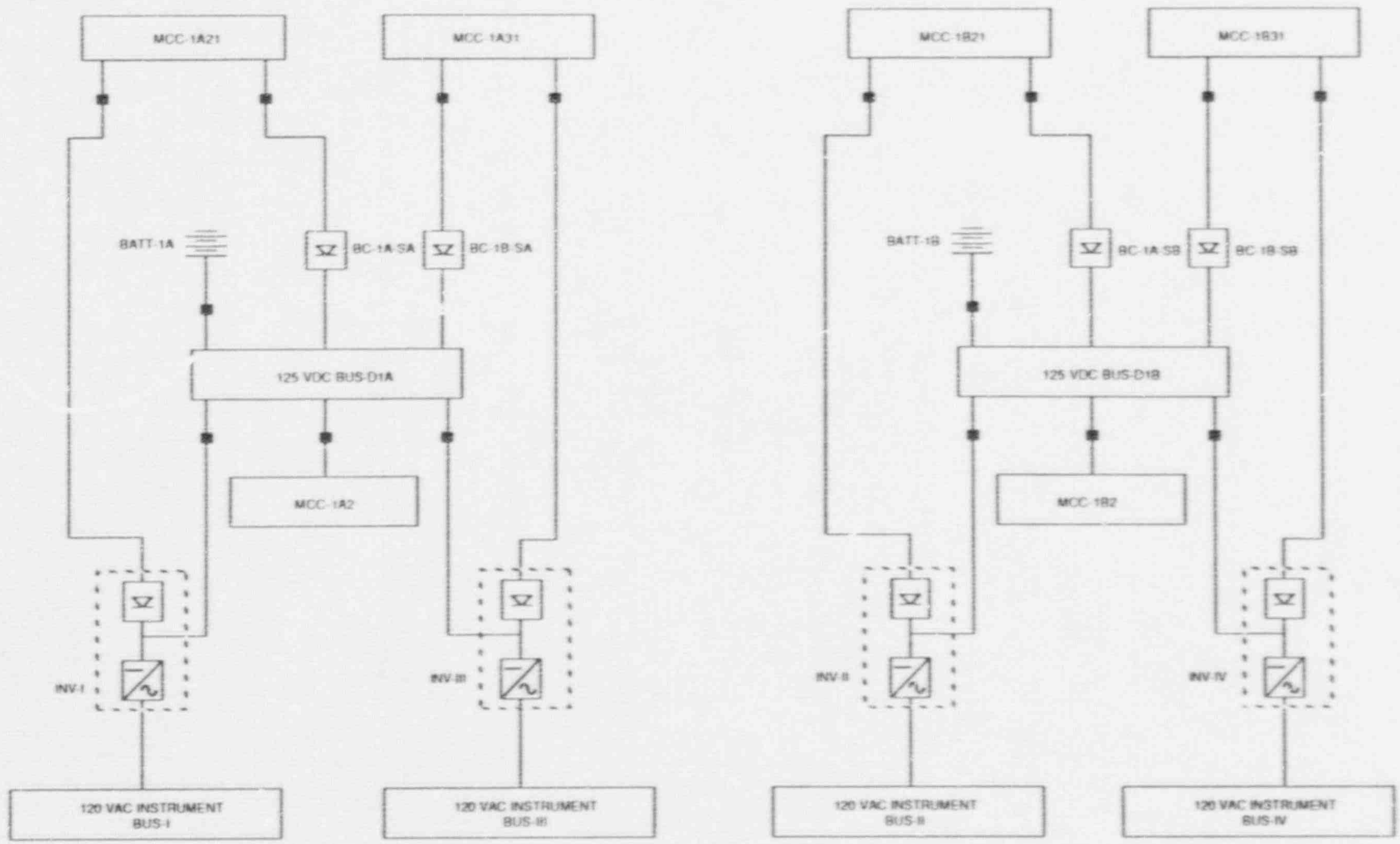
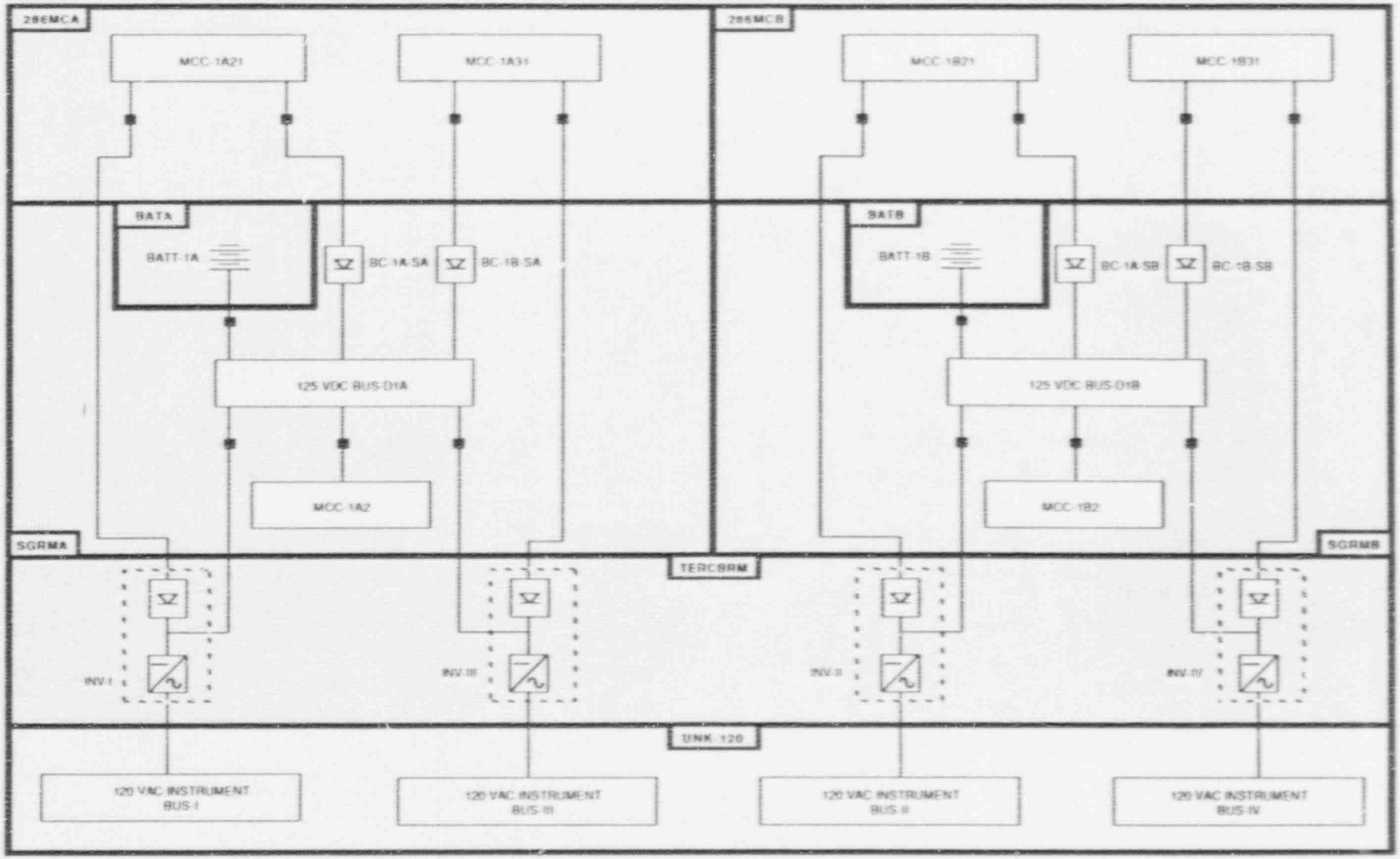


Figure 3.6-5. Shearon Harris 125 and 120 VAC Electric Power Systems



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.6-6. Shearon Harris 125 VDC and 120 VAC Electric Power Systems Showing Component Locations

Table 3.6-1. Shearon Harris Electric Power System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
BATT-1A	BATT	BATA		125		DC/A
BATT-1B	BATT	BATB		125		DC/B
BC-1A-SA	BC	SGRMA	MCC-1A21	125	286MCA	DC/A
BC-1A-SB	BC	SGRMB	MCC-1B21	125	286MCB	DC/B
BC-1B-SA	BC	SGRMA	MCC-1A31	125	286MCA	DC/A
BC-1B-SB	BC	SGRMB	MCC-1B31	125	286MCB	DC/B
BUS-1A	BUS	SGRMA	DG-1A	6900	DGA	AC/A
BUS-1A1	BUS	UNK-1A1	TR-1A1	480	UNK-1A1	AC/A
BUS-1A3	BUS	SGRMA	TR-1A3	480	SGRMA	AC/A
BUS-1B	BUS	SGRMB	DG-1B	6900	DGB	AC/B
BUS-1B1	BUS	UNK-1B1	TR-1B1	480	UNK-1B1	AC/B
BUS-1B3	BUS	SGRMB	TR-1B3	480	SGRMB	AC/B
BUS-D1A	BUS	SGRMA	BATT-1A	125	BATA	DC/A
BUS-D1A	BUS	SGRMA	BC-1A-SA	125	SGRMA	DC/A
BUS-D1A	BUS	SGRMA	BC-1B-SA	125	SGRMA	DC/A
BUS-D1B	BUS	SGRMB	BATT-1B	125	BATB	DC/B
BUS-D1B	BUS	SGRMB	BC-1A-SB	125	SGRMB	DC/B
BUS-D1B	BUS	SGRMB	BC-1B-SB	125	SGRMB	DC/B
BUS-I	BUS	UNK-120	INV-I	120	TERCBRM	AC/A
BUS-II	BUS	UNK-120	INV-II	120	TERCBRM	AC/B
BUS-III	BUS	UNK-120	INV-III	120	TERCBRM	AC/A
BUS-IV	BUS	UNK-120	INV-IV	120	TERCBRM	AC/B
CB-1A	CB	SGRMA	DG-1A	6900	DGA	AC/A
CB-1B	CB	SGRMB	DG-1B	6900	DGB	AC/B
DG-1A	DG	DGA		6900		AC/A
DG-1B	DG	DGB		6900		AC/B
INV-I	INV	TERCBRM	MCC-1A21	120	286MCA	AC/A

Table 3.6-1. Shearon Harris Electric Power System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
INV-I	INV	TERCBRM	BUS-D1A	120	SGRMA	AC/A
INV-II	INV	TERCBRM	MCC-1B21	120	286MCB	AC/B
INV-II	INV	TERCBRM	BUS-D1B	120	SGRMB	AC/B
INV-III	INV	TERCBRM	MCC-1A31	120	286MCA	AC/A
INV-III	INV	TERCBRM	BUS-D1A	120	SGRMA	AC/A
INV-IV	INV	TERCBRM	MCC-1B31	120	286MCB	AC/B
INV-IV	INV	TERCBRM	BUS-D1B	120	SGRMB	AC/B
MCC-1A21	MCC	286MCA	BUS-1A3	480	SGRMA	AC/A
MCC-1A31	MCC	286MCA	BUS-1A3	480	SGRMA	AC/A
MCC-1B21	MCC	286MCB	BUS-1B3	480	SGRMB	AC/B
MCC-1B31	MCC	286MCB	BUS-1B3	480	SGRMB	AC/B
TR-1A1	TRAN	UNK-1A1	BUS-1A	480	SGRMA	AC/A
TR-1A3	TRAN	SGRMA	BUS-1A	480	SGRMA	AC/A
TR-1B1	TRAN	UNK-1B1	BUS-1B	480	SGRMB	AC/B
TR-1B3	TRAN	SGRMB	BUS-1B	480	SGRMB	AC/B

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Shearon Harris

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BATT-1A	125	DC/A	BATA	EP	BUS-D1A	BUS	SGRMA
BATT-1B	125	DC/B	BATB	EP	BUS-D1B	BUS	SGRMB
BC-1A-SA	125	DC/A	SGRMA	EP	BUS-D1A	BUS	SGRMA
BC-1A-SB	125	DC/B	SGRMB	EP	BUS-D1B	BUS	SGRMB
BC-1B-SA	125	DC/A	SGRMA	EP	BUS-D1A	BUS	SGRMA
BC-1B-SB	125	DC/B	SGRMB	EP	BUS-D1B	BUS	SGRMB
BUS-1A	6900	AC/A	SGRMA	AFS	AF-P1A	MDP	AB236
BUS-1A	6900	AC/A	SGRMA	CCW	CC-P1A	MDP	AB236
BUS-1A	6900	AC/A	SGRMA	CVCS	CS-P1	MDP	SIA
BUS-1A	480	AC/A	SGRMA	EP	TR-1A1	TRAN	UNK-1A1
BUS-1A	480	AC/A	SGRMA	EP	TR-1A3	TRAN	SGRMA
BUS-1A	6900	AC/A	SGRMA	SW	SW-P1A	MDP	MINTK
BUS-1A1	480	AC/A	UNK-1A1	RCS	PNL-A	PNL	261PENA
BUS-1A3	480	AC/A	SGRMA	EP	MCC-1A21	MCC	286MCA
BUS-1A3	480	AC/A	SGRMA	EP	MCC-1A31	MCC	286MCA
BUS-1B	6900	AC/B	SGRMB	AFS	AF-P1B	MDP	AB236
BUS-1B	6900	AC/B	SGRMB	CCW	CC-P1B	MDP	AB236
BUS-1B	6900	AC/B	SGRMB	CCW	CC-P1C	MDP	AB236
BUS-1B	6900	AC/B	SGRMB	CVCS	CS-P2	MDP	SIB
BUS-1B	6900	AC/B	SGRMB	CVCS	CS-P3	MDP	SIC
BUS-1B	480	AC/B	SGRMB	EP	TR-1B1	TRAN	UNK-1B1
BUS-1B	480	AC/B	SGRMB	EP	TR-1B3	TRAN	SGRMB
BUS-1B	6900	AC/B	SGRMB	SW	SW-P1B	MDP	MINTK
BUS-1B1	480	AC/B	UNK-1B1	RCS	PNL-B	PNL	261PENB
BUS-1B3	480	AC/B	SGRMB	EP	MCC-1B21	MCC	286MCB
BUS-1B3	480	AC/B	SGRMB	EP	MCC-1B31	MCC	286MCB
BUS-D1A	120	AC/A	SGRMA	EP	INV-I	INV	TERCBRM
BUS-D1A	120	AC/A	SGRMA	EP	INV-III	INV	TERCBRM
BUS-D1B	120	AC/B	SGRMB	EP	INV-II	INV	TERCBRM
BUS-D1B	120	AC/B	SGRMB	EP	INV-IV	INV	TERCBRM
DG-1A	6900	AC/A	DGA	EP	BUS-1A	BUS	SGRMA

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Shearon Harris (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
DG-1A	6900	AC/A	DGA	EP	CB-1A	CB	SGRMA
DG-1B	6900	AC/B	DGB	EP	BUS-1B	BUS	SGRMB
DG-1B	6900	AC/B	DGB	EP	CB-1B	CB	SGRMB
INV-I	120	AC/A	TERCBRM	EP	BUS-I	BUS	UNK-120
INV-II	120	AC/B	TERCBRM	EP	BUS-II	BUS	UNK-120
INV-III	120	AC/A	TERCBRM	EP	BUS-III	BUS	UNK-120
INV-IV	120	AC/B	TERCBRM	EP	BUS-IV	BUS	UNK-120
MCC-1A2	125	DC/A	286MCA	AFS	AF-116 (137)	MOV	STMTNL
MCC-1A2	125	DC/A	286MCA	AFS	AF-117 (143)	MOV	STMTNL
MCC-1A2	125	DC/A	286MCA	AFS	AF-118 (149)	MOV	STMTNL
MCC-1A2	125	DC/A	286MCA	AFS	MS-8	MOV	STMTNL
MCC-1A21	480	AC/A	286MCA	CCW	CC-191 (9483)	MOV	RC
MCC-1A21	125	DC/A	286MCA	EP	BC-1A-SA	BC	SGRMA
MCC-1A21	120	AC/A	286MCA	EP	INV-I	INV	TERCBRM
MCC-1A21	480	AC/A	286MCA	RCS	RC-501(8701B)	MOV	RC
MCC-1A21	480	AC/A	286MCA	RCS	RH-503(8701A)	MOV	RC
MCC-1A24	480	AC/A	261PENA	RCS	RC-V528 (8000C)	MOV	RC
MCC-1A31	480	AC/A	286MCA	CCW	CC-169 (9480A)	MOV	236PEN
MCC-1A31	480	AC/A	286MCA	CVCS	CS-520 (115C)	MOV	AB236
MCC-1A31	480	AC/A	286MCA	CVCS	CS-610 (8107)	MOV	CS-UNK
MCC-1A31	480	AC/A	286MCA	CVCS	SI-500 (8884)	MOV	AB236
MCC-1A31	480	AC/A	286MCA	CVCS	SI-502 (8885)	MOV	AB236
MCC-1A31	480	AC/A	286MCA	CVCS	SI-503 (8803A)	MOV	AB216
MCC-1A31	480	AC/A	286MCA	CVCS	SI-506 (8801A)	MOV	AB216
MCC-1A31	125	DC/A	286MCA	EP	BC-1B-SA	BC	SGRMA
MCC-1A31	120	AC/A	286MCA	EP	INV-III	INV	TERCBRM
MCC-1A35	480	AC/A	AB261	CCW	CC-19 (9384)	MOV	AB236
MCC-1A35	480	AC/A	AB261	CCW	CC-5 (9370)	MOV	AB236
MCC-1A35	480	AC/A	AB261	CVCS	CS-523 (115B)	MOV	AB236
MCC-1A35	480	AC/A	AB261	CVCS	CS-587(8130A)	MOV	AB236
MCC-1A35	480	AC/A	AB261	CVCS	CS-589(8131A)	MOV	AB236

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Shearon Harris (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-1A35	480	AC/A	AB261	CVCS	[illegible]-603(8132A)	MOV	AB236
MCC-1A35	480	AC/A	AB261	CVCS	CS-605(8133A)	MOV	AB236
MCC-1A35	480	AC/A	AB261	SW	SW-15 (270)	MOV	2TKBL
MCC-1A35	480	AC/A	AB261	SW	SW-70	MOV	AB236
MCC-1A35	480	AC/A	AB261	SW	SW-71	MOV	AB236
MCC-1A35	480	AC/A	AB261	[illegible]	[illegible]	MOV	AB236
MCC-1A35	480	AC/A	AB261	SW	SW-75	MOV	AB236
MCC-1B2	125	DC/B	286MCB	AFS	MS-9	MOV	STMTNL
MCC-1B21	125	DC/B	286MCB	EP	BC-1A-SB	BC	SGRMB
MCC-1B21	120	AC/B	286MCB	EP	INV-II	INV	TERCBRM
MCC-1B21	480	AC/B	286MCB	RCS	RC-500(8702B)	MOV	RC
MCC-1B21	480	AC/B	286MCB	RCS	RC-502(8702A)	MOV	RC
MCC-1B24	480	AC/B	261PENB	RCS	RC-V526 (8000A)	MOV	RC
MCC-1B24	480	AC/B	261PENB	RCS	RC-V527 (8000B)	MOV	RC
MCC-1B31	480	AC/B	286MCB	AFS	AF-19 (93)	MOV	STMTNL
MCC-1B31	480	AC/B	286MCB	CCW	CC-170 (9480B)	MOV	236PEN
MCC-1B31	480	AC/B	286MCB	CVCS	CS-609 (8108)	MOV	CS-UNK
MCC-1B31	480	AC/B	286MCB	CVCS	CS-8102A	MOV	AB236
MCC-1B31	480	AC/B	286MCB	CVCS	CS-8102B	MOV	AB236
MCC-1B31	480	AC/B	286MCB	CVCS	CS-8102C	MOV	AB236
MCC-1B31	480	AC/B	286MCB	CVCS	SI-501 (8886)	MOV	AB236
MCC-1B31	480	AC/B	286MCB	CVCS	SI-504 (8803B)	MOV	AB216
MCC-1B31	480	AC/B	286MCB	CVCS	SI-505 (8801B)	MOV	AB216
MCC-1B31	125	DC/B	286MCB	EP	BC-1B-SB	BC	SGRMB
MCC-1B31	120	AC/B	286MCB	EP	INV-IV	INV	TERCBRM
MCC-1B35	480	AC/B	AB261	CCW	CC-20 (9385)	MOV	AB236
MCC-1B35	480	AC/B	AB261	CCW	CC-6 (9371)	MOV	AB236
MCC-1B35	480	AC/B	AB261	CVCS	CS-521(115E)	MOV	AB236
MCC-1B35	480	AC/B	AB261	CVCS	CS-522 (115D)	MOV	AB236
MCC-1B35	480	AC/B	AB261	CVCS	CS-588(8130B)	MOV	AB236
MCC-1B35	480	AC/B	AB261	CVCS	CS-590(8131B)	MOV	AB236

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Shearon Harris (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-1B35	480	AC/B	AB261	CVCS	CS-604(8132B)	MOV	AB236
MCC-1B35	480	AC/B	AB261	CVCS	CS-606(8133B)	MOV	AB236
MCC-1B35	480	AC/B	AB261	CVCS	CS-611 (8105)	MOV	AB261
MCC-1B35	480	AC/B	AB261	SW	SW-16 (271)	MOV	2TKBL
MCC-1B35	480	AC/B	AB261	SW	SW-72	MOV	AB236
MCC-1B35	480	AC/B	AB261	SW	SW-73	MOV	AB236
MCC-1B35	480	AC/B	AB261	SW	SW-76	MOV	AB236
MCC-1B35	480	AC/B	AB261	SW	SW-77	MOV	AB236
TR-1A1	480	AC/A	UNK-1A1	EP	BUS-1A1	BUS	UNK-1A1
TR-1A3	480	AC/A	SGRMA	EP	BUS-1A3	BUS	SGRMA
TR-1B1	480	AC/B	UNK-1B1	EP	BUS-1B1	BUS	UNK-1B1
TR-1B3	480	AC/B	SGRMB	EP	BUS-1B3	BUS	SGRMB
UNKNOWN				AFS	AF-10 (55)	MOV	STMTNL
UNKNOWN				AFS	MS-145AB	MOV	AB236
UNKNOWN				CCW	CC-190 (9484)	MOV	236PEN
UNKNOWN				CCW	CC-F2 (685)	MOV	236PEN
UNKNOWN				CVCS	CS-142	MOV	AB261
UNKNOWN				CVCS	CS-147	MOV	AB261
UNKNOWN				CVCS	CS-152	MOV	AB261
UNKNOWN				CVCS	CS-153	MOV	AB261

3.7 COMPONENT COOLING WATER SYSTEM (CCWS)

3.7.1 System Function

The CCWS serves to remove heat from the reactor auxiliaries and RHR heat exchangers and to transfer it to the Service Water System for rejection to the ultimate heat sink. The CCWS ensures continuous operation or safe shutdown of the plant under all modes of operation. The CCWS serves as an intermediate system between the RCS and SWS, thereby reducing the probability of leakage of potentially radioactive coolant.

3.7.2 System Definition

The CCWS is a closed loop cooling water system designed to remove heat from the residual, spent fuel, seal water, letdown, excess letdown, and sample heat exchangers. The CCWS also provides cooling for the reactor coolant pump (RCP) motor bearing oil coolers and thermal barriers, and for the RHR pumps. The system consists of three pumps, two heat exchangers, and one surge tank. Flow to the cooled components is arranged in parallel flow circuits. There are two main flow loops, one serving Train A RHR components, and the other serving Train B RHR components. Other piping paths deliver cooling water to the RCPs and other non-essential components.

Component cooling water flows from the pumps, through the shell side of the CCWS heat exchangers, through the components being cooled and back to the pumps. Heat is rejected in the CCWS heat exchangers to the Service Water System.

Simplified drawings of the CCWS are shown in Figures 3.7-1 and 3.7-2. A summary of data on selected CCWS components is presented in Table 3.7-1.

3.7.3 System Operation

During normal operation one CCWS pump and one heat exchanger are required. A second pump is placed on standby to start automatically on low pressure in the CCW pump discharge header.

During the injection phase following a LOCA, all CCWS pumps receive a signal to start. During the recirculation phase the CCWS is separated into two parts, each of which can operate independently and remove residual heat from the recirculated water in the associated RHR heat exchanger. The non-essential loop, which serves the reactor coolant pumps, CVCS heat exchangers and other components, is isolated by closing two motor-operated valves upstream of the CCWS pump suction header and two motor-operated valves downstream of the CCWS heat exchanger header.

The CCW heat exchangers transfer heat to the Service Water System (see Section 3.8). The CCW surge tank is connected to the suction side of the pumps, and accommodates fluid expansion and contraction in the system. The surge tank is separated into two parts by a baffle.

3.7.4 System Success Criteria

Following a LOCA, one CCW pump and one heat exchanger are required to cool each operating RHR train. One RHR/CCWS train is required to provide adequate post-accident cooling. The Service Water System is required to remove heat from the CCWS (see Section 3.8).

3.7.5 Component Information

A. Component Cooling Water pumps 1A, 1B, 1C
   1. Rated flow: 8050 gpm @ 211 ft head (92 psid)
   2. Rated capacity: 100%
   3. Type: Horizontal centrifugal

B. Component Cooling Water heat exchangers 1A, 1B
   1. Heat transferred: 50.05×10^6 Btu/hr
   2. Type: Shell and straight tube

C. Surge tank
   1. Total Volume: 2000 gallons
   2. Normal water volume: 1000 gallons

3.7.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The CCWS pumps are automatically actuated following a LOCA.
   2. Remote manual
      The CCWS can be operated from the control room.

B. Motive Power
   The motor driven CCWS pumps and motor operated valves are Class 1E loads that can be supplied from the standby diesel generators as described in Section 3.6.

C. Other
   1. Lubrication and cooling are assumed to be provided locally for the CCWS pumps.
   2. Systems for pump room cooling have not been identified.

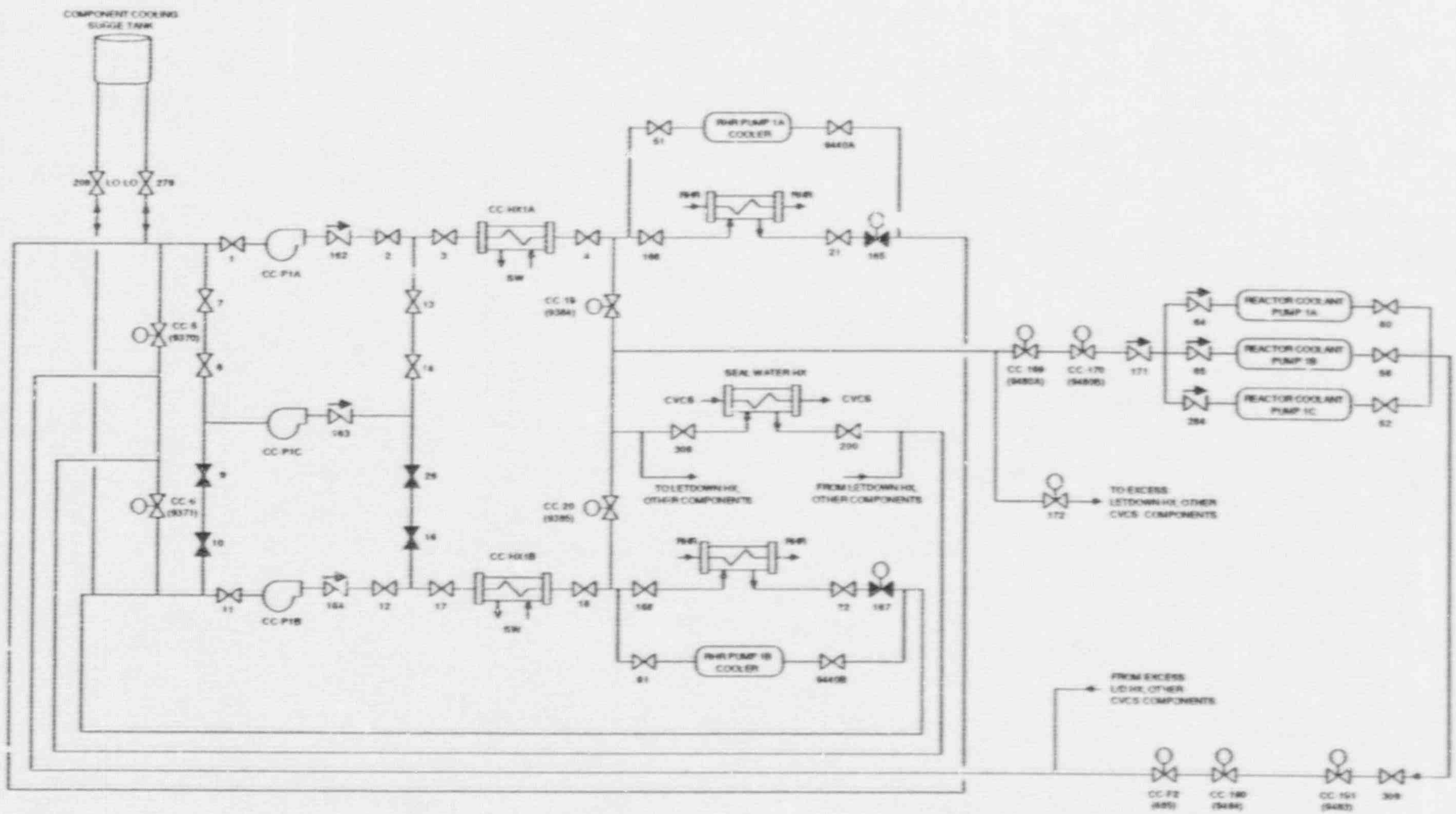


Figure 3.7-1. Shearon Harris Component Cooling Water System

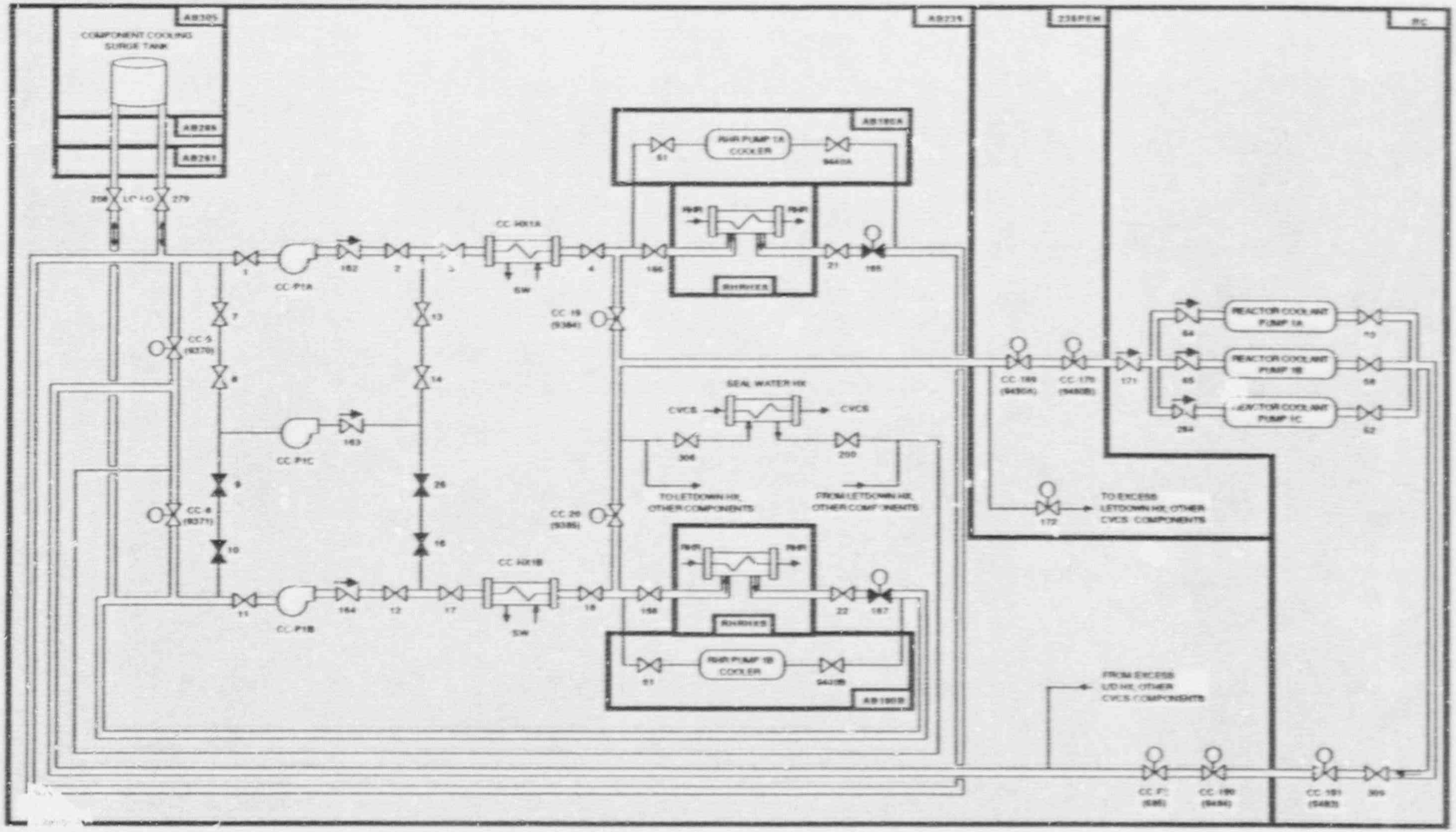


Figure 3.7-2. Shearon Harris Component Cooling Water System Showing Component Locations

Table 3.7-1. Shearon Harris Component Cooling Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CC-169 (9480A)	MOV	236PEN	MCC-1A31	480	286MCA	AC/A
CC-170 (9480B)	MOV	236PEN	MCC-1B31	480	286MCB	AC/B
CC-19 (9384)	MOV	AB236	MCC-1A35	480	AB261	AC/A
CC-190 (9484)	MOV	236PEN	UNKNOWN			
CC-191 (9483)	MOV	RC	MCC-1A21	480	286MCA	AC/A
CC-20 (9385)	MOV	AB236	MCC-1B35	480	AB261	AC/B
CC-5 (9370)	MOV	AB236	MCC-1A35	480	AB261	AC/A
CC-6 (9371)	MOV	AB236	MCC-1B35	480	AB261	AC/B
CC-F2 (685)	MOV	236PEN	UNKNOWN			
CC-HX1A	HX	AB236				
CC-HX1B	HX	AB236				
CC-P1A	MDP	AB236	BUS-1A	6900	SGRMA	AC/A
CC-P1B	MDP	AB236	BUS-1B	6900	SGRMB	AC/B
CC-P1C	MDP	AB236	BUS-1B	6900	SGRMB	AC/B
RC-P1A	MDP	RC				
RC-P1B	MDP	RC				
RC-P1C	MDP	RC				

3.8 SERVICE WATER SYSTEM (SWS)

3.8.1 System Function

The SWS supplies all the equipment cooling water for the plant, including the emergency shutdown requirements. Equipment cooled by the SWS includes the diesel generators, the component cooling water heat exchangers, containment coolers, and various air conditioning and ventilation coolers and condensers. The SWS can also deliver water to the suction of the auxiliary feedwater pumps, thereby serving as a backup water source to the condensate storage tank.

3.8.2 System Definition

The SWS consists of two normal service water pumps, two emergency service water pumps, and two service water booster pumps. The normal service water pumps take suction from the circulating water cooling tower basin and furnish all normal operating service water requirements through a single supply line. The two emergency service water pumps take suction from the main and auxiliary reservoirs in the emergency service water intake structure. Each pump supplies a redundant loop serving essential components. One service water booster pump is installed in each loop on the supply line to the containment fan coolers.

The ultimate heat sink consists of two alternate sources of cooling water, the Auxiliary Reservoir and the Main Reservoir. The emergency service water pumps can take suction from either reservoir. Water from the plant is returned to the Auxiliary Reservoir. The two reservoirs are connected by the Auxiliary Dam spillway.

Normal service water is cooled by a natural draft, hyperbolic type cooling tower.

Simplified drawings of the SWS, focusing on emergency service water, are shown in Figures 3.8-1 and 3.8-2. A summary of data on selected SWS components is presented in Table 3.8-1.

3.8.3 System Operation

During startup, shutdown, and normal operation, service water requirements can be met by one of the normal service water pumps taking suction on the circulating water cooling tower basin. The heated service water is returned to the cooling tower via the circulating water return pipes. When operable, the cooling tower can provide cooling water for plant shutdown without reliance on the Main or Auxiliary Reservoirs. During shutdown the cooling tower evaporative losses are sufficiently low so that makeup to the cooling tower is not required (Ref. 1, Section 9.2.1.2).

During emergency operation the ultimate heat sink dissipates the service water heat load. The Auxiliary Reservoir is the primary source of cooling water. When the level in the Auxiliary Reservoir is low, the suction of the emergency service water pumps is manually switched to the Main Reservoir.

The emergency service water pumps are located in dedicated bays in the Emergency Service Water and Cooling Tower Makeup Intake Structure. Each pump discharges into a separate pipeline which serves a redundant supply header. The equipment cooled by the emergency service water headers include the diesel generators, component cooling water heat exchangers, charging pumps, and containment fan coolers. Both emergency service water pumps can cool all three charging pumps. Both emergency service water pumps can also provide water to the suction of the Auxiliary Feedwater System pumps, thereby serving as a backup water source to the condensate storage tank.

The service water booster pumps are installed in the lines to the containment fan coolers. During emergency operation these pumps will maintain the service water pressure inside the coolers above the containment design pressure to prevent radioactive leaks into the Service Water System.

3.8.4 System Success Criteria

Under emergency shutdown and accident conditions, system success can be achieved by one emergency service water pump. The pump used should be of the same train as the essential equipment in need of cooling.

3.8.5 Component Information

A. Emergency service water pumps 1A, 1B
   1. Rated flow: 21,500 gpm @ 190 ft head (82 psid)
   2. Rated capacity: 100%

B. Normal service water pumps (2)
   1. Rated flow: 50,000 gpm @ 185 ft head (80 psid)

C. Service water booster pumps (2)
   1. Rated flow: 4250 gpm @ 120 ft head (52 psid)

3.8.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The emergency service water pumps will be started automatically on low pressure in the emergency service water header or on a safety injection signal.
   2. Remote Manual
      The emergency service water pumps can be operated from the control room.

B. Motive Power
   The motor-driven emergency service water pumps and motor-operated valves are Class 1E loads that can be supplied from the standby diesel generators as described in Section 3.6.

C. Other
   1. Lubrication and cooling are assumed to be provided locally for the SWS pumps.
   2. The SWS pump rooms are cooled by fan cooling units supplied from the SWS pump discharges.

3.8.7 Section 3.8 References

1. Shearon Harris Final Safety Analysis Report.

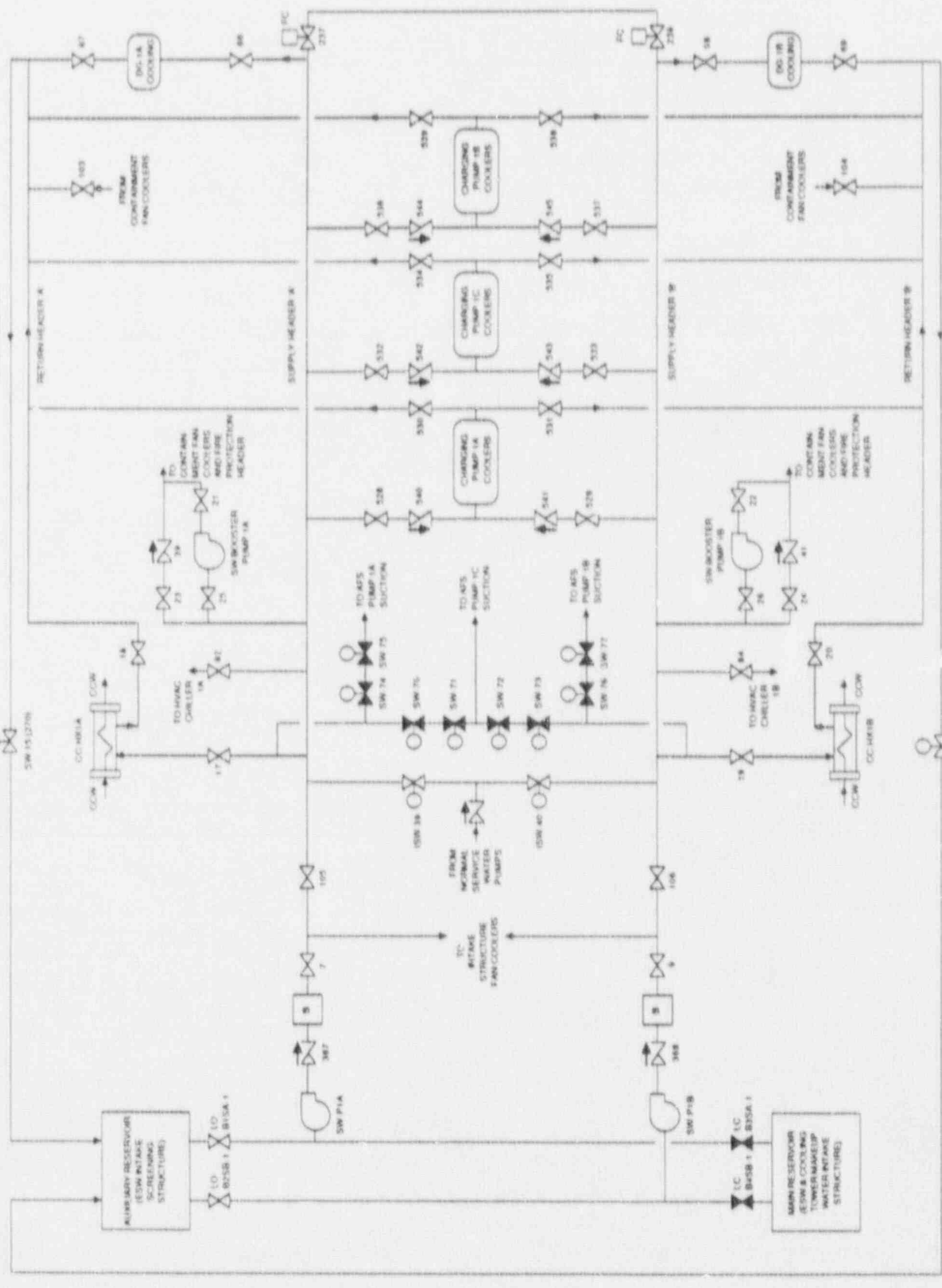


Figure 3.8-1. Shearon Harris Service Water System, Emergency Service Water Portion

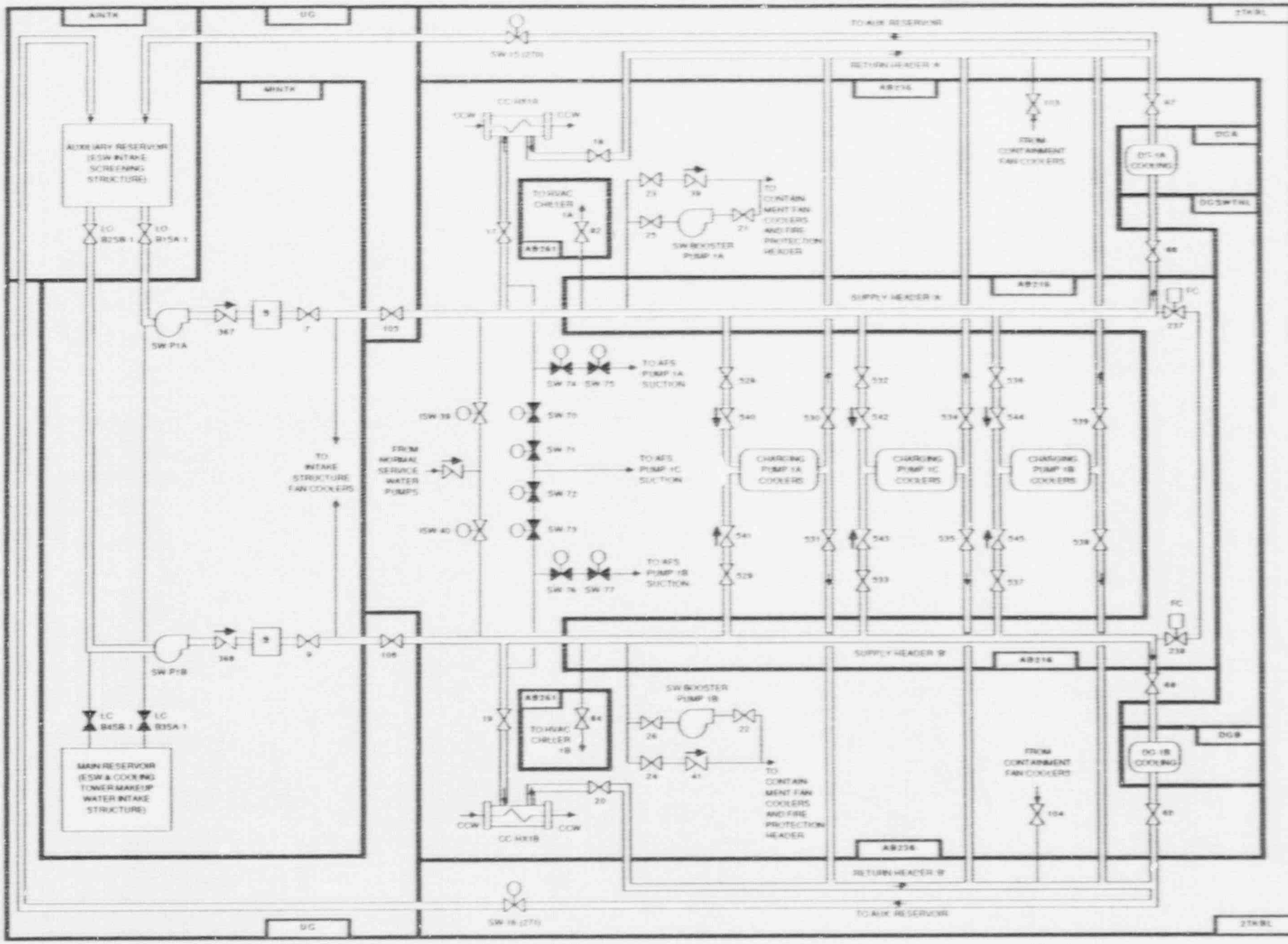


Figure 3.8-2. Shearon Harris Service Water System, Emergency Service Water Portion, Showing Component Locations

Table 3.8-1. Shearon Harris Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SW-15 (270)	MOV	2TKBL	MCC-1A35	480	AB261	AC/A
SW-16 (271)	MOV	2TKBL	MCC-1B35	480	AB261	AC/B
SW-70	MOV	AB236	MCC-1A35	480	AB261	AC/A
SW-71	MOV	AB236	MCC-1A35	480	AB261	AC/A
SW-72	MOV	AB236	MCC-1B35	480	AB261	AC/B
SW-73	MOV	AB236	MCC-1B35	480	AB261	AC/B
SW-74	MOV	AB236	MCC-1A35	480	AB261	AC/A
SW-75	MOV	AB236	MCC-1A35	480	AB261	AC/A
SW-76	MOV	AB236	MCC-1B35	480	AB261	AC/B
SW-77	MOV	AB236	MCC-1B35	480	AB261	AC/B
SW-AUX	TANK	AINTK				
SW-MAIN	TANK	MINTK				
SW-P1A	MDP	MINTK	BUS-1A	6900	SGRMA	AC/A
SW-P1B	MDP	MINTK	BUS-1B	6900	SGRMB	AC/B

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Shearon Harris site is located near the town of New Hill, NC. The site was originally established for four units, and occupies approximately 10,723 acres of land in southwest Wake County and southeast Chatham County. The environment is rural and primarily devoted to farming and dairying. The site is about 16 miles southwest of Raleigh and about 15 miles northeast of Sanford. Figure 4-1 (from Ref. 1) shows a general view of the site, while Figure 4-2 shows a simplified plot plan.

The major structures include the containment building, reactor auxiliary building, fuel handling building, turbine building, service building, diesel generator building, and cooling tower.

The reactor containment contains the RCS and portions of the AFS, ECCS, and CVCS for each unit.

The reactor auxiliary building, located north and east of the containment, contains the major engineered safety features components. Components of the AFS, ECCS, CVCS, CCWS, and electric power system are located in the auxiliary building. The control room is also located in the auxiliary building.

The fuel handling building is located west of the containment and contains the spent fuel pool. The turbine building is located east of the auxiliary building and contains components of the power conversion system. The diesel generator building is located east of the turbine building.

4.2 FACILITY LAYOUT DRAWINGS

Section views of the Shearon Harris containment, auxiliary, fuel handling and diesel buildings are shown in Figures 4-3 to 4-6. Simplified layout drawings of the auxiliary building are shown in Figures 4-7 to 4-13 and the diesel generator building is shown in Figures 4-14 to 4-16. Major rooms, stairways, elevators, and doorways are shown in the simplified layout drawings, however, many interior walls have been omitted for clarity. Labels printed in uppercase correspond to the location codes listed in Table 4-1 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

A listing of components by location is presented in Table 4-2. Components included in Table 4-2 are those found in the system data tables in Section 3, therefore this table is only a partial listing of the components and equipment that are located in a particular room or area of the plant.

4.3 SECTION 4 REFERENCES

1. Heddleson, F. A., "Design Data and Safety Features of Commercial Nuclear Power Plants," ORNL-NSIC-55, Volume 3, Oak Ridge National Laboratory, Nuclear Safety Information Center, April 1974.

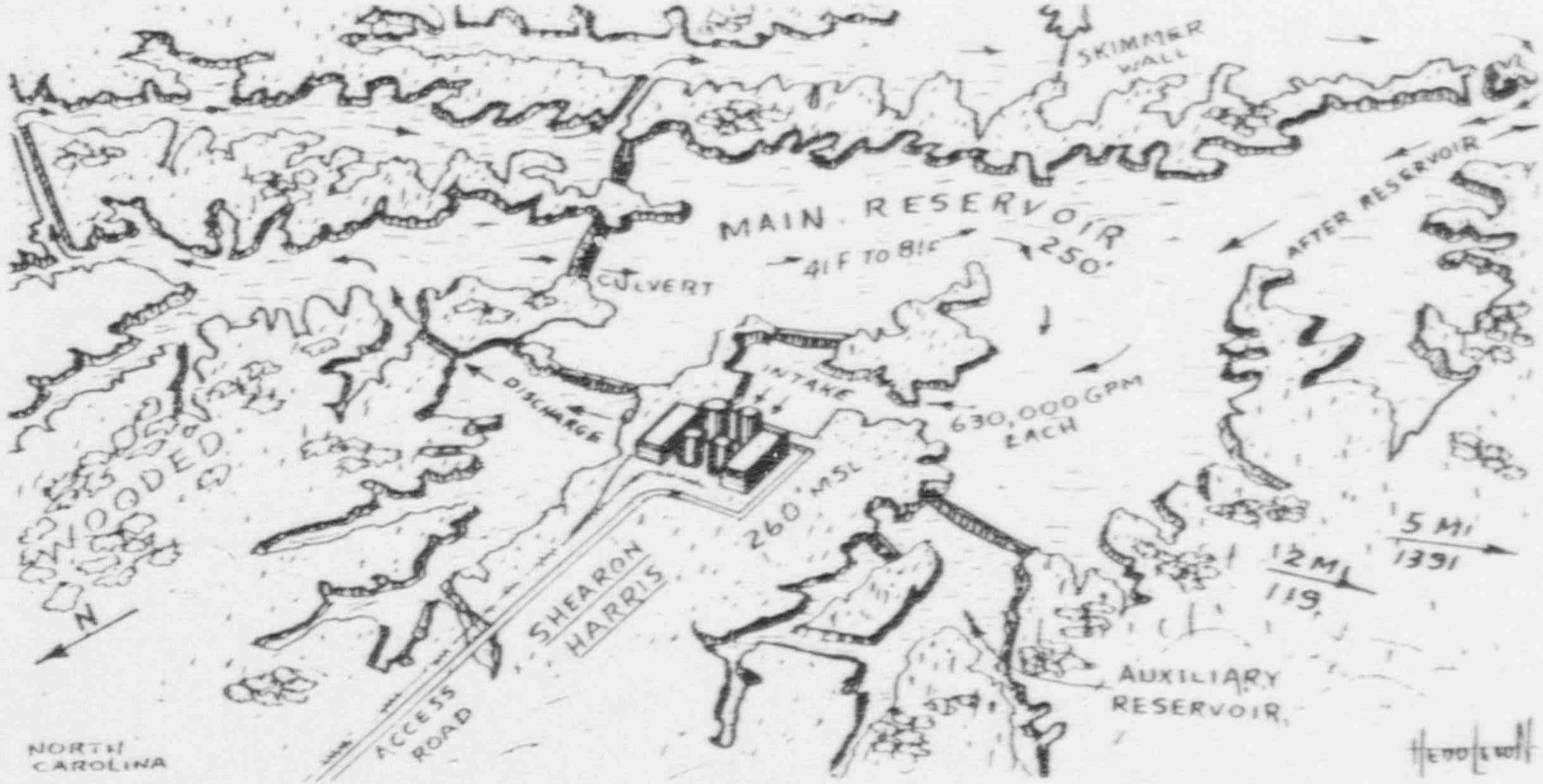


Figure 4-1. General View of Shearon Harris Site and Vicinity

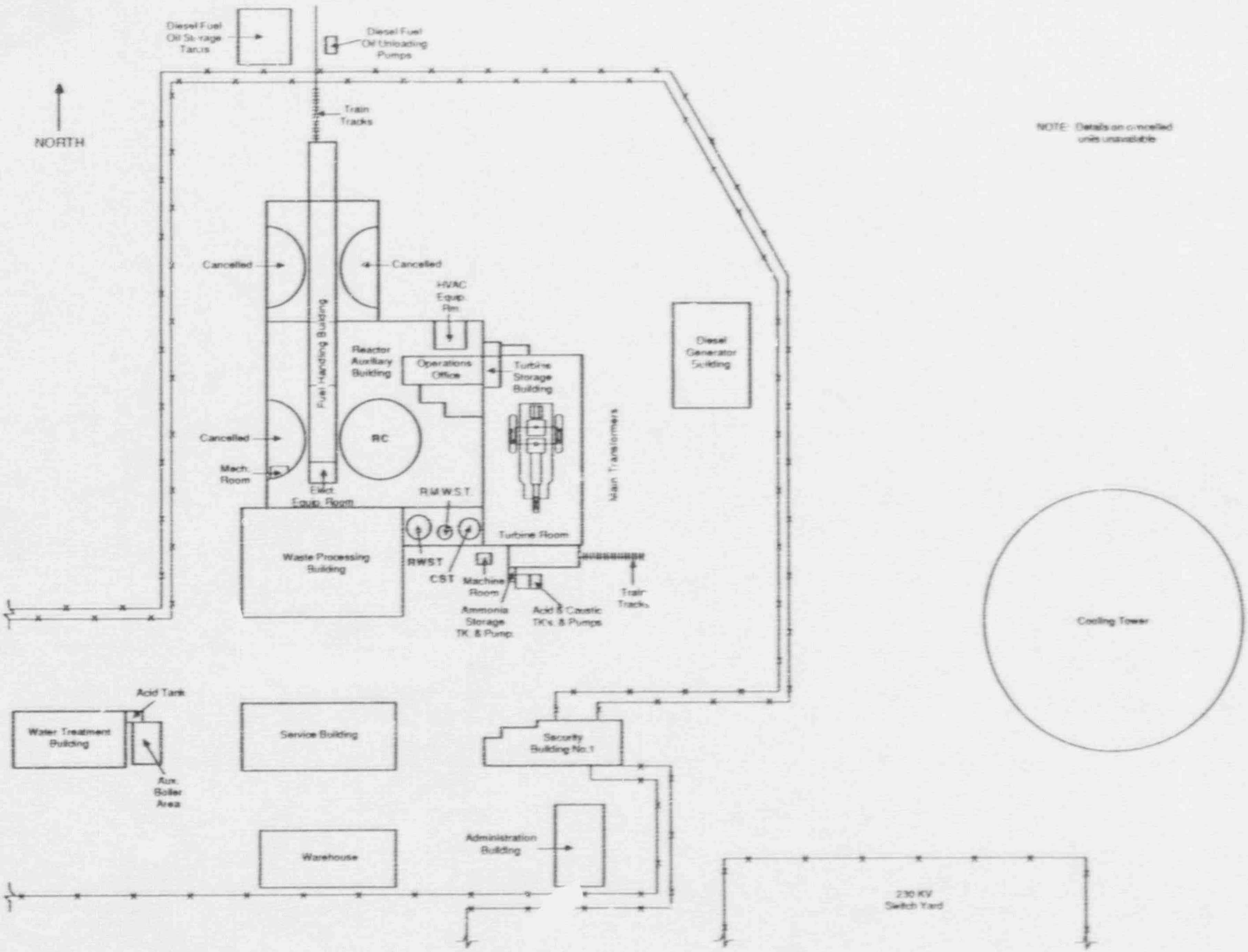


Figure 4-2. Shearon Harris General Plot Plan

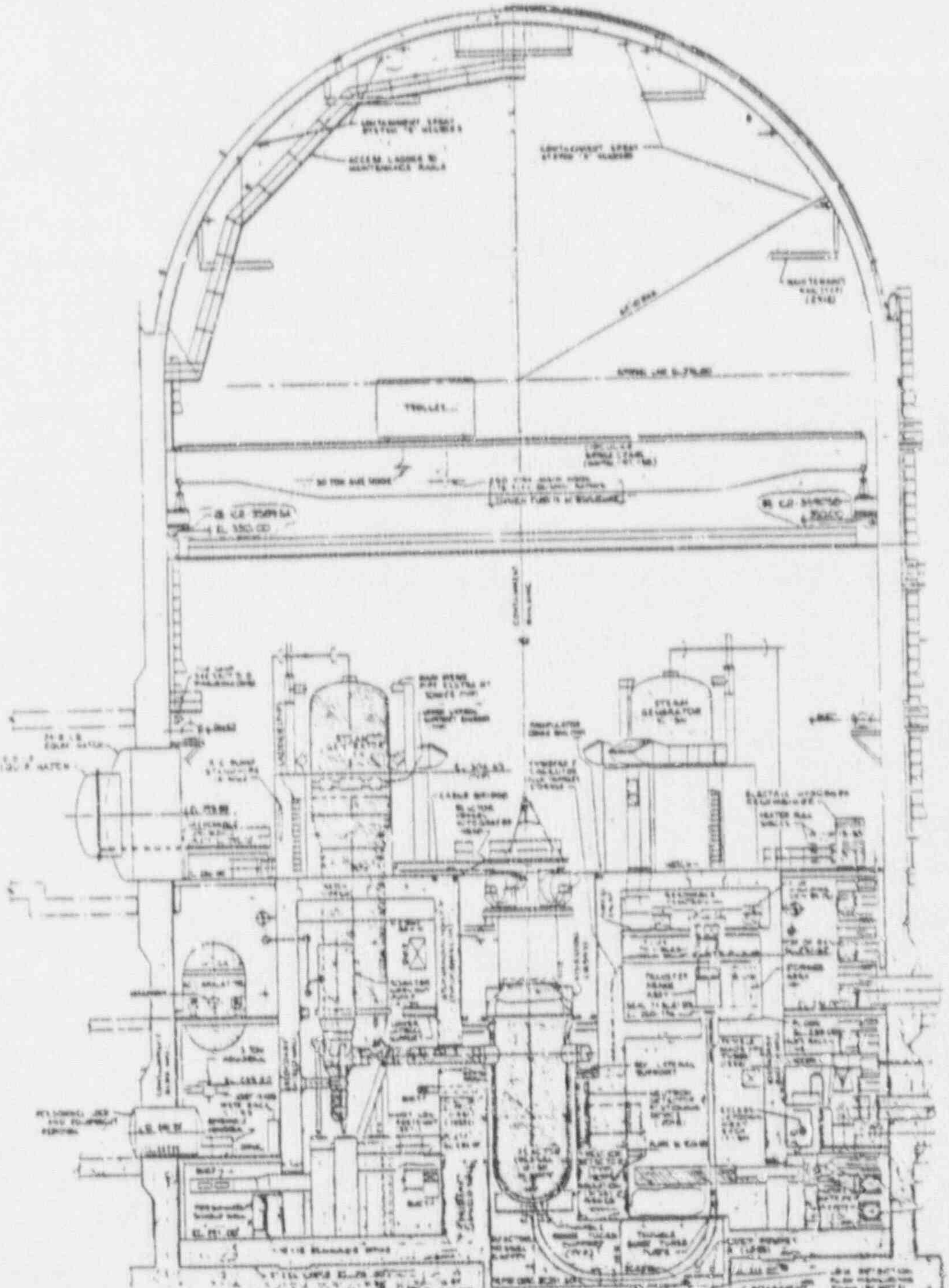


Figure 4-3. Shearon Harris Containment Building
Section Drawings (Page 1 of 2)

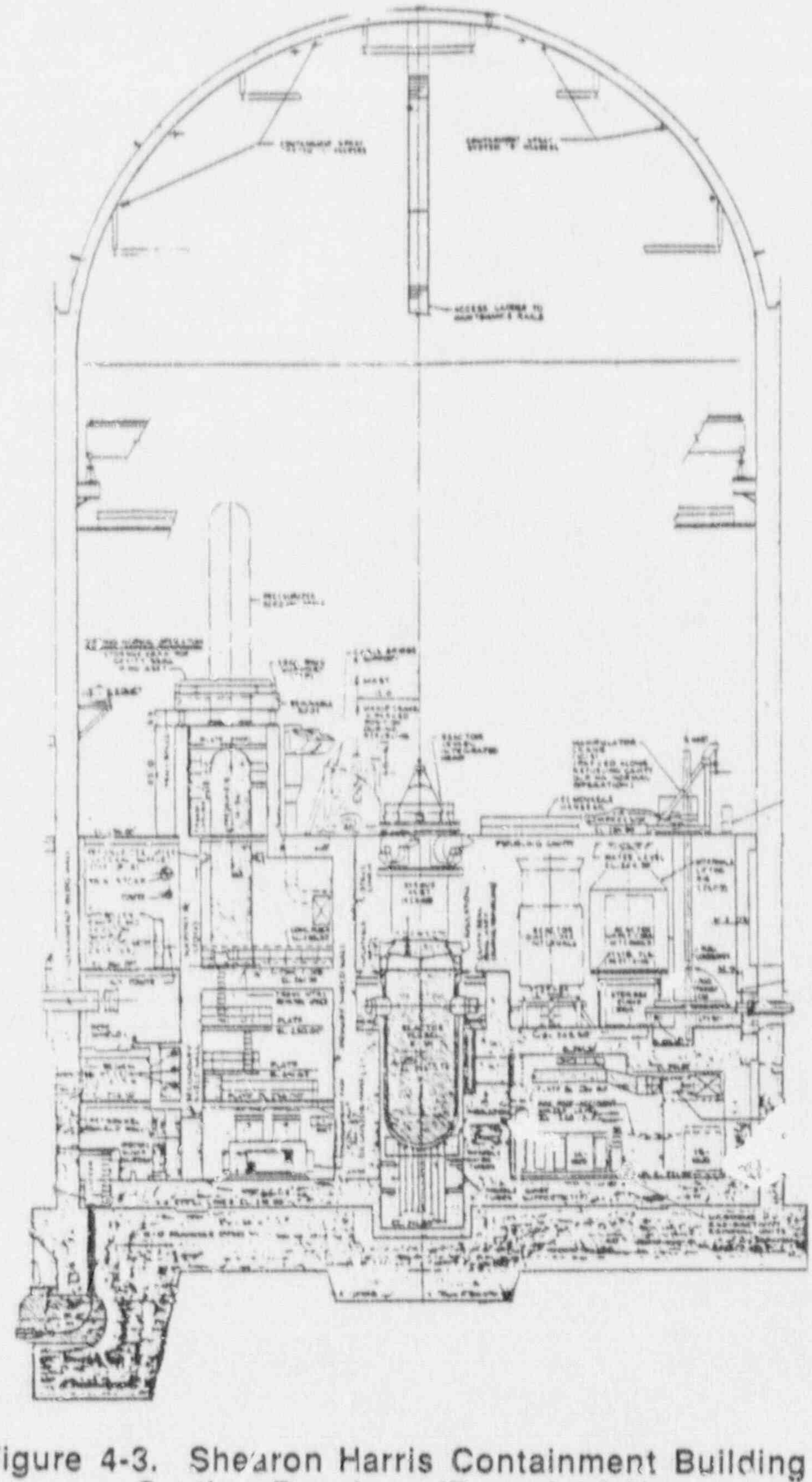


Figure 4-3. Shearon Harris Containment Building Section Drawings (Page 2 of 2)

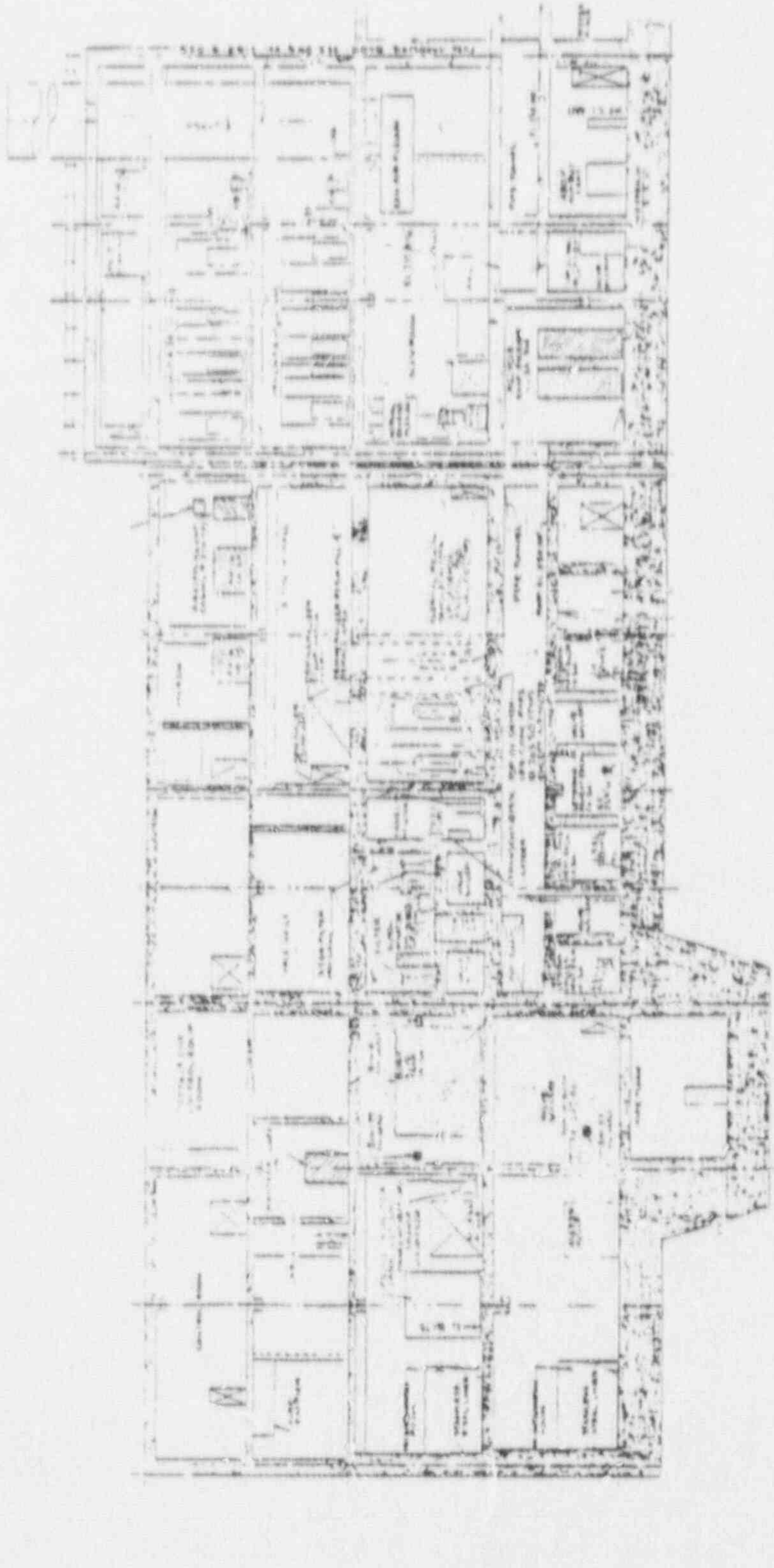


Figure 4-4. Shearon Harris Reactor Auxiliary Building Section Drawings (Page 1 of 4)

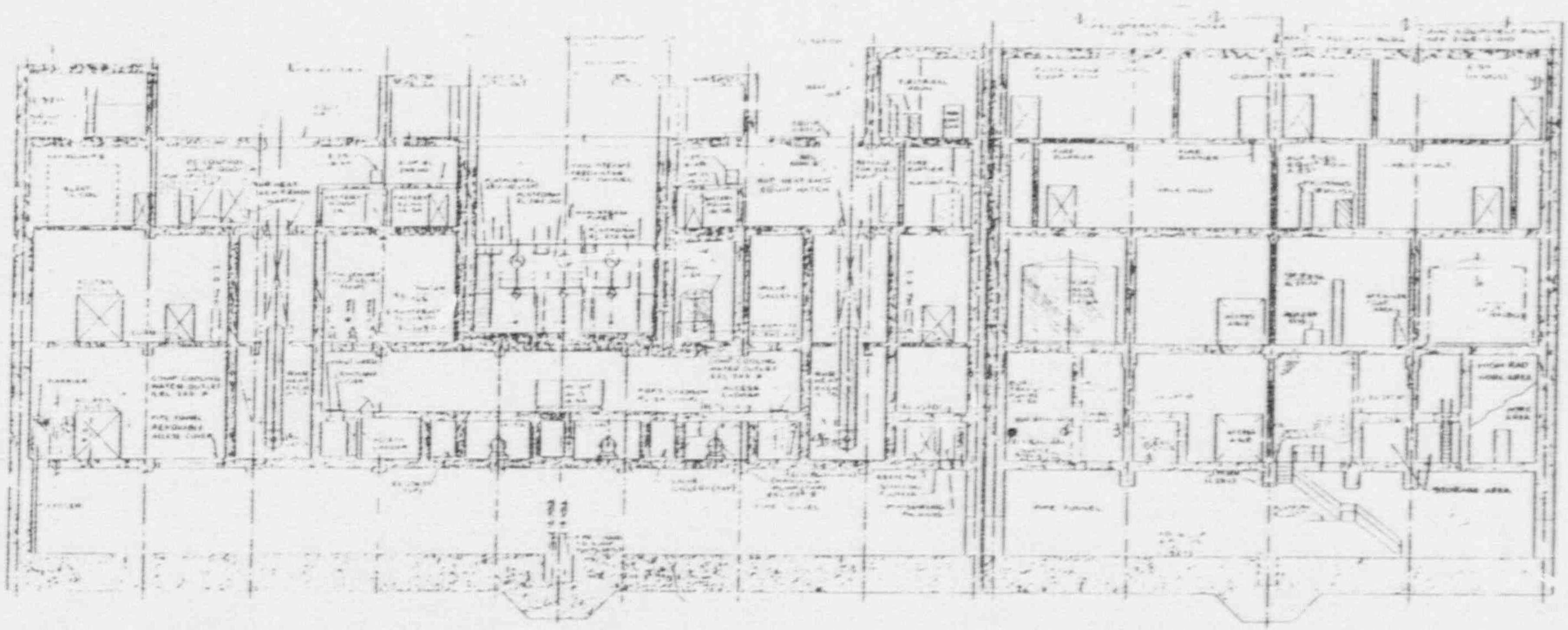


Figure 4-4. Shearon Harris Reactor Auxiliary Building Section Drawings (Page 2 of 4)

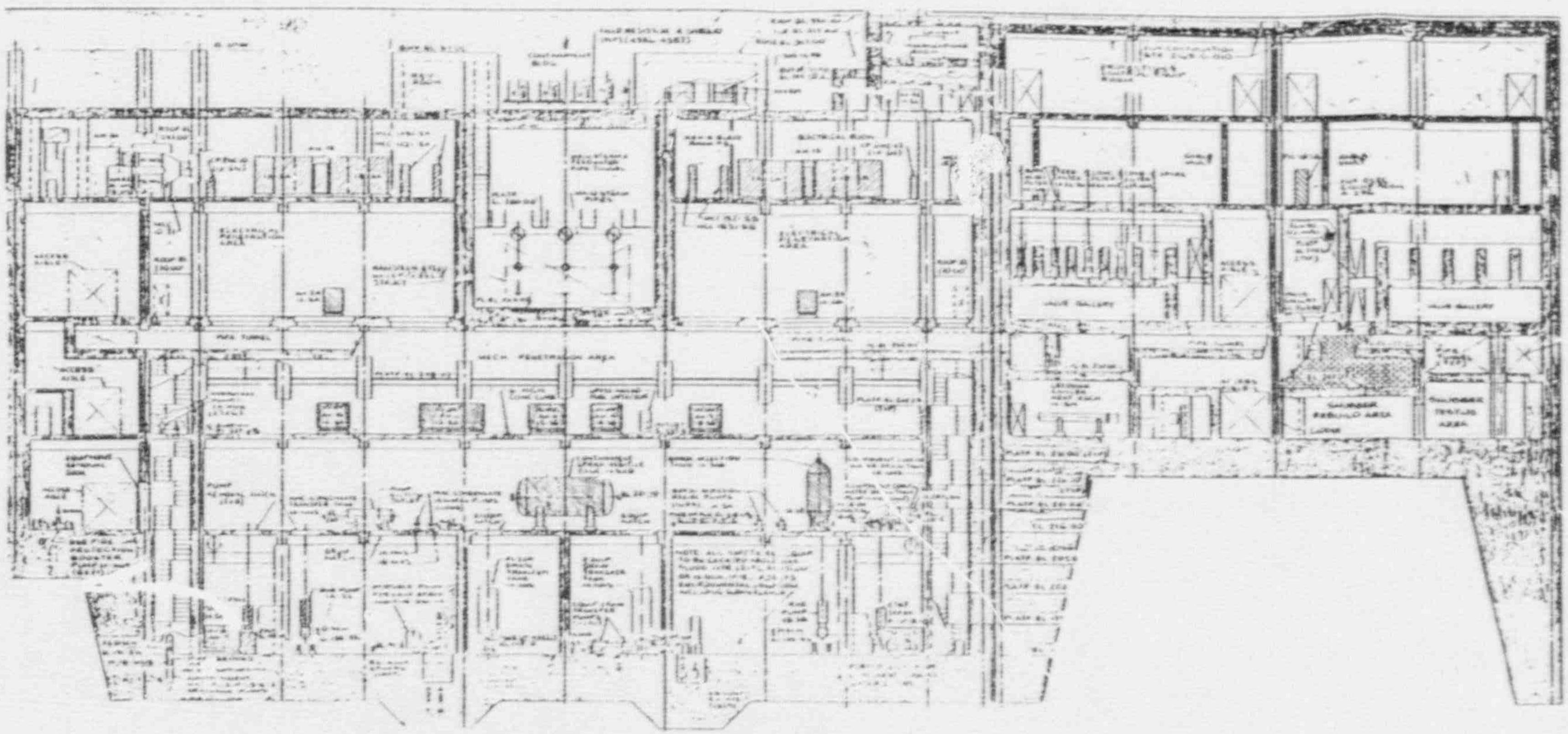


Figure 4-4. Shearon Harris Reactor Auxiliary Building Section Drawings (Page 3 of 4)

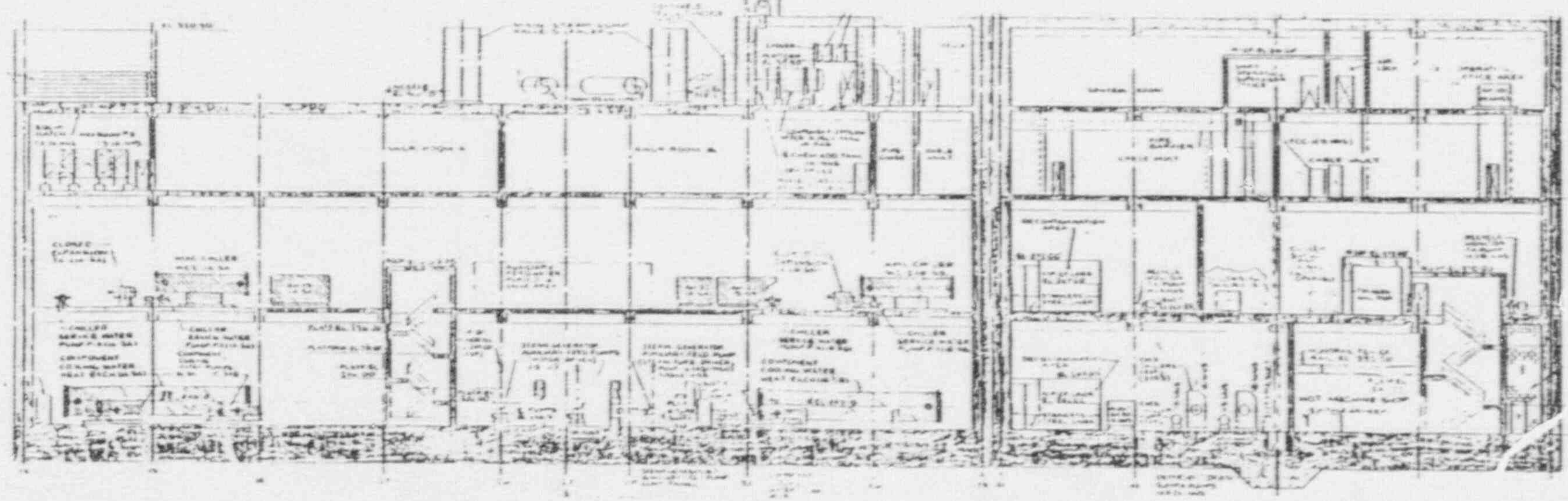


Figure 4-4. Shearon Harris Reactor Auxiliary Building Section Drawings (Page 4 of 4)

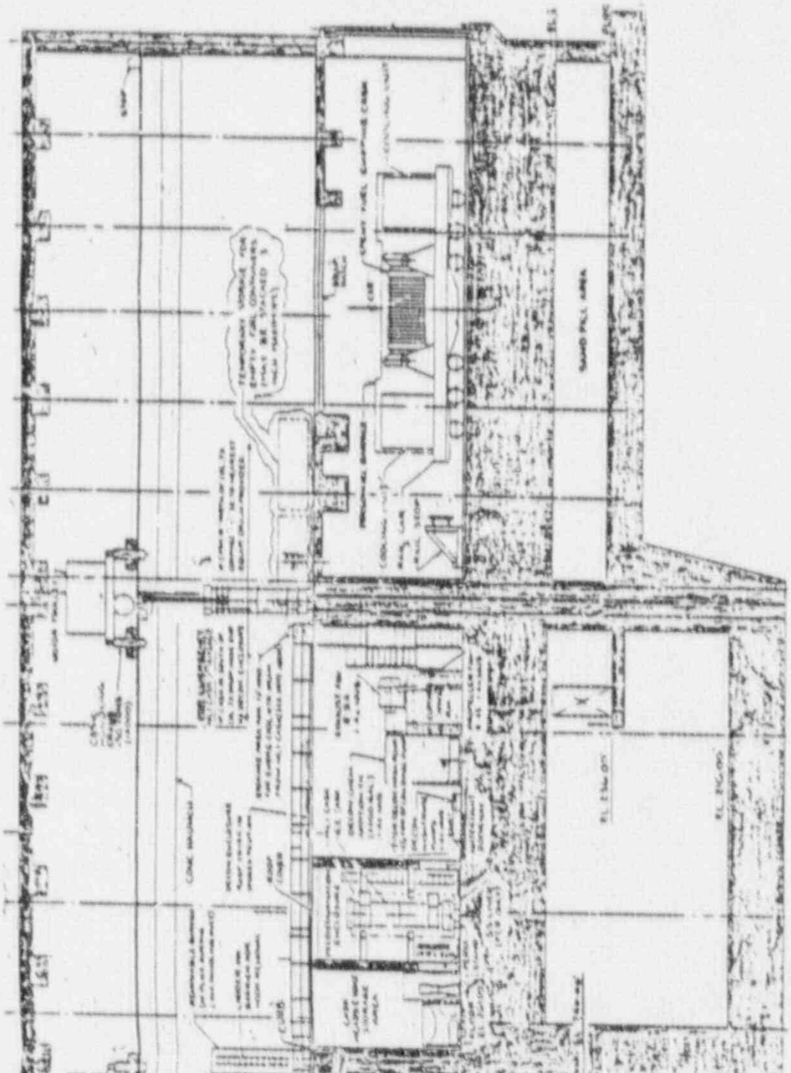


Figure 4-5. Shearon Harris Fuel Handling Building Section Drawings (Page 1 of 2)

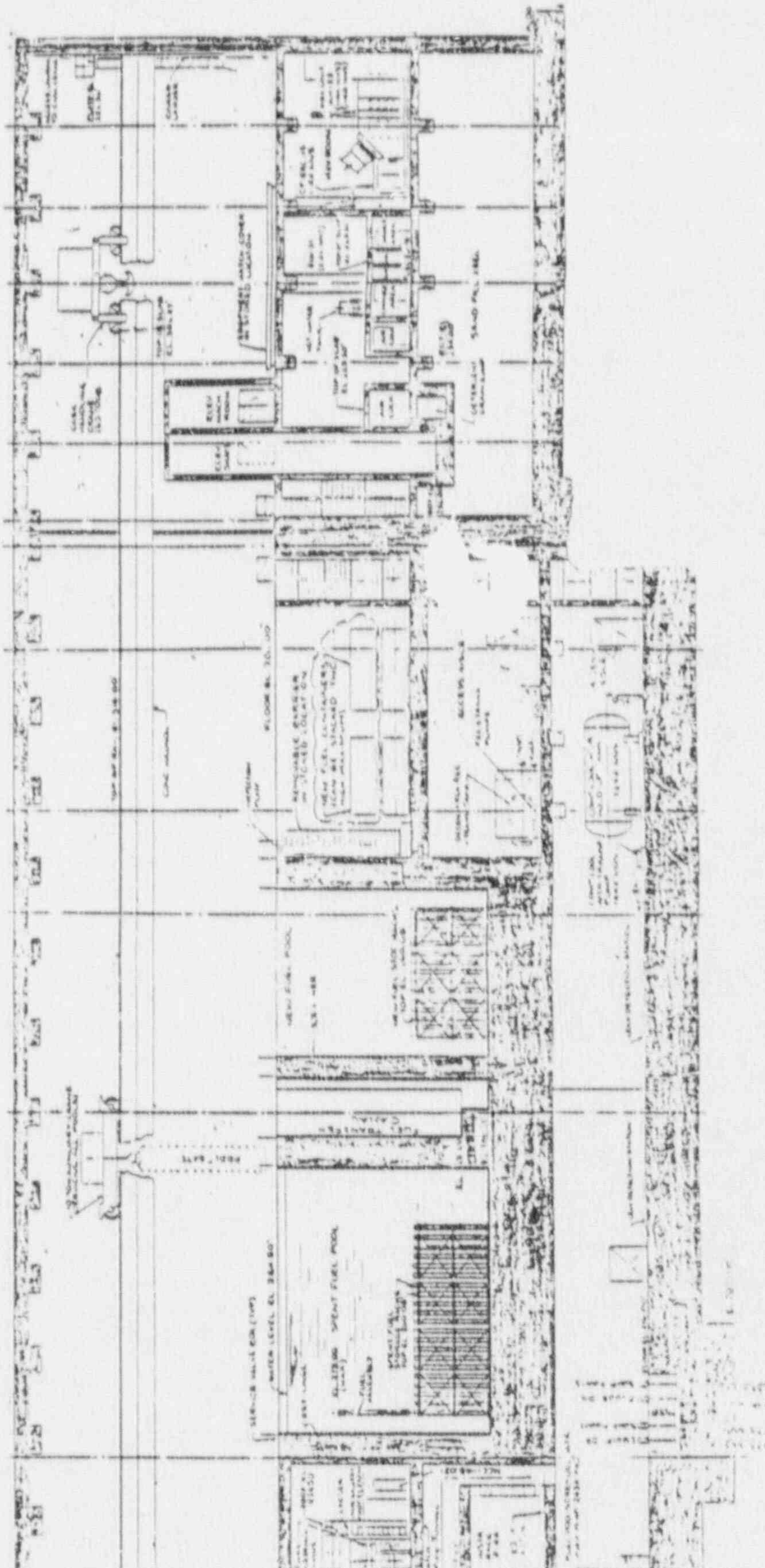


Figure 4-5. Shearon Harris Fuel Handling Building Section Drawings (Page 2 of 2)

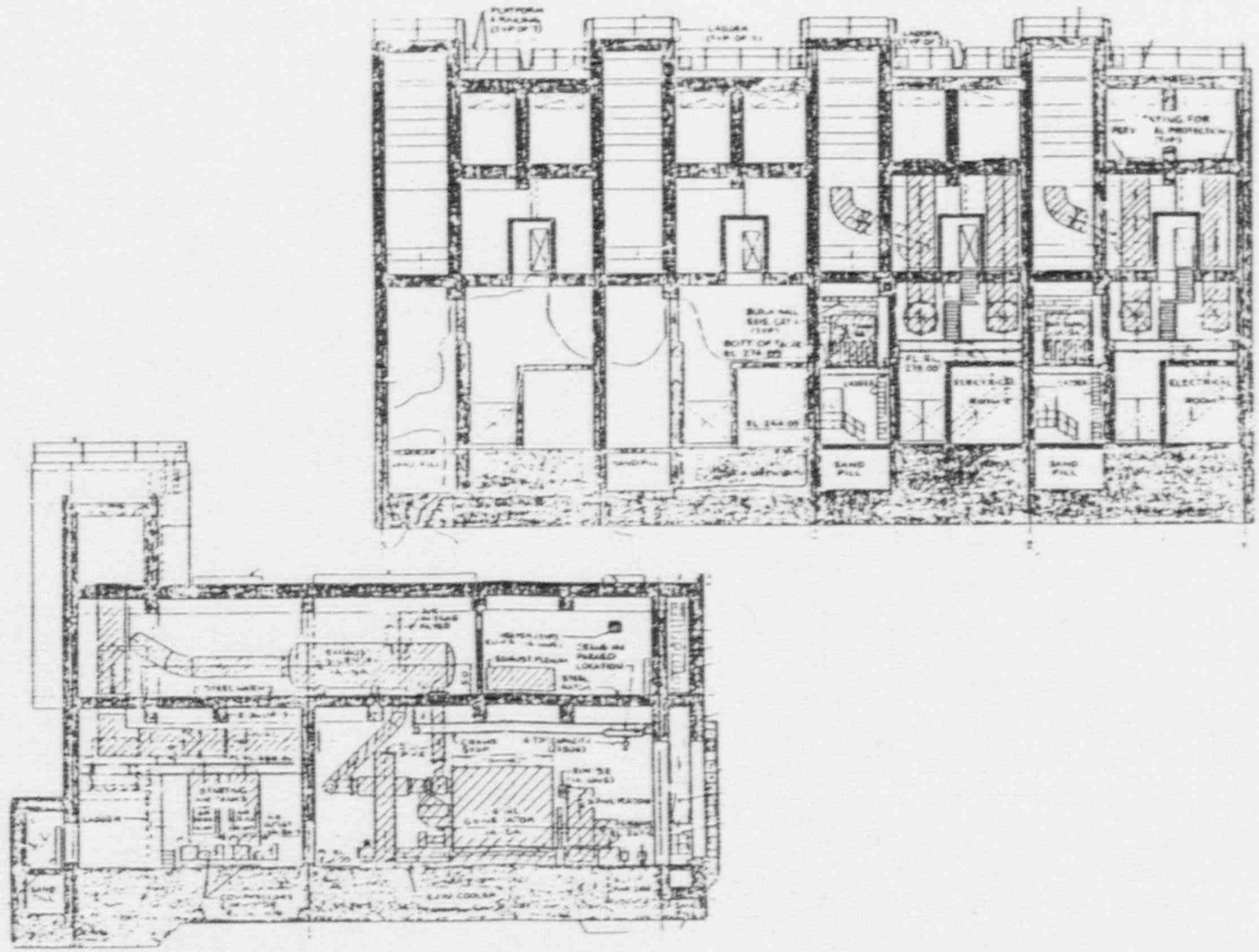


Figure 4-6. Shearon Harris Diesel Generator Building Section Drawings (Page 1 of 2)

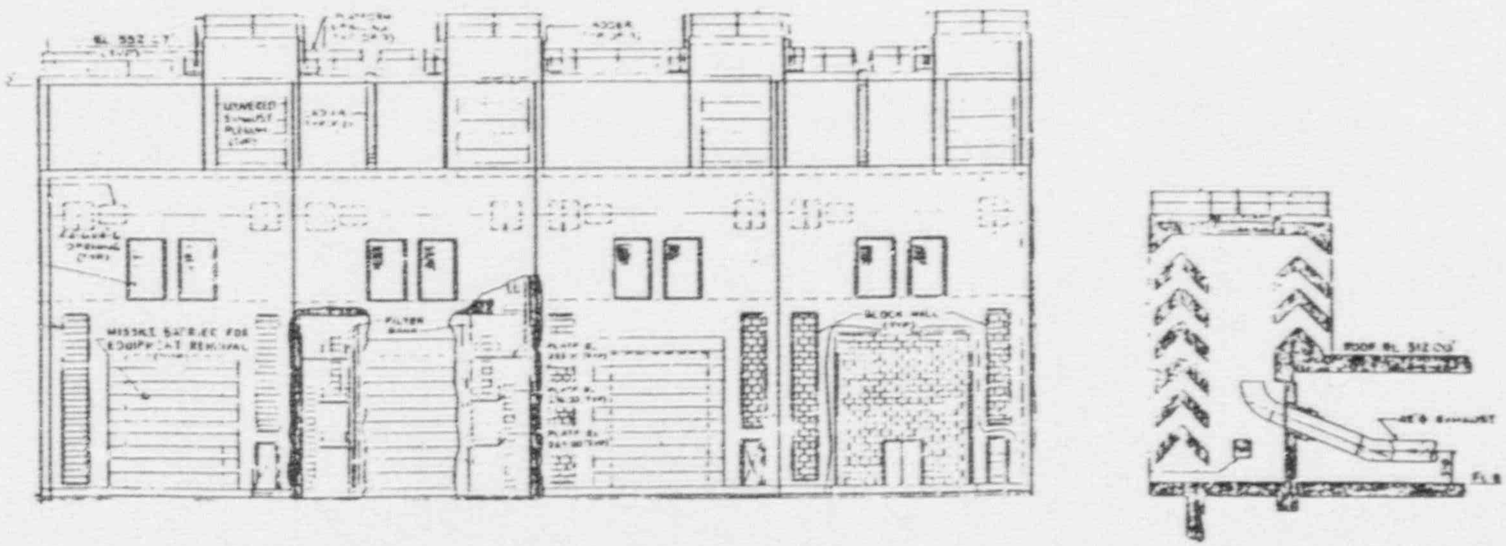


Figure 4-6. Shearon Harris Diesel Generator Building Section Drawings (Page 2 of 2)

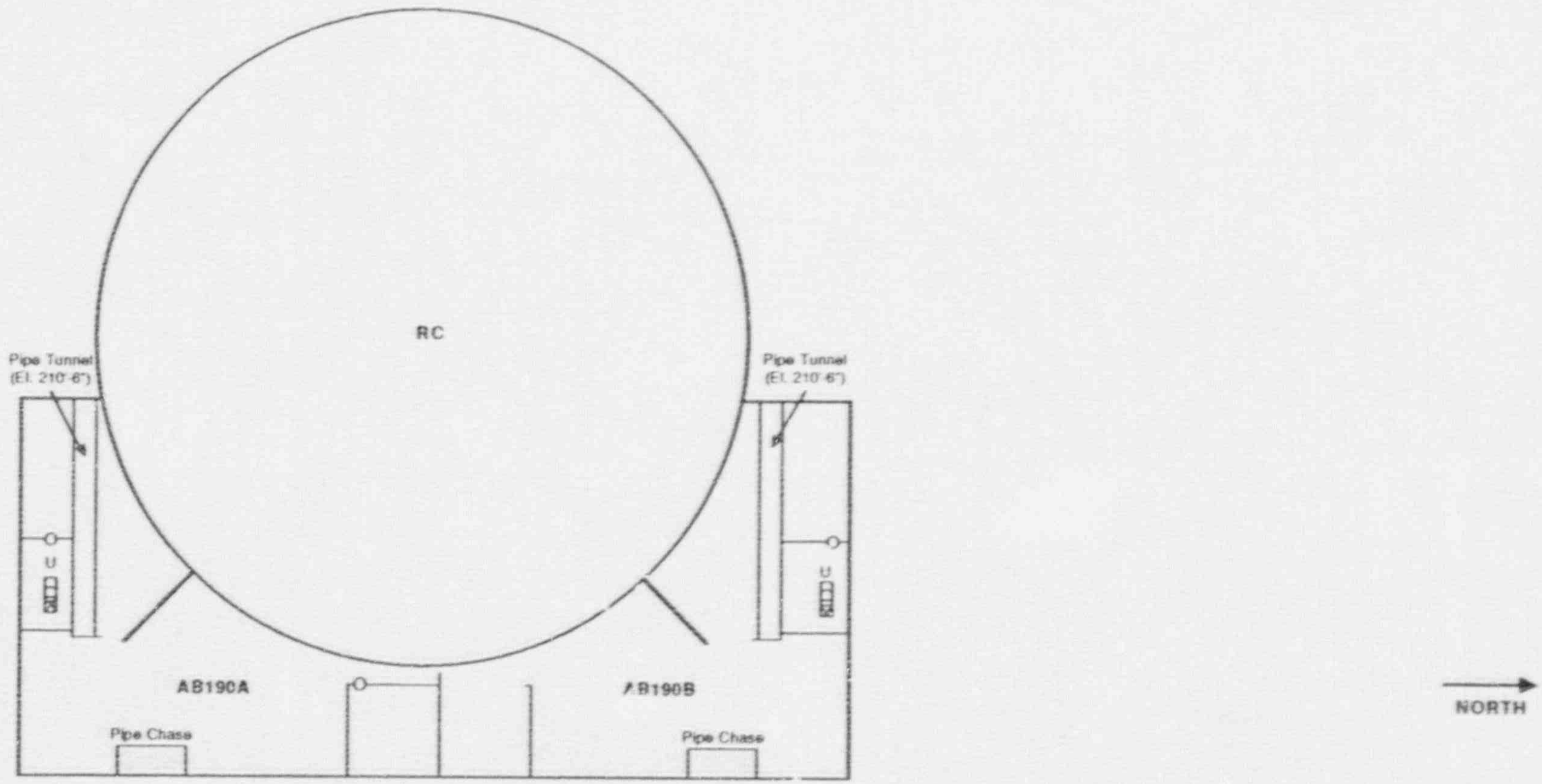


Figure 4-7. Shearon Harris Reactor Auxiliary Building, Elevation 190'-0"

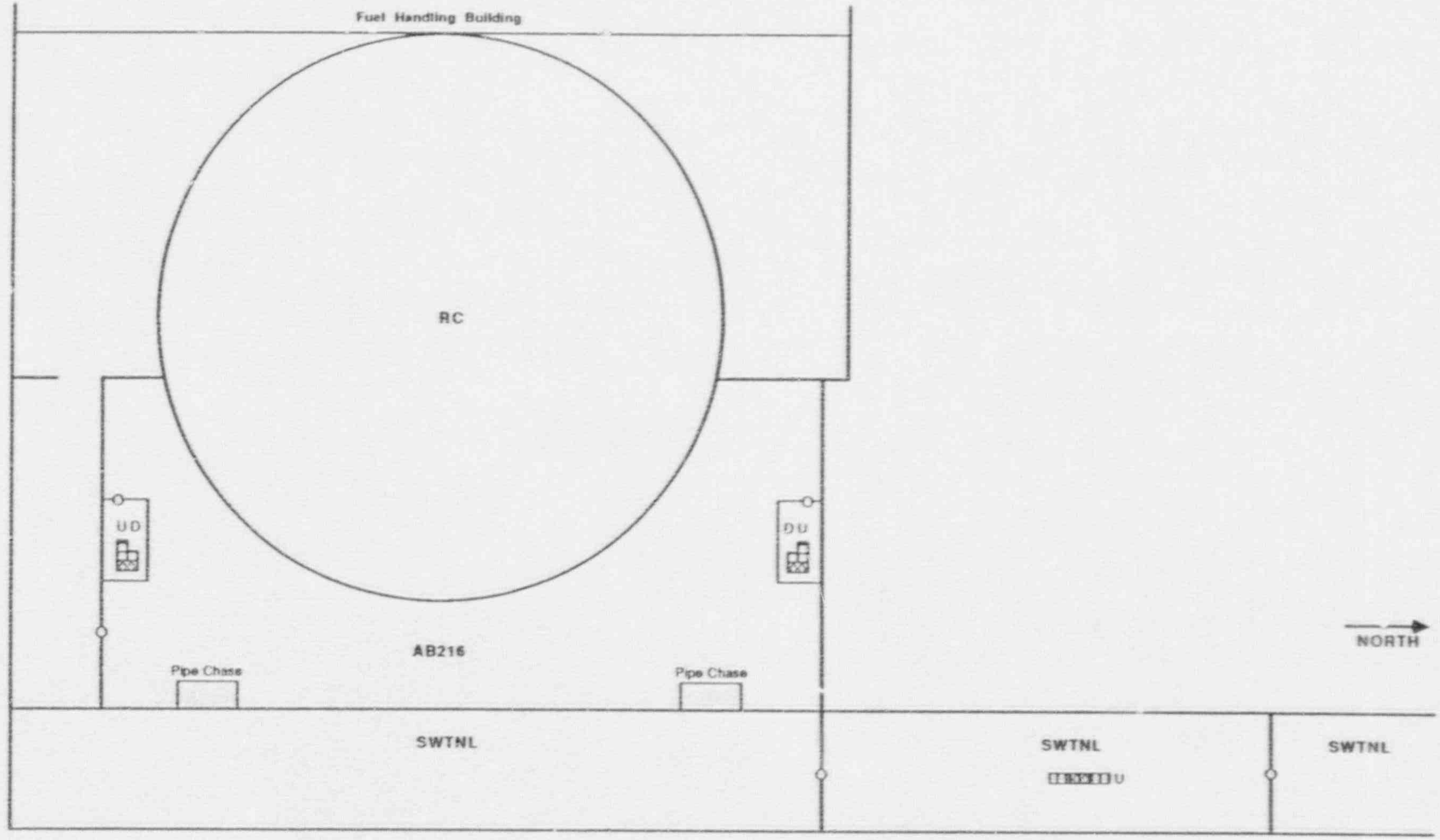


Figure 4-8. Shearon Harris Reactor Auxiliary Building, Elevation 216'-0"

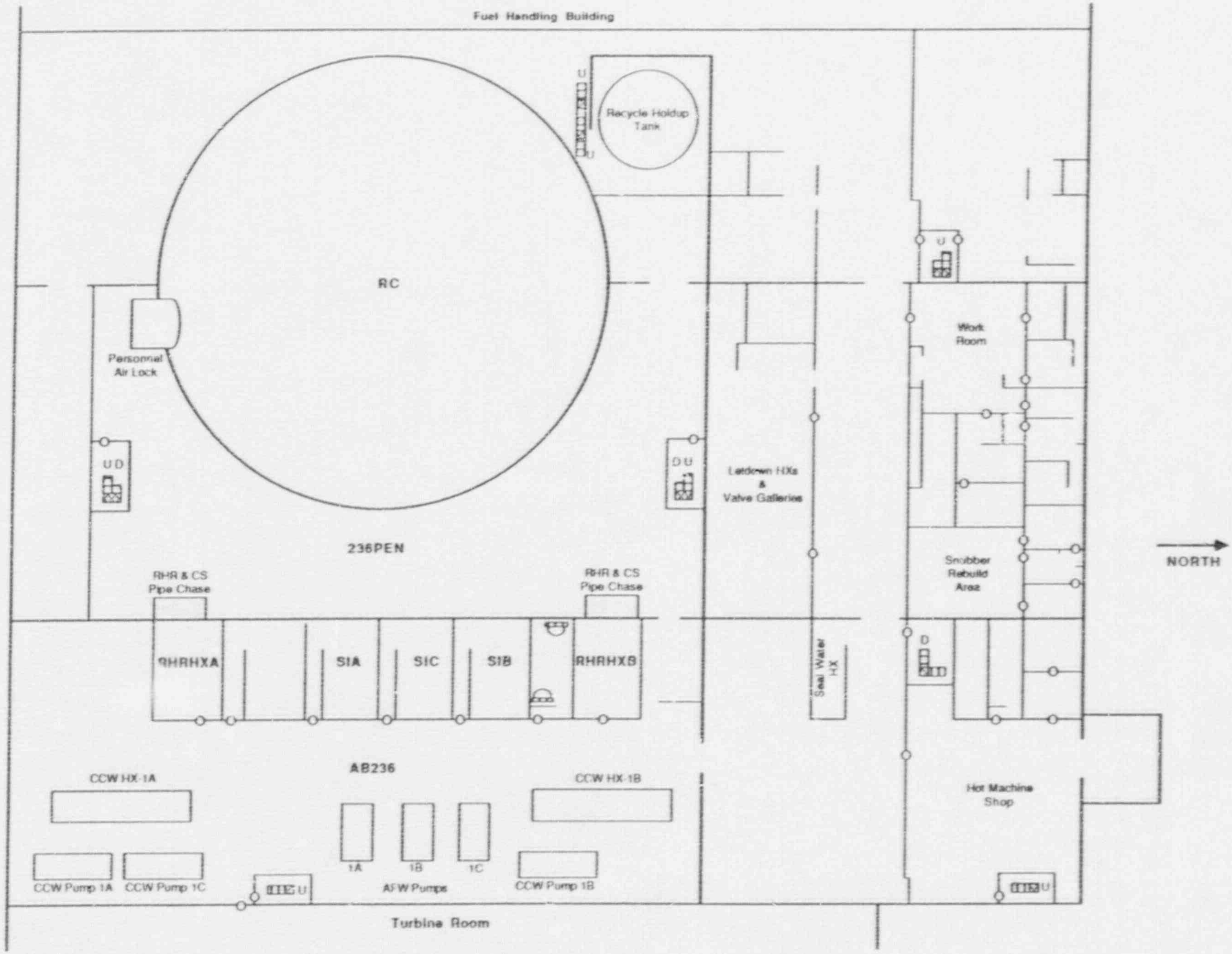


Figure 4-9. Shearon Harris Reactor Auxiliary Building, Elevation 236'-0"

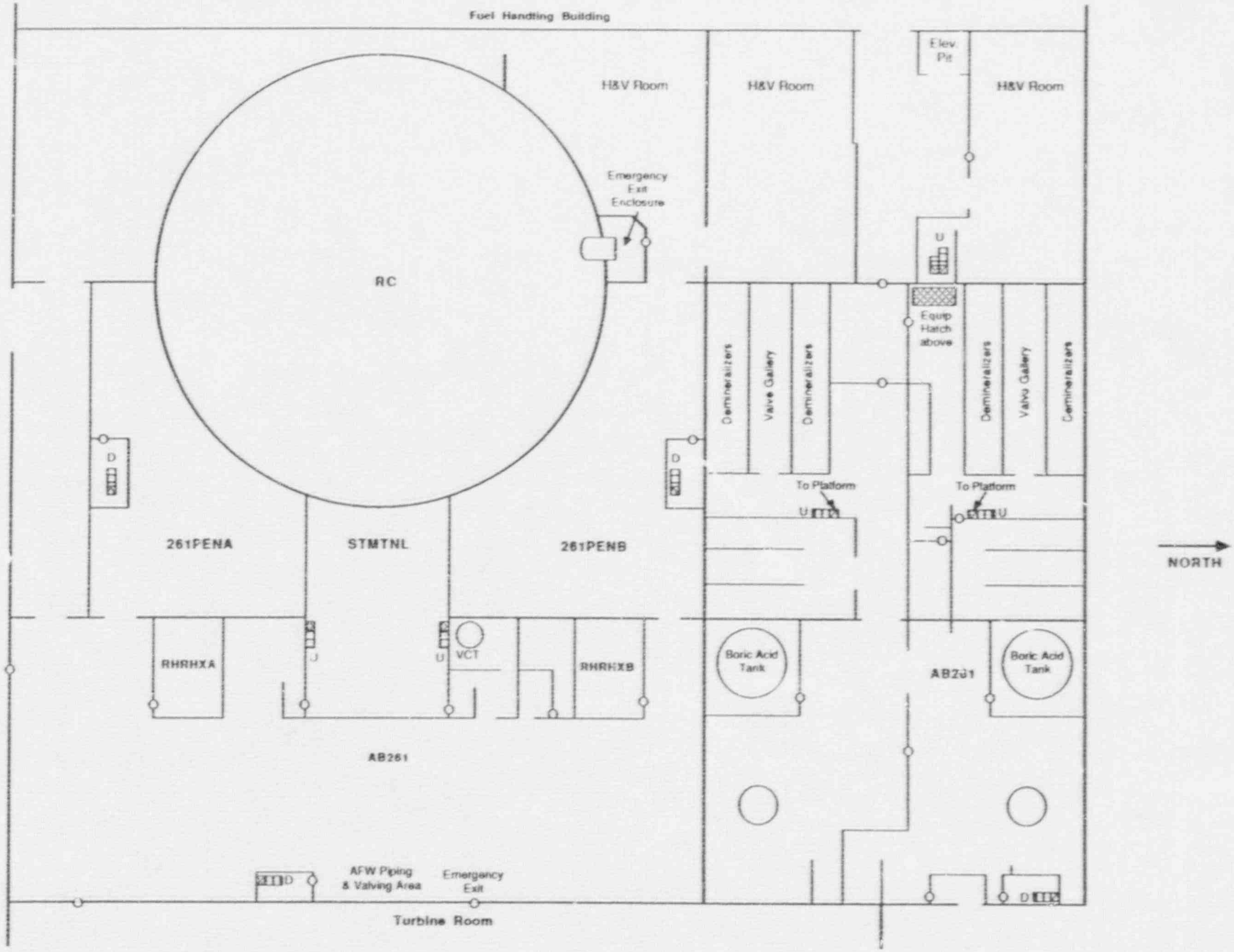


Figure 4-10. Shearon Harris Reactor Auxiliary Building, Elevation 261'-0"

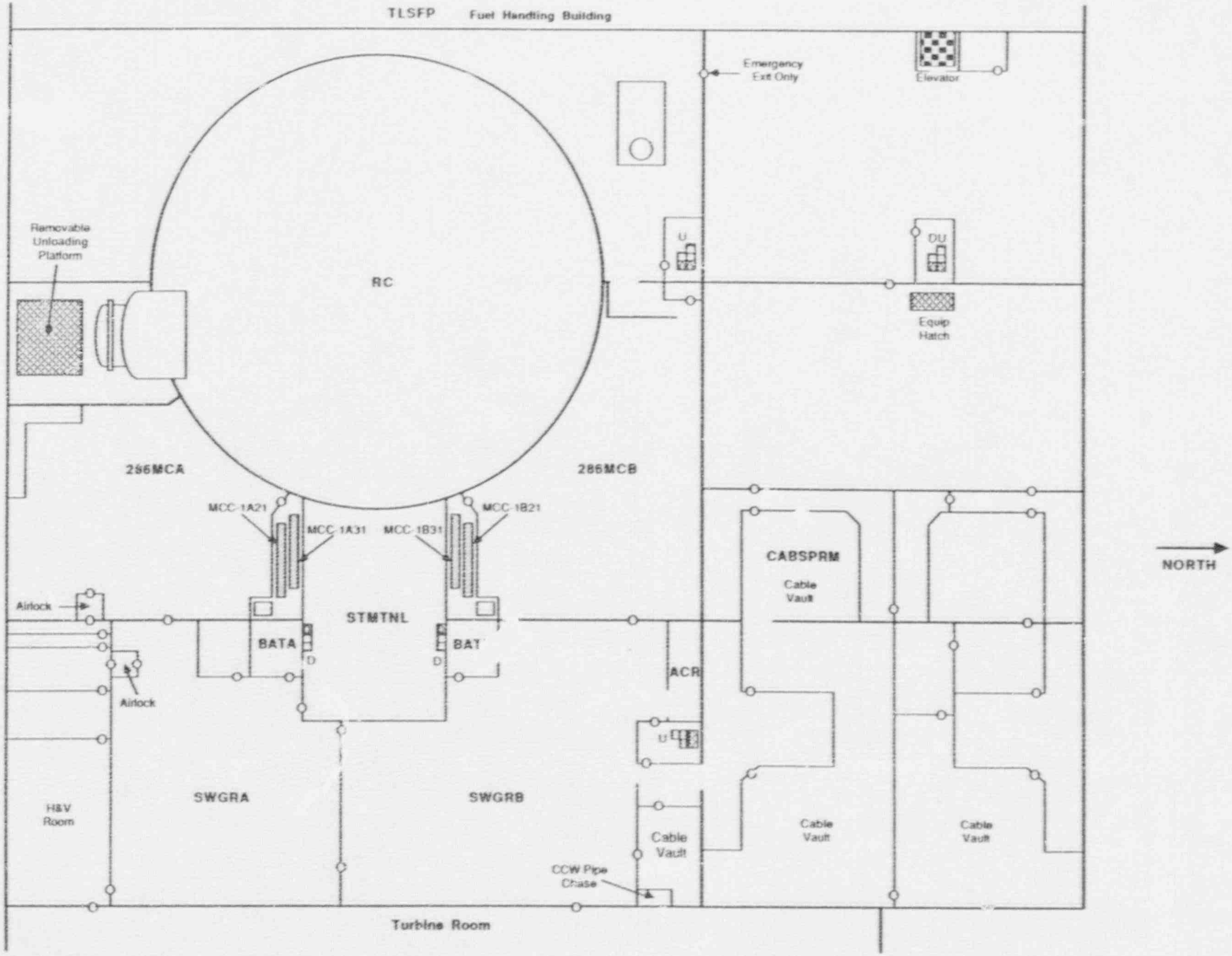


Figure 4-11. Shearon Harris Reactor Auxiliary Building, Elevation 286'-0"

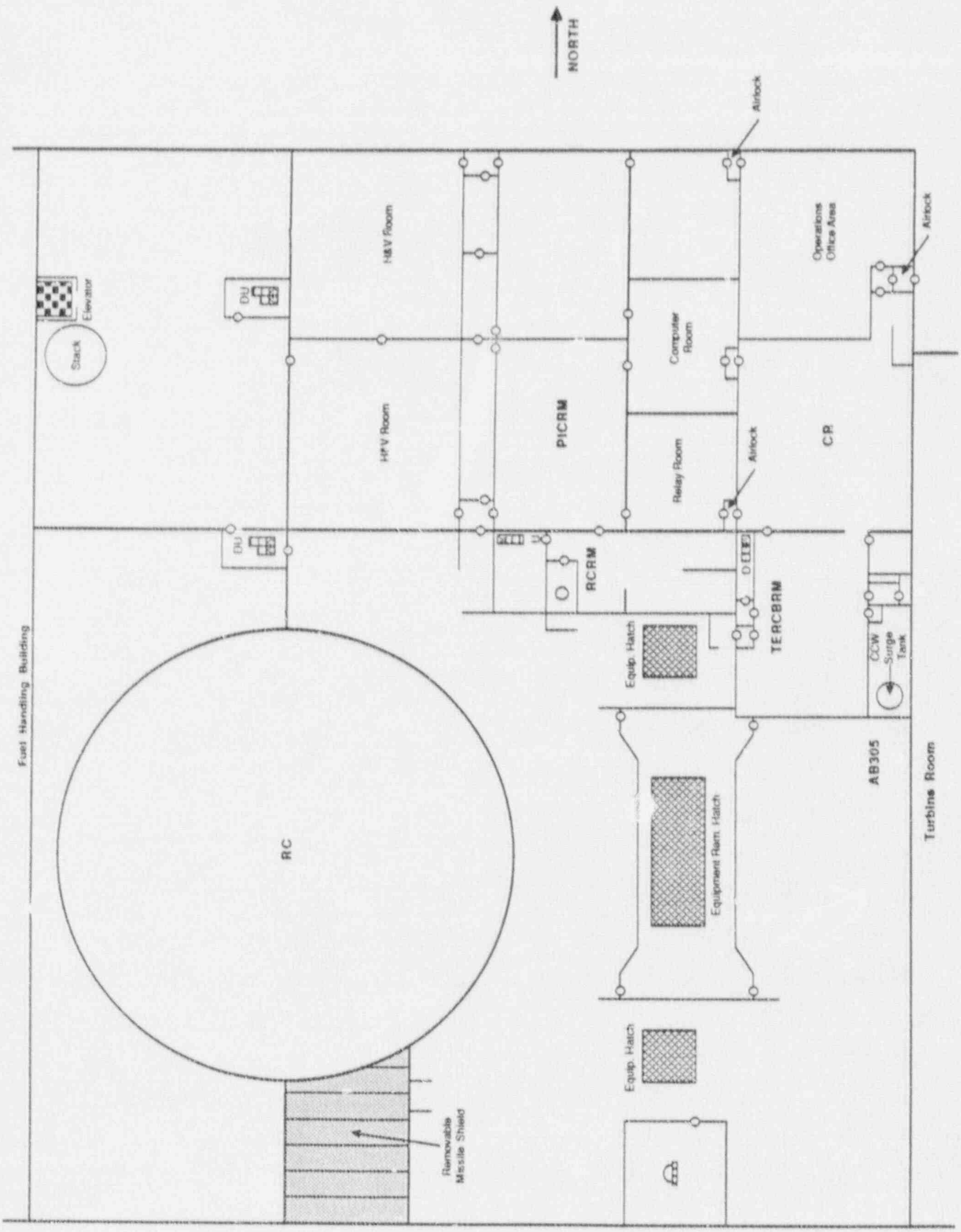


Figure 4-12. Shearon Harris Reactor Auxiliary Building, Elevation 305'-0"

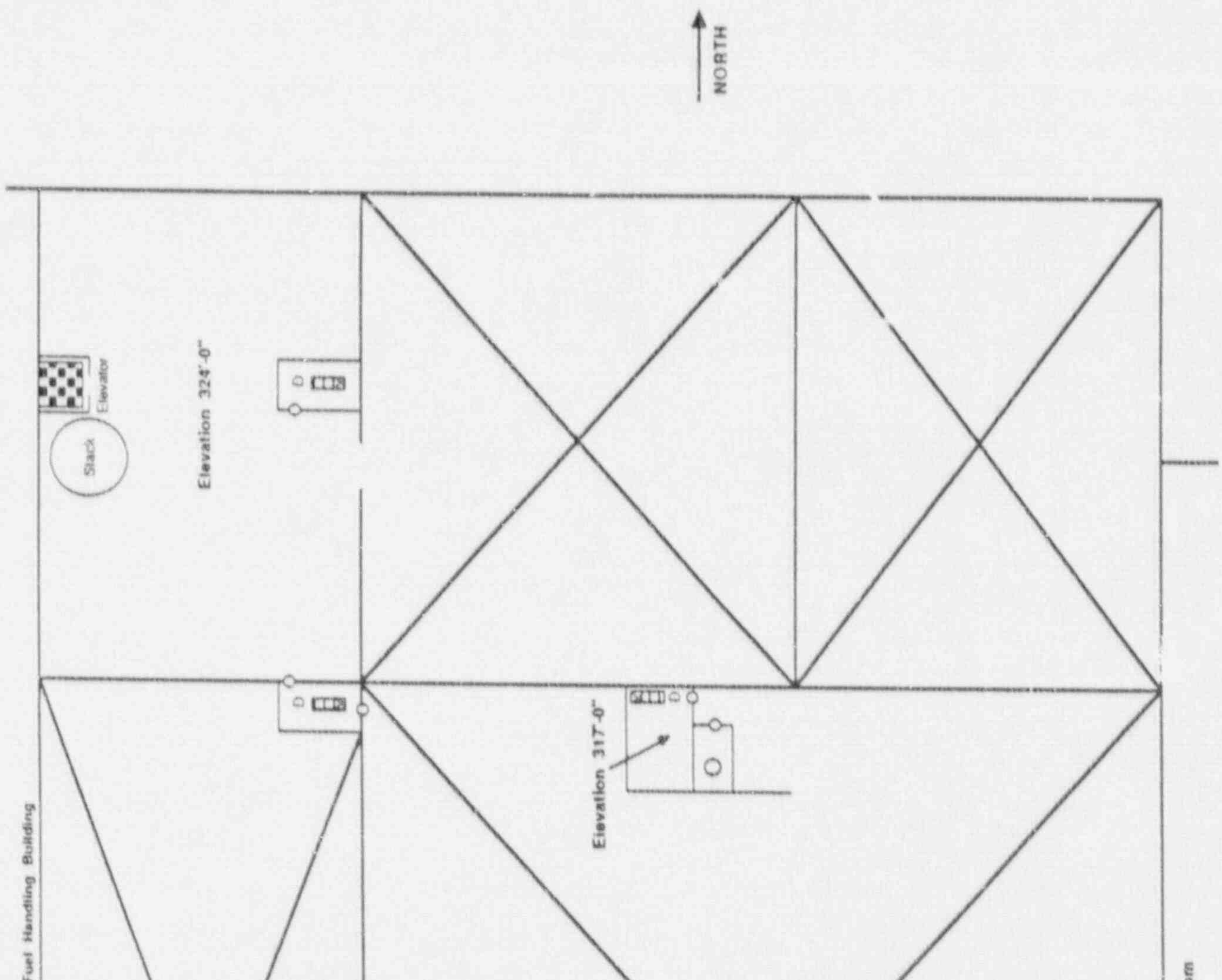


Figure 4-13. Shearon Harris Reactor Auxiliary Building, Elevations 317'-0" and 324'-0"

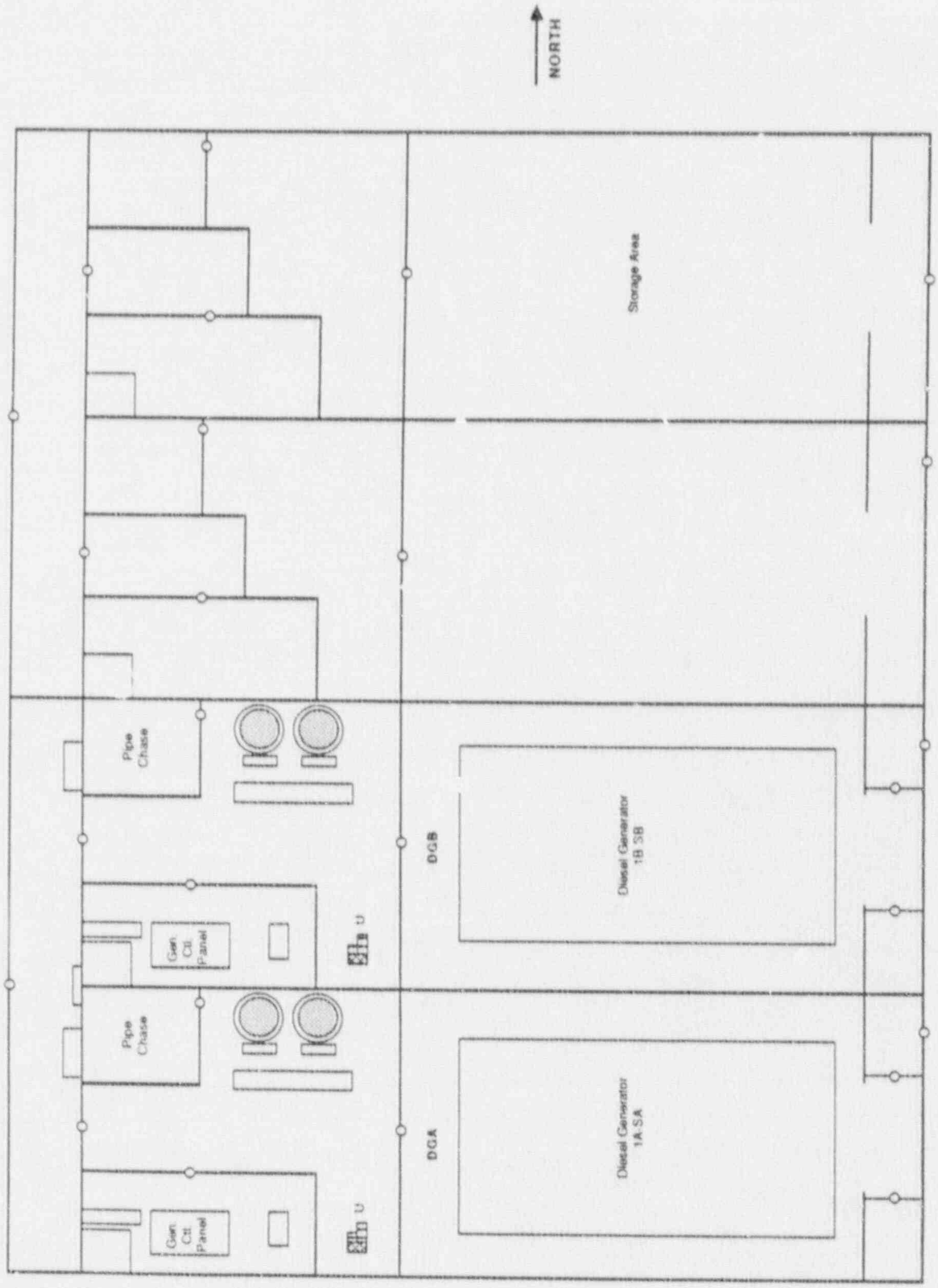


Figure 4-14. Shearon Harris Diesel Generator Building, Elevation 261'-0"

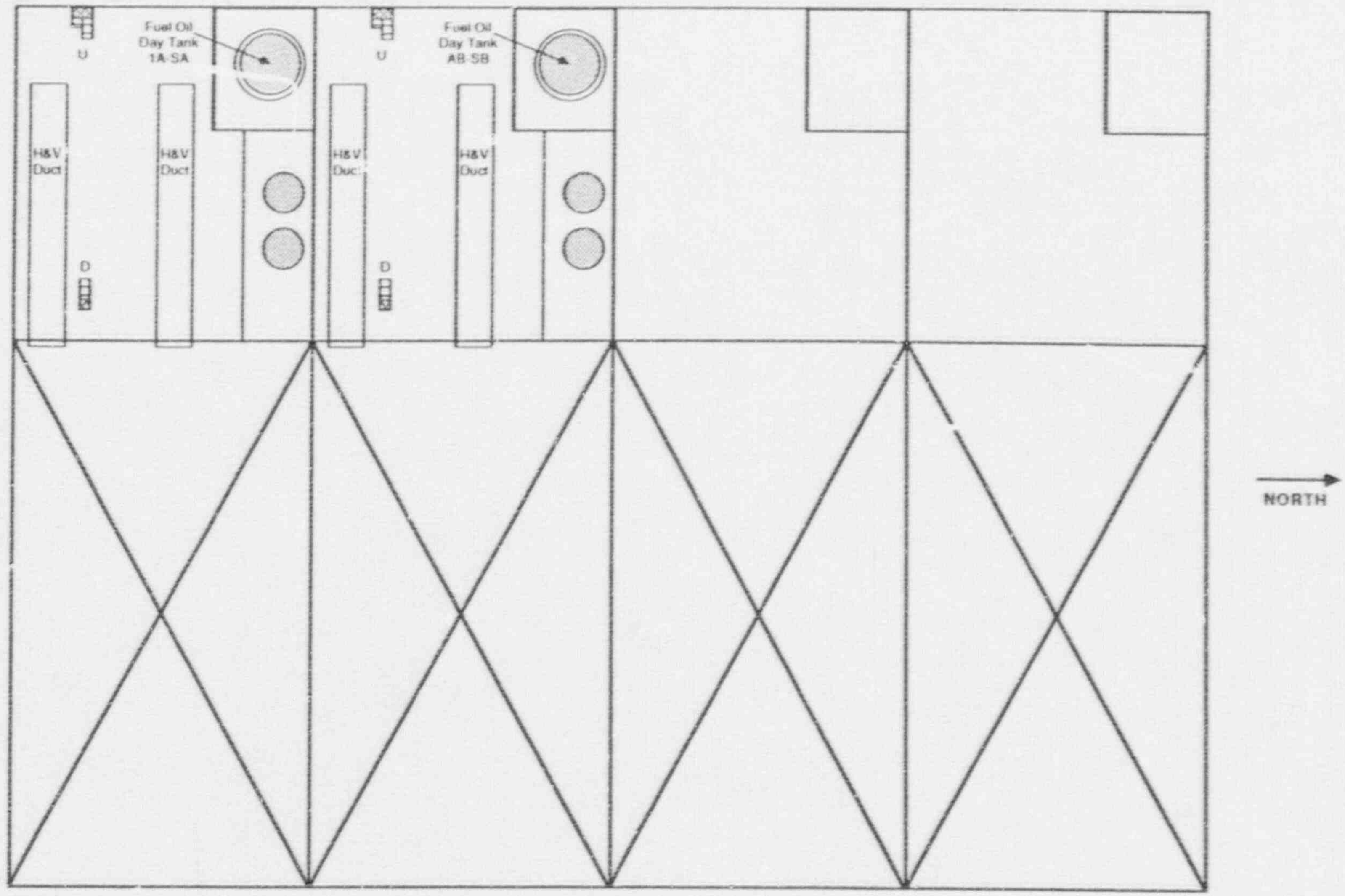


Figure 4-15. Shearon Harris Diesel Generator Building, Elevation 280'-0"

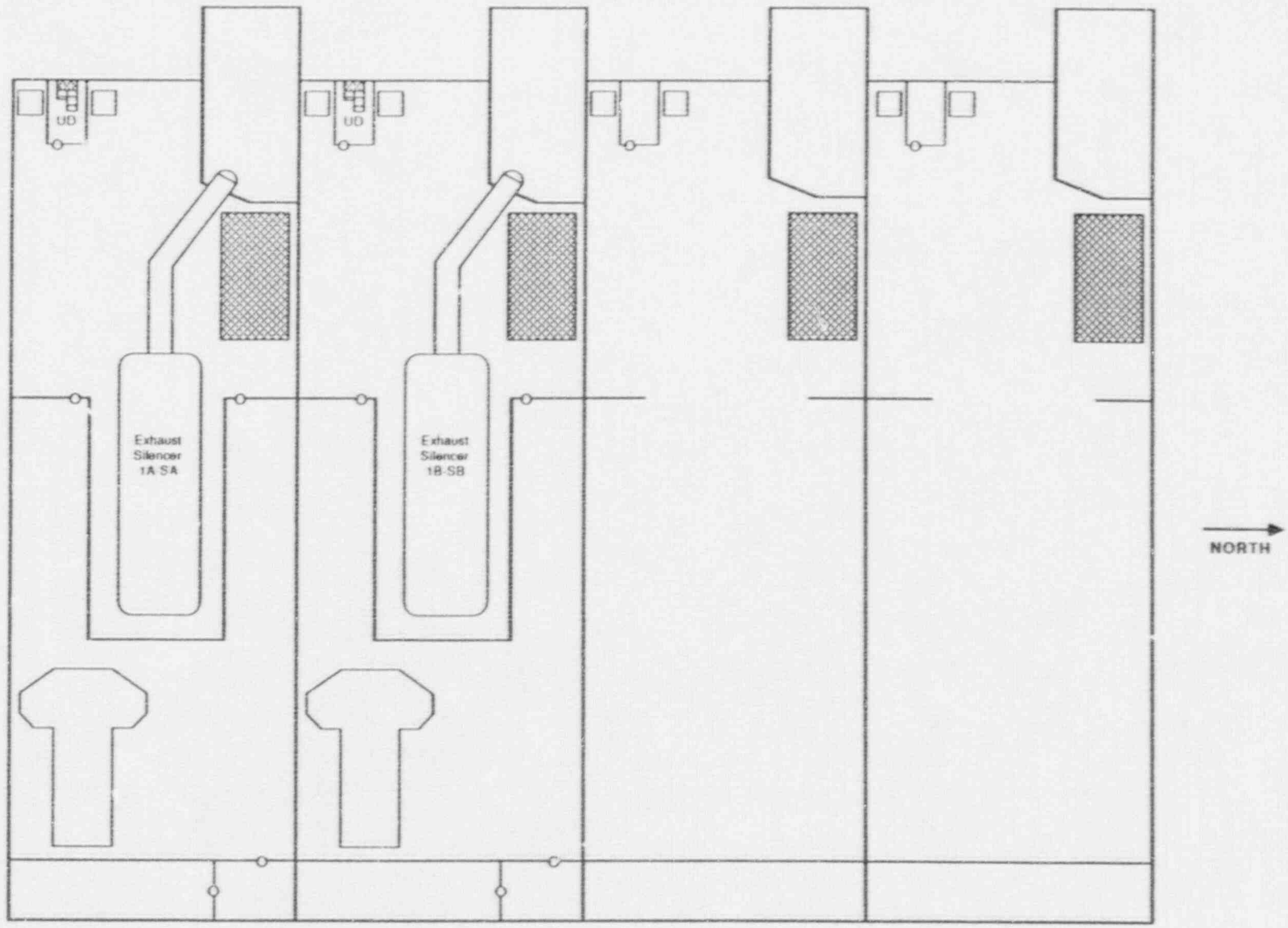


Figure 4-16. Shearon Harris Diesel Generator Building, Elevation 292'-0"

Table 4-1. Definition of Shearon Harris Building and Location Codes

	Abbreviation	Description
1.	236PEN	Reactor containment penetration area on level 236 of the auxiliary building.
2.	261PENA	Train 'A' reactor containment penetration area located on level 261 of the auxiliary building southeast of containment.
3.	261PENB	Train 'B' reactor containment penetration area located on level 261 of the auxiliary building southwest of containment.
4.	286MCA	Train 'A' motor control center room located southeast of containment on level 286 of the auxiliary building.
5.	286MCB	Train 'B' motor control center room located southwest of containment on level 286 of the auxiliary building.
6.	2TKBL	Level 236 of what was to be the unit No. 2 tank building.
7.	AB190A	Level 190 of the auxiliary building, south side.
8.	AB190B	Level 190 of the auxiliary building, north side.
9.	AB216	Level 216 of the auxiliary building.
10.	AB236	Level 236 of the auxiliary building.
11.	AB261	Level 261 c ie auxiliary building.
12.	AB286	Level 286 of the auxiliary building.
13.	AB305	Level 305 of the auxiliary building.
14.	ACR	Auxiliary control room located on level 286 of the auxiliary building.
15.	AINTK	Auxiliary intake structure.
16.	BATA	Room containing train 'A' emergency batteries located on level 286 of the auxiliary building.
17.	BATB	Room containing train 'B' emergency batteries located on level 286 of the auxiliary building.
18.	CABSPRM	Cable spreading room located on level 286 of the auxiliary building.
19.	CR	Control room located on level 305 of the auxiliary building.

Table 4-1. Definition of Shearon Harris Building and Location Codes (Continued)

	Abbreviation	Description
20.	CST	Condensate storage tank located at the south end of the auxiliary building.
21.	DGA	Room in the diesel generator building containing the train 'A' emergency diesel generator.
22.	DGB	Room in the diesel generator building containing the train 'B' emergency diesel generator.
23.	DGSWTNL	Diesel generator service water tunnel located underground between level 216 of the auxiliary building and the diesel generator building.
24.	MINTK	Main intake structure.
25.	PICRM	Room containing the process instrumentation and control racks on level 305 of the auxiliary building.
26.	RC	Reactor containment.
27.	RCRM	Room containing the rod control racks on level 305 of the auxiliary building.
28.	RHRHXA	Room containing the train 'A' residual heat removal system heat exchanger on level 236 of the auxiliary building.
29.	RHRHXB	Room containing the train 'B' residual heat removal system heat exchanger on level 236 of the auxiliary building.
30.	RWST	Refueling water storage tank.
31.	SGRMA	Train 'A' switchgear room located on level 286 of the auxiliary building.
32.	SGRMB	Train 'B' switchgear room located on level 286 of the auxiliary building.
33.	SIA	Room on level 236 of the auxiliary building containing charging pump 1.
34.	SIB	Room on level 236 of the auxiliary building containing charging pump 2.
35.	SIC	Room on level 236 of the auxiliary building containing charging pump 3.

Table 4-1. Definition of Shearon Harris Building and Location Codes (Continued)

	Abbreviation	Description
36.	STMTNL	Main steam tunnel rising vertically from level 263 to the roof of the auxiliary building.
37.	TERCBRM	Room containing instrument inverters on level 305 of the auxiliary building.
38.	TLSFP	Spent fuel pool operating floor, located at level 286 of the fuel handling building.

Table 4-2. Partial Listing of Components by Location at Shearon Harris

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
236PEN	CCW	CC-169 (9480A)	MOV
236PEN	CCW	CC-170 (9480B)	MOV
236PEN	CCW	CC-190 (9484)	MOV
236PEN	CCW	CC-F2 (685)	MOV
261PENA	RCS	PNL-A	PNL
261PENB	RCS	PNL-B	PNL
286MCA	EP	MCC-1A21	MCC
286MCA	EP	MCC-1A31	MCC
286MCB	EP	MCC-1B21	MCC
286MCB	EP	MCC-1B31	MCC
2TKBL	SW	SW-15 (270)	MOV
2TKBL	SW	SW-16 (271)	MOV
AB216	CVCS	SI-503 (8803A)	MOV
AB216	CVCS	SI-504 (8803B)	MOV
AB216	CVCS	SI-506 (8801A)	MOV
AB216	CVCS	SI-505 (8801B)	MOV
AB236	AFS	MS-145AB	MOV
AB236	AFS	AF-P1A	MDP
AB236	AFS	AF-P1X	TDP
AB236	AFS	AF-P1B	MDP
AB236	CCW	CC-19 (9384)	MOV
AB236	CCW	CC-20 (9385)	MOV
AB236	CCW	CC-5 (9370)	MOV
AB236	CCW	CC-6 (9371)	MOV
AB236	CCW	CC-P1A	MDP
AB236	CCW	CC-P1B	MDP
AB236	CCW	CC-P1C	MDP
AB236	CCW	CC-HX1A	HX
AB236	CCW	CC-HX1B	HX
AB236	CVCS	CS-523 (115B)	MOV

Table 4-2. Partial Listing of Components by Location at Shearon Harris (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
AB236	CVCS	CS-520 (115C)	MOV
AB236	CVCS	CS-522 (115D)	MOV
AB236	CVCS	CS-521(115E)	MOV
AB236	CVCS	CS-8102A	MOV
AB236	CVCS	CS-8102B	MOV
AB236	CVCS	CS-8102C	MOV
AB236	CVCS	CS-587(8130A)	MOV
AB236	CVCS	CS-588(8130B)	MOV
AB236	CVCS	CS-589(8131A)	MOV
AB236	CVCS	CS-590(8131B)	MOV
AB236	CVCS	CS-603(8132A)	MOV
AB236	CVCS	CS-604(8132B)	MOV
AB236	CVCS	CS-605(8133A)	MOV
AB236	CVCS	CS-606(8133B)	MOV
AB236	CVCS	SI-500 (8884)	MOV
AB236	CVCS	SI-502 (8885)	MOV
AB236	CVCS	SI-501 (8886)	MOV
AB236	SW	SW-70	MOV
AB236	SW	SW-71	MOV
AB236	SW	SW-72	MOV
AB236	SW	SW-73	MOV
AB236	SW	SW-74	MOV
AB236	SW	SW-75	MOV
AB236	SW	SW-76	MOV
AB236	SW	SW-77	MOV
AB261	CVCS	CS-142	MOV
AB261	CVCS	CS-147	MOV
AB261	CVCS	CS-152	MOV
AB261	CVCS	CS-153	MOV
AB261	CVCS	CS-611 (8105)	MOV

Table 4-2. Partial Listing of Components by Location at Shearon Harris (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
AB261	CVCS	CS-VCT	TANK
AB261	CVCS	CS-VCT	TANK
AB261	CVCS	CS-VCT	TANK
AINTK	SW	SW-AUX	TANK
AINTK	SW	SW-AUX	TANK
BATA	EP	BATT-1A	BATT
BATB	EP	BATT-1B	BATT
CS-UNK	CVCS	CS-609 (8108)	MOV
CS-UNK	CVCS	CS-610 (8107)	MOV
CST	AFS	AF-CST	TANK
CST	AFS	AF-CST	TANK
CST	AFS	AF-CST	TANK
DGA	EP	DG-1A	DG
DGB	EP	DG-1B	DG
MINTK	SW	SW-P1A	MDP
MINTK	SW	SW-MAIN	TANK
MINTK	SW	SW-P1B	MDP
MINTK	SW	SW-MAIN	TANK
RC	CCW	CC-191 (9483)	MOV
RC	CCW	RC-P1A	MDP
RC	CCW	RC-P1B	MDP
RC	CCW	RC-P1C	MDP
RC	RCS	RC-V526 (8000A)	MOV
RC	RCS	RC-V527 (8000B)	MOV
RC	RCS	RC-V528 (8000C)	MOV
RC	RCS	RC-P529 (444B)	NV
RC	RCS	RC-P527 (445A)	NV
RC	RCS	RC-P528 (445B)	NV
RC	RCS	RH-503(8701A)	MOV
RC	RCS	RC-502(8702A)	MOV

Table 4-2. Partial Listing of Components by Location at Shearon Harris (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	RCS	RC-501(8701B)	MOV
RC	RCS	RC-500(8702B)	MOV
RWST	CVCS	CT-RWST	TANK
SGRMA	EP	CB-1A	CB
SGRMA	EP	BUS-1A	BUS
SGRMA	EP	BUS-D1A	BUS
SGRMA	EP	BUS-1A3	BUS
SGRMA	EP	TR-1A3	TRAN
SGRMA	EP	BC-1A-SA	BC
SGRMA	EP	BC-1B-SA	BC
SGRMA	EP	BUS-D1A	BUS
SGRMA	EP	BUS-D1A	BUS
SGRMB	EP	CB-1B	CB
SGRMB	EP	BUS-1B	BUS
SGRMB	EP	BUS-D1B	BUS
SGRMB	EP	BUS-1B3	BUS
SGRMB	EP	TR-1B3	TRAN
SGRMB	EP	BC-1A-SB	BC
SGRMB	EP	BC-1B-SB	BC
SGRMB	EP	BUS-D1B	BUS
SGRMB	EP	BUS-D1B	BUS
SIA	CVCS	CS-P1	MDP
SIB	CVCS	CS-P2	MDP
SIC	CVCS	CS-P3	MDP
STMTNL	AFS	AF-19 (93)	MOV
STMTNL	AFS	AF-10 (55)	MOV
STMTNL	AFS	AF-116 (137)	MOV
STMTNL	AFS	AF-117 (143)	MOV
STMTNL	AFS	AF-118 (149)	MOV
STMTNL	AFS	MS-8	MOV

Table 4-2. Partial Listing of Components by Location at Shearon Harris (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
STMTNL	AFS	MS-9	MOV
TERCBRM	EP	INV-I	INV
TERCBRM	EP	INV-I	INV
TERCBRM	EP	INV-II	INV
TERCBRM	EP	INV-II	INV
TERCBRM	EP	INV-III	INV
TERCBRM	EP	INV-III	INV
TERCBRM	EP	INV-IV	INV
TERCBRM	EP	INV-IV	INV
UNK-120	EP	BUS-I	BUS
UNK-120	EP	BUS-II	BUS
UNK-120	EP	BUS-III	BUS
UNK-120	EP	BUS-IV	BUS
UNK-1A1	EP	BUS-1A1	BUS
UNK-1A1	EP	TR-1A1	TRAN
UNK-1B1	EP	BUS-1B1	BUS
UNK-1B1	EP	TR-1B1	TRAN

5. BIBLIOGRAPHY FOR SHEARON HARRIS

1. NUREG-0972, "Environmental Statement Related to the Operation of Shearon Harris Nuclear Power Plant Units 1 and 2," USNRC Office of Nuclear Reactor Regulation.

2. NUREG-1038, "Safety Evaluation Report Related to the Operation of Shearon Harris Nuclear Power Plant, Units 1 and 2," USNRC Division of Licensing, November 1983.

3. NUREG-1208, "Technical Specifications for Shearon Harris Nuclear Power Plant Unit 1," USNRC Division of Pressurized Water Reactor Licensing, October 1986.

4. NUREG-1240, "Technical Specifications for Shearon Harris Nuclear Power Plant, Unit 1," USNRC Division of Pressurized Water Reactor Licensing, January 1987.

5. NUREG/CR-4311, "Review of the Shearon Harris Unit 1 Auxiliary Feedwater System Reliability Analysis," Brookhaven National Laboratory, February 1986.

APPENDIX A
DEFINITION OF SYMBOLS USED IN THE SYSTEM AND LAYOUT DRAWINGS

A1. SYSTEM DRAWINGS

A1.1 Fluid System Drawings

The simplified system drawings are accurate representations of the major flow paths in a system and the important interfaces with other fluid systems. As a general rule, small fluid lines that are not essential to the basic operation of the system are not shown in these drawings. Lines of this type include instrumentation lines, vent lines, drain lines, and other lines that are less than 1/3 the diameter of the connecting major flow path. There usually are two versions of each fluid system drawing; a simplified system drawing, and a comparable drawing showing component locations. The drawing conventions used in the fluid system drawings are the following:

- Flow generally is left to right.
  - Water sources are located on the left and water "users" (i.e., heat loads) or discharge paths are located on the right.
  - One exception is the return flow path in closed loop systems which is right to left.
  - Another exception is the Reactor Coolant System (RCS) drawing which is "vessel-centered", with the primary loops on both sides of the vessel.
  - Horizontal lines always dominate and break vertical lines.

- Component symbols used in the fluid system drawings are defined in Figure A-1.
  - Most valve and pump symbols are designed to allow the reader to distinguish among similar components based on their support system requirements (i.e., electric power for a motor or solenoid, steam to drive a turbine, pneumatic or hydraulic source for valve operation, etc.)
  - Valve symbols allow the reader to distinguish among valves that allow flow in either direction, check (non-return) valves, and valves that perform an overpressure protection function. No attempt has been made to define the specific type of valve (i.e., as a globe, gate, butterfly, or other specific type of valve).
  - Pump symbols distinguish between centrifugal and positive displacement pumps and between types of pump drives (i.e., motor, turbine, or engine).

- Locations are identified in terms of plant location codes defined in Section 4 of this Sourcebook.
  - Location is indicated by shaded "zones" that are not intended to represent the actual room geometry.
  - Locations of discrete components represent the actual physical location of the component.
  - Piping locations between discrete components represent the plant areas through which the piping passes (i.e. including pipe tunnels and underground pipe runs).
  - Component locations that are not known are indicated by placing the components in an unshaded (white) zone.
  - The primary flow path in the system is highlighted (i.e., bold white line) in the location version of the fluid system drawings.

A1.2 Electrical System Drawings

The electric power system drawings focus on the Class 1E portions of the plant's electric power system. Separate drawings are provided for the AC and DC portions of the Class 1E system. There often are two versions of each electrical system drawing; a simplified system drawing, and a comparable drawing showing component locations. The drawing conventions used in the electrical system drawings are the following:

- Flow generally is top to bottom
  - In the AC power drawings, the interface with the switchyard and/or offsite grid is shown at the top of the drawing.
  - In the DC power drawings, the batteries and the interface with the AC power system are shown at the top of the drawing.
  - Vertical lines dominate and break horizontal lines.

- Component symbols used in the electrical system drawings are defined in Figure A-2.

- Locations are identified in terms of plant location codes defined in Section 4 of this Sourcebook.
  - Locations are indicated by shaded "zones" that are not intended to represent the actual room geometry.
  - Locations of discrete components represent the actual physical location of the component.
  - The electrical connections (i.e., cable runs) between discrete components, as shown on the electrical system drawings, DO NOT represent the actual cable routing in the plant.
  - Component locations that are not known are indicated by placing the discrete components in an unshaded (white) zone.

A2. SITE AND LAYOUT DRAWINGS

A2.1 Site Drawings

A general view of each reactor site and vicinity is presented along with a simplified site plan showing the arrangement of the major buildings, tanks, and other features of the site. The general view of the reactor site is obtained from ORNL-NSIC-55 (Ref. 1). The site drawings are approximately to scale, but should not be used to estimate distances on the site. As-built scale drawings should be consulted for this purpose.

Labels printed in bold uppercase correspond to the location codes defined in Section 4 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

A2.2 Layout Drawings

Simplified building layout drawings are developed for the portions of the plant that contain components and systems that are described in Section 3 of this Sourcebook. Generally, the following buildings are included: reactor building, auxiliary building, fuel building, diesel building, and the intake structure or pumphouse. Layout drawings generally are not developed for other buildings.

Symbols used in the simplified layout drawings are defined in Figure A-3. Major rooms, stairways, elevators, and doorways are shown in the simplified layout drawings however, many interior walls have been omitted for clarity. The building layout drawings, are approximately to scale, should not be used to estimate room size or distances. As-built scale drawings for should be consulted his purpose.

Labels printed in uppercase bolded also correspond to the location codes defined in Section 4 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

A3. APPENDIX A REFERENCES

1. Heddleson, F.A., "Design Data and Safety Features of Commercial Nuclear Power Plants.", ORNL-NSIC-55, Volumes 1 to 4, Oak Ridge National Laboratory, Nuclear Safety Information Center, December 1973 (Vol.1), January 1972 (Vol. 2), April 1974 (Vol. 3), and March 19[illegible] (Vol. 4)

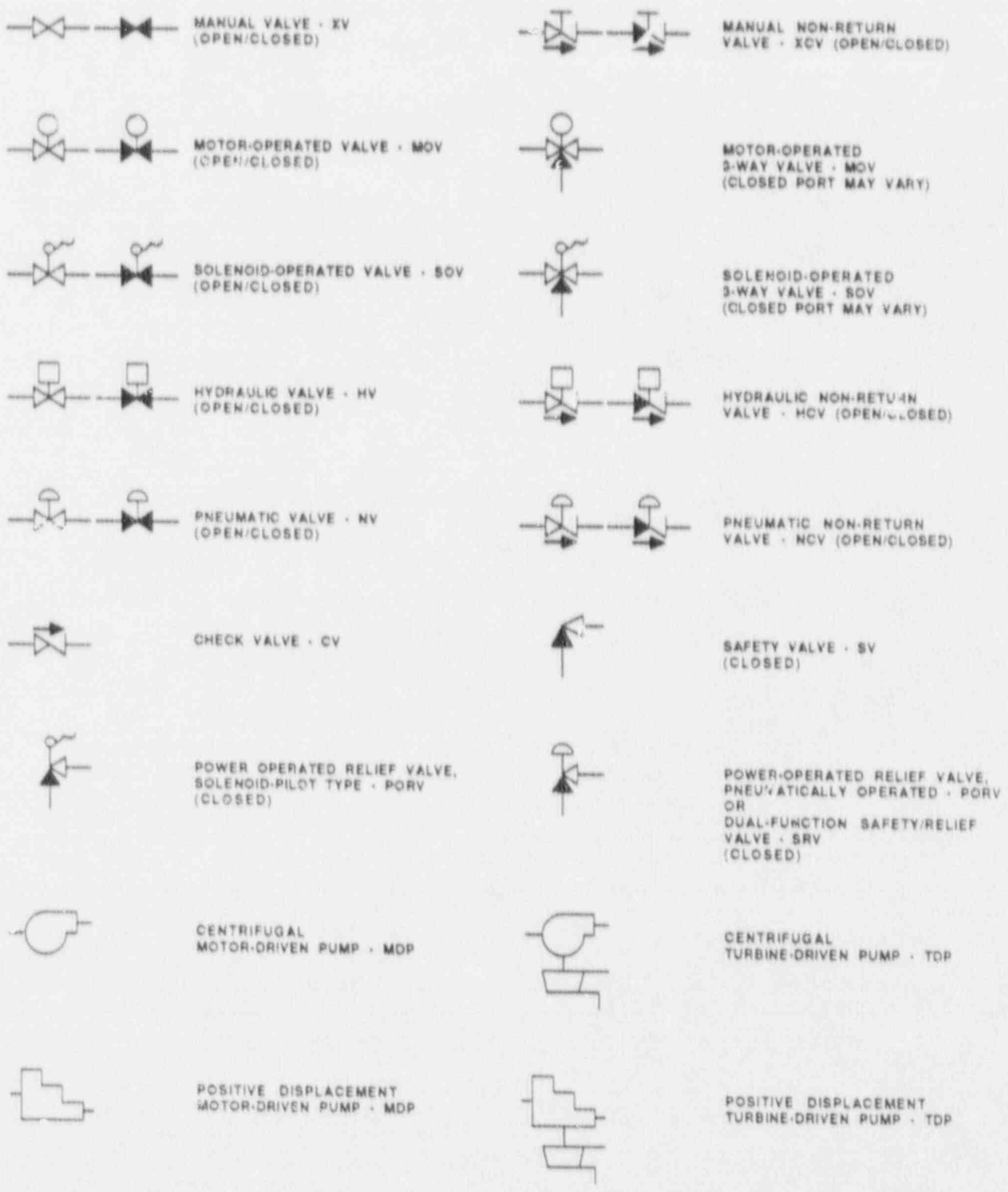


Figure A-1. Key To Symbols In Fluid System Drawings

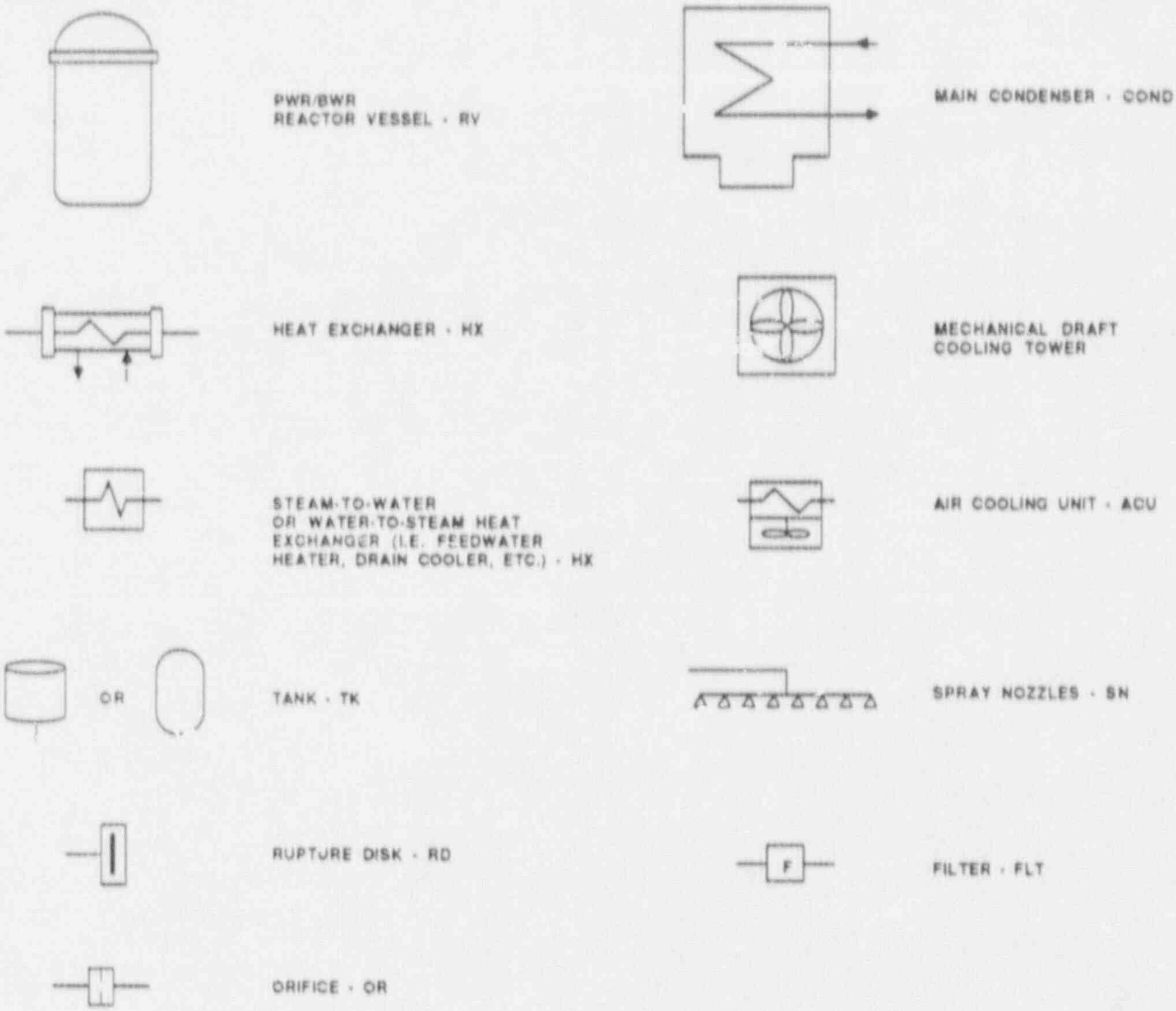


Figure A-1. Key To Symbols In Fluid System Drawings (Continued)

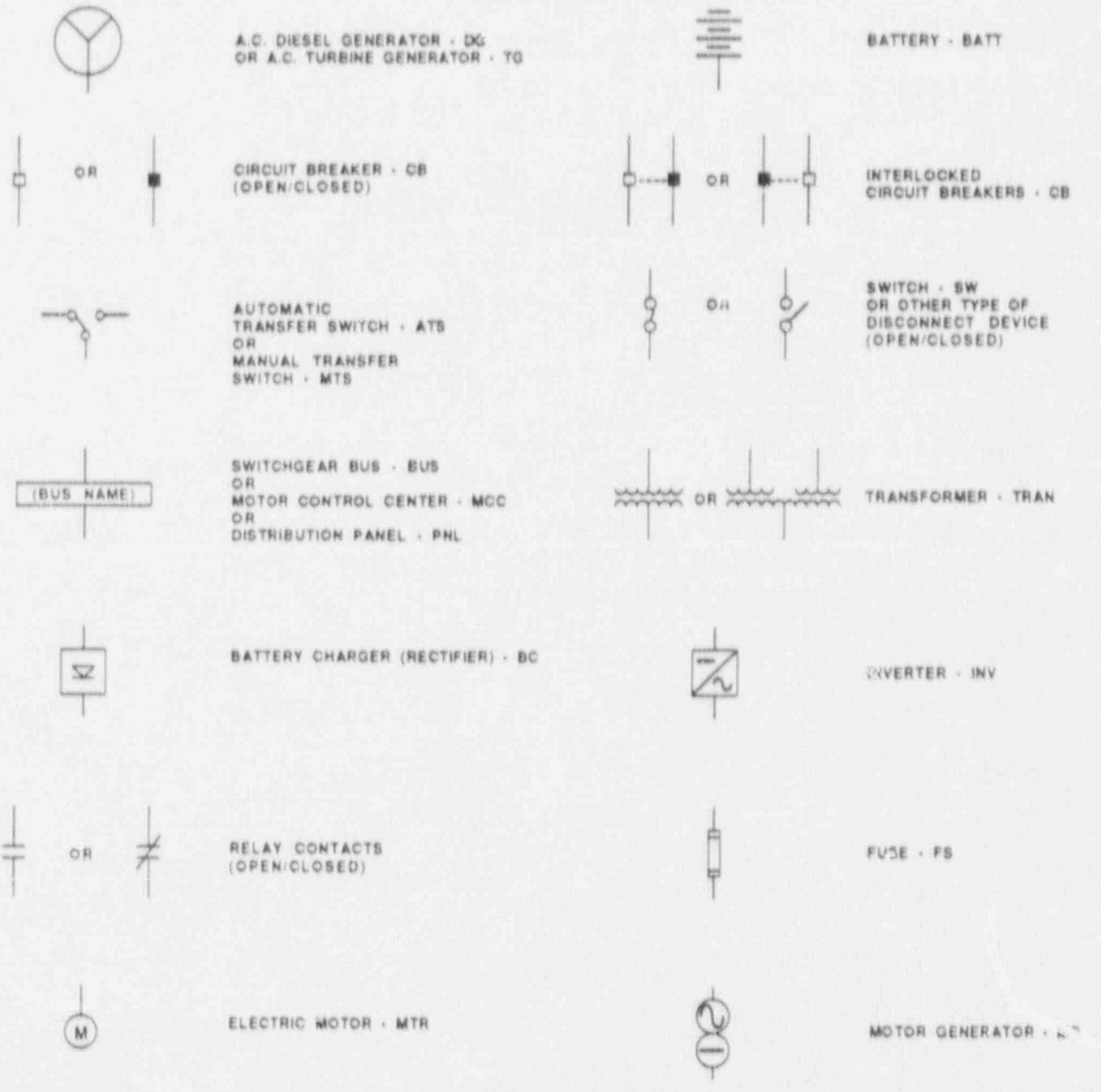


Figure A-2. Key To Symbols In Electrical System Drawings

Figure A-3. Key To Symbols In Facility Layout Drawings

APPENDIX B
DEFINITION OF TERMS USED IN THE DATA TABLES

Terms appearing in the data tables in Sections 3 and 4 of this Sourcebook are defined as follows:

SYSTEM (also LOAD SYSTEM) - All components associated with a particular system description in the Sourcebook have the same system code in the data base. System codes used in this Sourcebook are the following:

Code	Definition
RCS	Reactor Coolant System
AFS	Auxiliary Feedwater System
ECCS	Emergency Core Cooling System (including HPSI and LPSI)
CVCS	Chemical and Volume Control (Charging) System
EP	Electric Power System
CCW	Component Cooling Water System
SW	Service Water System

COMPONENT ID (also LOAD COMPONENT ID) - The component identification (ID) code in a data table matches the component ID that appears in the corresponding system drawing. The component ID generally begins with a system preface followed by a component number. The system preface is not necessarily the same as the system code described above. For component IDs, the system preface corresponds to what the plant calls the component (e.g. HPI, RHR). An example is HPI-730, denoting valve number 730 in the high pressure injection system, which is part of the ECCS. The component number is a contraction of the component number appearing in the plant piping and instrumentation drawings (P&IDs) and electrical one-line system drawings.

LOCATION (also COMPONENT LOCATION and POWER SOURCE LOCATION) - Refer to the location codes defined in Section 4.

COMPONENT TYPE (COMP TYPE) - Refer to Table B-1 for a list of component type codes.

POWER SOURCE - The component ID of the power source is listed in this field (see COMPONENT ID, above). In this data base, a "power source" for a particular component (i.e. a load or a distribution component) is the next higher electrical distribution or generating component in a distribution system. A single component may have more than one power source (i.e. a DC bus powered from a battery and a battery charger).

POWER SOURCE VOLTAGE (also VOLTAGE) - The voltage "seen" by a load of a power source is entered in this field. The downstream (output) voltage of a transformer, inverter, or battery charger is used.

EMERGENCY LOAD GROUP (EMERG LOAD GROUP) - AC and DC load groups (or electrical divisions) are defined as appropriate to the plant. Generally, AC load groups are identified as AC/A, AC/B, etc. The emergency load group for a third-of-a-kind load (i.e. a "swing" load) that can be powered from either of two AC load groups would be identified as AC/AB. DC load group follows similar naming conventions.

TABLE B-1. COMPONENT TYPE CODES

COMPONENT	COMP TYPE
VALVES:	
Motor-operated valve	MOV
Pneumatic (air-operated) valve	NV or AOV
Hydraulic valve	HV
Solenoid-operated valve	SOV
Manual valve	XV
Check valve	CV
Pneumatic non-return valve	NCV
Hydraulic non-return valve	HCV
Safety valve	SV
Dual function safety/relief valve	SRV
Power-operated relief valve (pneumatic or solenoid-operated)	PORV
PUMPS:	
Motor-driven pump (centrifugal or PD)	MDP
Turbine-driven pump (centrifugal of PD)	TDP
Diesel-driven pump (centrifugal of PD)	DDP
OTHER FLUID SYSTEM COMPONENTS:	
Reactor vessel	RV
Steam generator (U-tube or once-through)	SG
Heat exchanger (water-to-water HX, or water-to-air HX)	HX
Cooling tower	CT
Tank	TANK or TK
Sump	SUMP
Rupture disk	RD
Orifice	ORIF
Filter or strainer	FLT
Spray nozzle	SN
Heaters (i.e. pressurizer heaters)	HTR
VENTILATION SYSTEM COMPONENTS:	
Fan (motor-driven, any type)	FAN
Air cooling unit (air-to-water HX, usually including a fan)	ACU or FCU
Condensing (air-conditioning) unit	COND
EMERGENCY POWER SOURCES:	
Diesel generator	DG
Gas turbine generator	GT
Battery	BATT

TABLE B-1. COMPONENT TYPE CODES (Continued)

COMPONENT	COMP TYPE
ELECTRIC POWER DISTRIBUTION EQUIPMENT:	
Bus or switchgear	BUS
Motor control center	MCC
Distribution panel or cabinet	PNL or CAB
Transformer	TRAN or XFMR
Battery charger (rectifier)	BC or RECT
Inverter	INV
Uninterruptible power supply (a unit that may include battery, battery charger, and inverter)	UPS
Motor generator	MG
Circuit breaker	CB
Switch	SW
Automatic transfer switch	ATS
Manual transfer switch	MTS