NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

FT. CALHOUN

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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:

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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.

FORT CALHOUN
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	12/88	Original report

FORT CALHOUN SYSTEM SOURCEBOOK

This sourcebook contains summary information on the Fort Calhoun Station, Unit No. 1. 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.

1. SUMMARY DATA ON PLANT

Basic information on the Fort Calhoun Station, Unit No. 1 nuclear power plant is listed below:

- Docket number	50-285
- Operator	Omaha Public Power District
- Location	Nebraska, 19 miles north of Omaha
- Commercial operation date	9/73
- Reactor type	PWR
- NSSS vendor	Combustion Engineering
- Number of loops	2
- Power (MWt/MWe)	1420/457
- Architect-engineer	Gibbs, Hill, Durham, and Richardson, Inc.
- Containment type	Reinforced concrete cylinder with steel liner, post-tensioned in three directions

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

The Fort Calhoun is an early-vintage Combustion Engineering PWR with a two-loop nuclear steam supply system (NSSS). In terms of power rating, Fort Calhoun is the smallest operating C-E plant. Other two-loop Combustion Engineering plants in the United States are:

- Arkansas Nuclear One -2
- Calvert Cliffs 1 and 2
- Millstone 2
- Palisades
- Palo Verde 1, 2, and 3
- San Onofre 2 and 3
- St. Lucie 1 and 2
- Waterford 3

All of these plants have large, dry containments.

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at the Fort Calhoun Station in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at the Fort Calhoun Station 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 Fort Calhoun 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	4
- Auxiliary Feedwater (AFW) and Secondary Steam Relief (SSR) Systems	Same	3.2	9.4
- Emergency Core Cooling Systems (ECCS)	Safety Injection System (SIS)		
- High-Pressure Injection & Recirculation	High-Pressure Safety Injection System	3.3	6.2
- Low-pressure Injection & Recirculation	Low-Pressure Safety Injection System	X	6.2
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Shutdown Cooling System	X	9.3
- Main Steam and Power Conversion Systems	Main Steam System, Feedwater and Condensate System, Circulating Water System	X	10
- Other Heat Removal Systems	None identified	-	-
Reactor Coolant Inventory Control Systems			
- Chemical and Volume Control System (CVCS) (Charging System)	Same	X	9.2
- ECCS	See ECCS, above	-	-

Table 3-1. Summary of Fort Calhoun Systems Covered in this Report (Continued)

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Containment Systems			
- Containment	Same	X	5
- Containment Heat Removal Systems			
- Containment Spray System	Same	3.4	6.3
- Containment Fan Cooler System	Containment Air Recirculation, Cooling, and Iodine Removal System	3.8	6.4, 9.10
- Containment Normal Ventilation Systems	See Containment Air Recirculation, Cooling, and Iodine Removal System, above	X	9.10
- Combustible Gas Control Systems	Hydrogen Purge System	X	9.10
Reactor and Reactivity Control Systems			
- Reactor Core	Same	X	3
- Control Rod System	Control Element Drive Mechanisms (CEDMs)	X	3
- Boration Systems	See CVCS, above	-	-
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Reactor Protective System (RPS)	3.9	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Engineered Safeguards Control System	3.9	7.3
- Remote Shutdown System	Local Control Panels	3.9	7.6.4

Table 3-1. Summary of Fort Calhoun Systems Covered in this Report (Continued)

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Instrumentation & Control (I&C) Systems (continued)			
- Other I&C Systems	Regulating Systems,	X	7.5
	Instrumentation Systems	X	7.6
Support Systems			
- Class 1E Electric Power System	Same	3.5	8.3, 8.4
- Non-Class 1E Electric Power System	Same	3.5	8.2, 8.3
- Diesel Generator Auxiliary Systems	Same	3.5	8.4
- Component Cooling Water (CCW) System	Auxiliary Coolant Component Cooling Water System	3.6	9.7
- Service Water System (SWS)	Raw Water (RW) System	3.7	9.8
- Other Cooling Water Systems	Turbine Plant Cooling Water System	X	9.9
- Fire Protection Systems	Same	X	9.11
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Auxiliary and Turbine Building Ventilating Systems, Control Room Air-Conditioning System	X	9.10
- Instrument and Service Air Systems	Compressed Air System	X	9.12
- Refueling and Spent Fuel Systems	Same	X	9.5, 9.6
- Radioactive Waste Systems	Same	X	11
- Radiation Protection Systems	Same	X	11

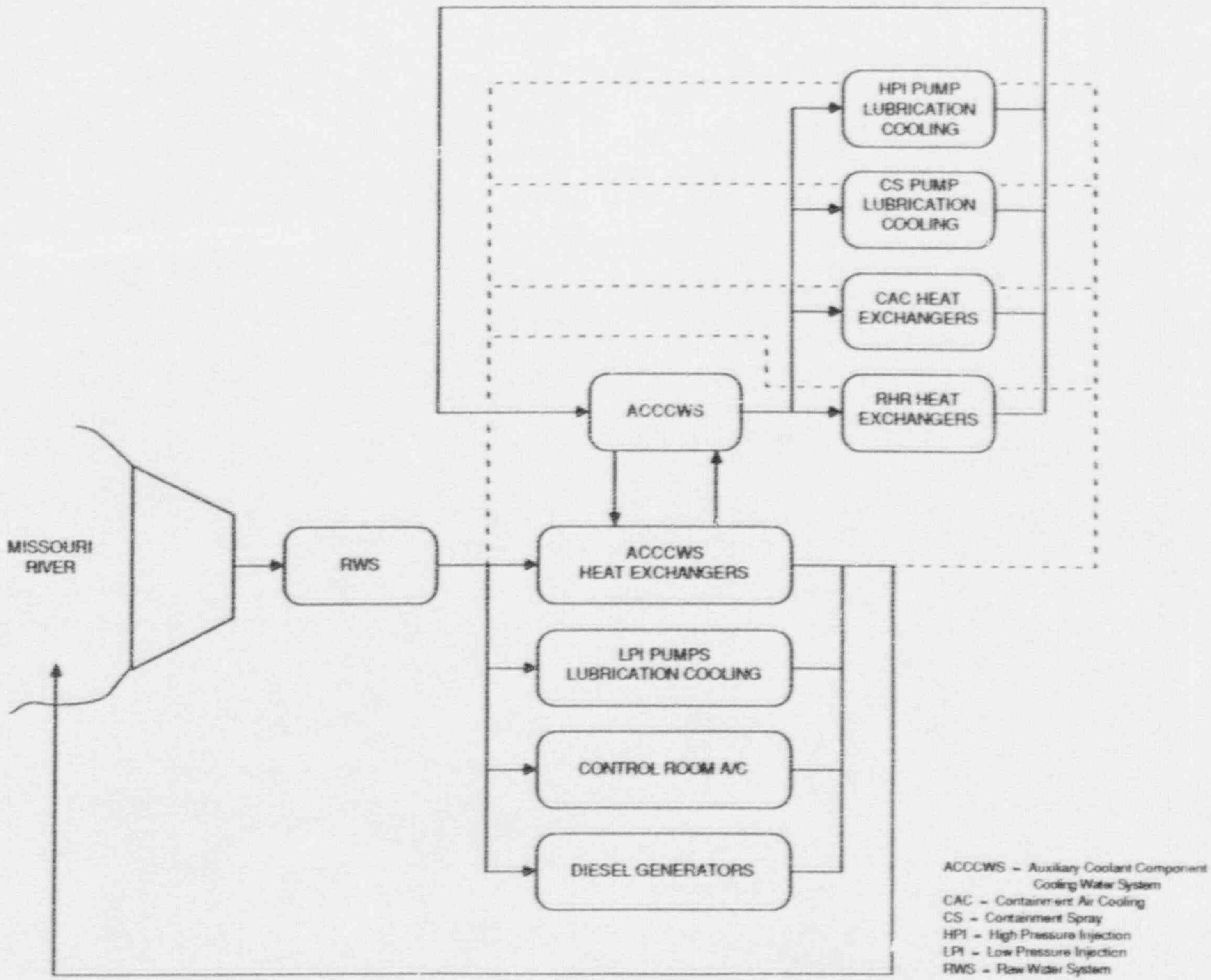

Figure 3-1. Cooling Water Systems Functional Diagram for Fort Calhoun

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) main coolant loops, (c) main coolant pumps, (d) the primary side of the steam generators, (e) pressurizer, and (f) connected piping out to a suitable isolation valve boundary. Simplified diagrams of the RCS 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 four coolant pumps which draw coolant through two steam generators and two main coolant loop vessel discharge lines. The coolant pumps return coolant through four vessel return lines. 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 (charging system).

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 main 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 (see Section 3.2) 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 containment through the pressurizer relief valves. There are two power-operated relief valves and two 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). Each power-operated relief valve has an associated motor operated block valve.

Following a LOCA, reactor core heat is dumped to the containment as reactor coolant and ECCS makeup water spills from the break. For a short-term period, the containment can act as a heat sink; however, the containment spray systems or the containment air cooling systems must operate in order to complete a heat transfer path to the ultimate heat sink (see Sections 3.4 and 3.8).

3.1.4 System Success Criteria

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

- An unmitigatible LOCA is not initiated.
- If a mitigatible 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. Volume: 7066 ft^3, including pressurizer
  2. Normal operating pressure: 2100 psia

B. Pressurizer
  1. Volume: 900 ft^3 (500 ft^3 water, 400 ft^3 steam)

C. Safety Valves (2)
  1. Set pressure: 2485 psig
  2. Relief capacity: 200,000 lb/hr each

D. Power-Operated Relief Valves (2)
  1. Set pressure: 2400 psia
  2. Relief capacity: 99,000 lb/hr each

E. Steam Generators
  1. Type: Vertical U-Tube
  2. Primary-side volume: 850 ft^3

3.1.6 Support Systems and Interfaces

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

B. Main Coolant Pump Seal Injection Water System
The chemical and volume control system supplies seal water to cool the main coolant pump shaft seals and to maintain a controlled inleakage 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.

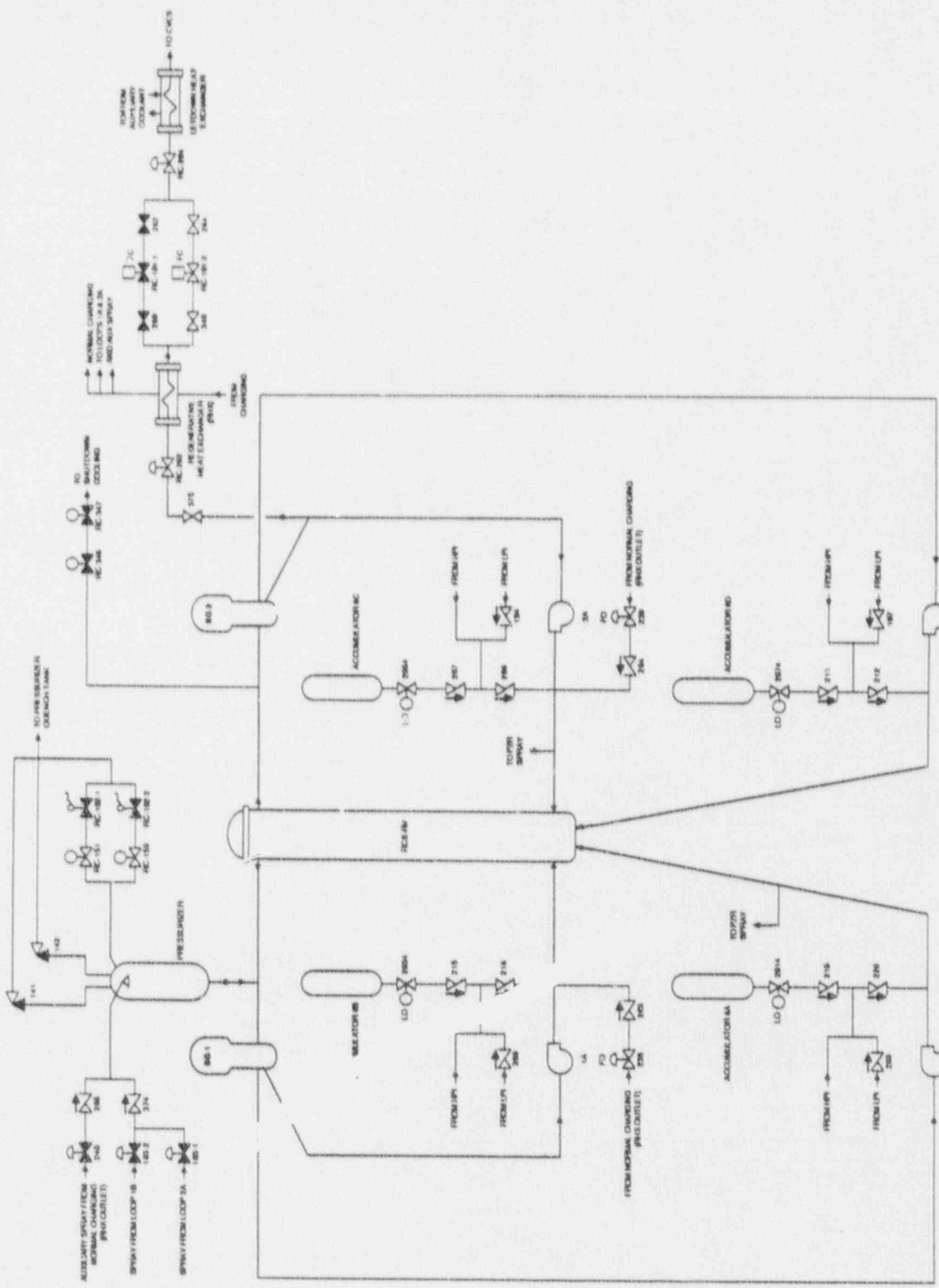

Figure 3.1-1. Fort Calhoun Reactor Coolant System

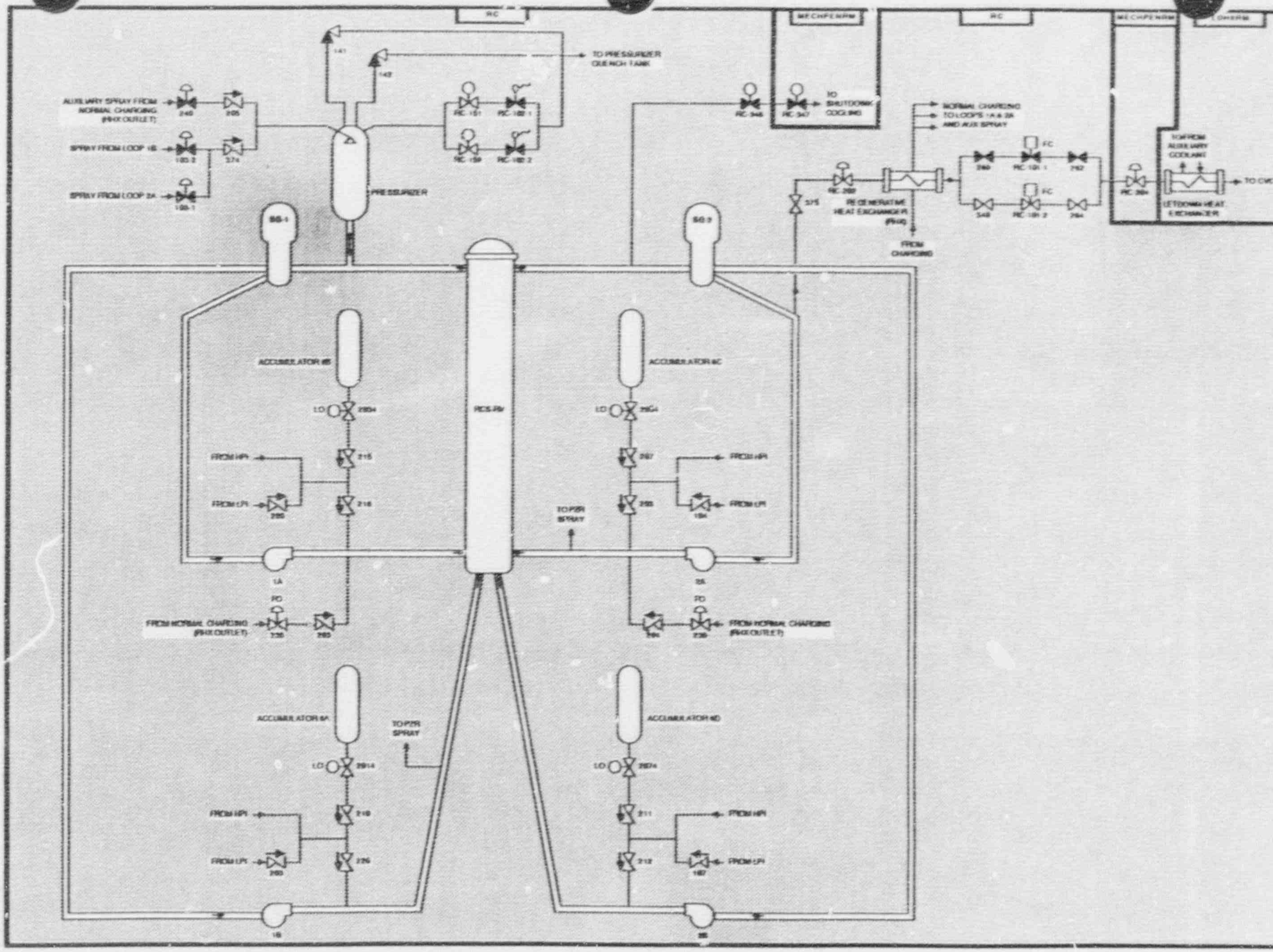

Figure 3.1-2. Fort Calhoun Reactor Coolant System Showing Component Locations

Table 3.1-1. Ft. Calhoun Reactor Coolant System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RC-101-2	HV	RC				
RC-102-1	SOV	RC	MCC-3C1	480	EPENRMEAST	AC/A
RC-102-2	SOV	RC	MCC-4B1	480	EPENRMWEST	AC/B
RC-150	MOV	RC	MCC-3B1	480	EPENRMEAST	AC/A
RC-151	MOV	RC	MCC-4A1	480	EPENRMWEST	AC/B
RC-202	NV	RC				
RC-204	NV	MECHPENRM				
RC-347	MOV	MECHPENRM	MCC-4C2	480	4C2	AC/B
RC-348	MOV	RC	MCC-3B1	480	EPENRMEAST	AC/A

3.2 AUXILIARY FEEDWATER (AFW) SYSTEM AND SECONDARY STEAM RELIEF (SSR) SYSTEM

3.2.1 System Function

The AFW system 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 SSR system 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 AFW and SSR systems constitute an open-loop fluid system that provides for heat transfer from the RCS following transients.

3.2.2 System Definition

The AFW system consists of one motor-driven pump and one steam turbine-driven pump, that draw a suction on the emergency feedwater storage tank (EFST) and supply water to both steam generators when needed. The AFW pump steam turbine drive is supplied from both steam generators and exhausts to atmosphere. Makeup to the EFST is provided from the condensate system. Alternate water sources for the EFST include the demineralized water system, the outside condensate storage tank, and the fire protection system.

The SSR system includes five safety valves on each of the two main steam headers. A steam dump valve also is located in the A main steam header, downstream of the main steam isolation valve.

Simplified drawings of the AFW and SSR systems are shown in Figures 3.2-1 and 3.2-2. A summary of data on selected AFW system components is presented in Table 3.2-1.

3.2.3 System Operation

During normal plant operation, the AFW system is in standby. Both auxiliary feed pumps (FW-6 and FW-10) are automatically started whenever the low water level setpoint is reached in either steam generator; electric power is supplied to the motor driven pump, FW-6, and the valve admitting steam to the turbine driven pump, FW-10 is opened. All valves in the auxiliary feedwater line from the EFST to the intact steam generator(s) open automatically if the low water level setpoint has been reached and will open and close as needed to maintain an acceptable water level in the steam generator(s).

The system also can be remote-manually operated from the control room or from a combination of local and remote-manual operations from the electrical penetration room. The turbine driven pump, FW-10, requires instrument power for lubrication of the pump. In addition, the steam supply valve, 1045, fails closed upon loss of control power. The motor driven pump, FW-6, is normally aligned to a non-Class 1E bus and must be manually aligned to an emergency bus by the operator following a loss of offsite power.

The amount of water in the emergency feedwater storage tank is adequate to remove heat for 8 hours. The tank has a capacity at 60,350 gallons and can be resupplied with water from the fire protection system. One of the fire pumps is diesel engine driven and can be used following loss of offsite power.

Steam generator dry-out time is estimated to be approximately 16 minutes (Ref. 1). The two redundant AFW pumps are available for response with the capability of feeding through two systems of piping. The preferred path is through the auxiliary feedwater piping (valves 1108A, B and 1107A, B). An alternative is to use the main feedwater lines by opening valve 1384. Reactor decay heat is rejected to an ultimate heat sink by venting to atmosphere through the AFW safety valves on each main steam line.

Note that the AFW system has two sections of pipe which are single point failures (tank to pump suction and pump discharge to steam generator header split). The system also has a component single point failure with manual valve 339.

3.2.4 System Success Criteria

For the decay heat removal function to be successful, both the AFW system and the SSR system must operate successfully. The AFW success criteria are the following (Ref. 1):

- Any one AFW pump can provide adequate flow.
- Water must be provided from the EFST to the AFW pump suctions
- Makeup to any one steam generator provides adequate decay heat removal from the reactor coolant system.

The SSR system must operate to complete the heat transfer path to the environment. The number of safety valves that must open for the decay heat removal function is not known, however total system capacity can pass a steam flow equivalent to a reactor power level of 1500 MWt at the secondary safety valve nominal setpoint pressures (i.e. 1000 to 1050 psid) (Ref. 2).

3.2.5 Component Information

A. Steam turbine-driven AFW pump FW-10
   1. Rated flow: 260 gpm @ 2400 ft head (1040 psid)
   2. Rated capacity: 100%

B. Motor-driven AFW pump FW-6
   1. Rated flow: 260 gpm @ 2400 ft head (1040 psid)
   2. Rated capacity: 100%

C. Emergency feedwater storage tank
   1. Capacity: 60,350 gallons

D. Secondary steam relief valves
   1. Five ASME code safety valves per main steam line (10 total)
   2. Capacity (total): 6.536×10^6 lb/hr

3.2.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The AFW pumps are automatically actuated based on the following signals:
      a. Turbine driven pump FW-10
         1) steam generator wide range level
         2) differential pressure between two steam generators
         3) loss of offsite power
         4) trip of main feedwater pumps
      b. Motor-driven pump FW-6
         1) steam generator wide range level
         2) differential pressure between two steam generators
         3) trip of main feedwater pumps

2. Remote manual
   The AFW system can be actuated by remote manual means from the main control room
3. Alternate remote manual
   AFW pumps can be controlled from an AFW control panel

B. Motive power
1. The AFW motor-driven pump is a non-Class 1E AC load that can be supplied from the standby diesel generators.
2. The AFW valves are Class 1E DC loads that can be supplied from the station batteries. All valves in the normal AFW supply path fail open upon loss of DC power except valve 1045 in the turbine steam supply line to AFW pump FW-10.
3. The AFW turbine-driven pump is supplied from both main steam headers, upstream of the main steam isolation valves.

C. Other
1. Lubrication is provided locally for pumps, pump motors, and the turbine drive. The lubrication system for the turbine drive requires DC power from either the A or B DC bus.

3.2.7 Section 3.2 References

1. NUREG-0635, "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in Combustion Engineering Designed Operating Plants," USNRC, January 1980.

2. Fort Calhoun Updated FSAR, Section 4.3.4.

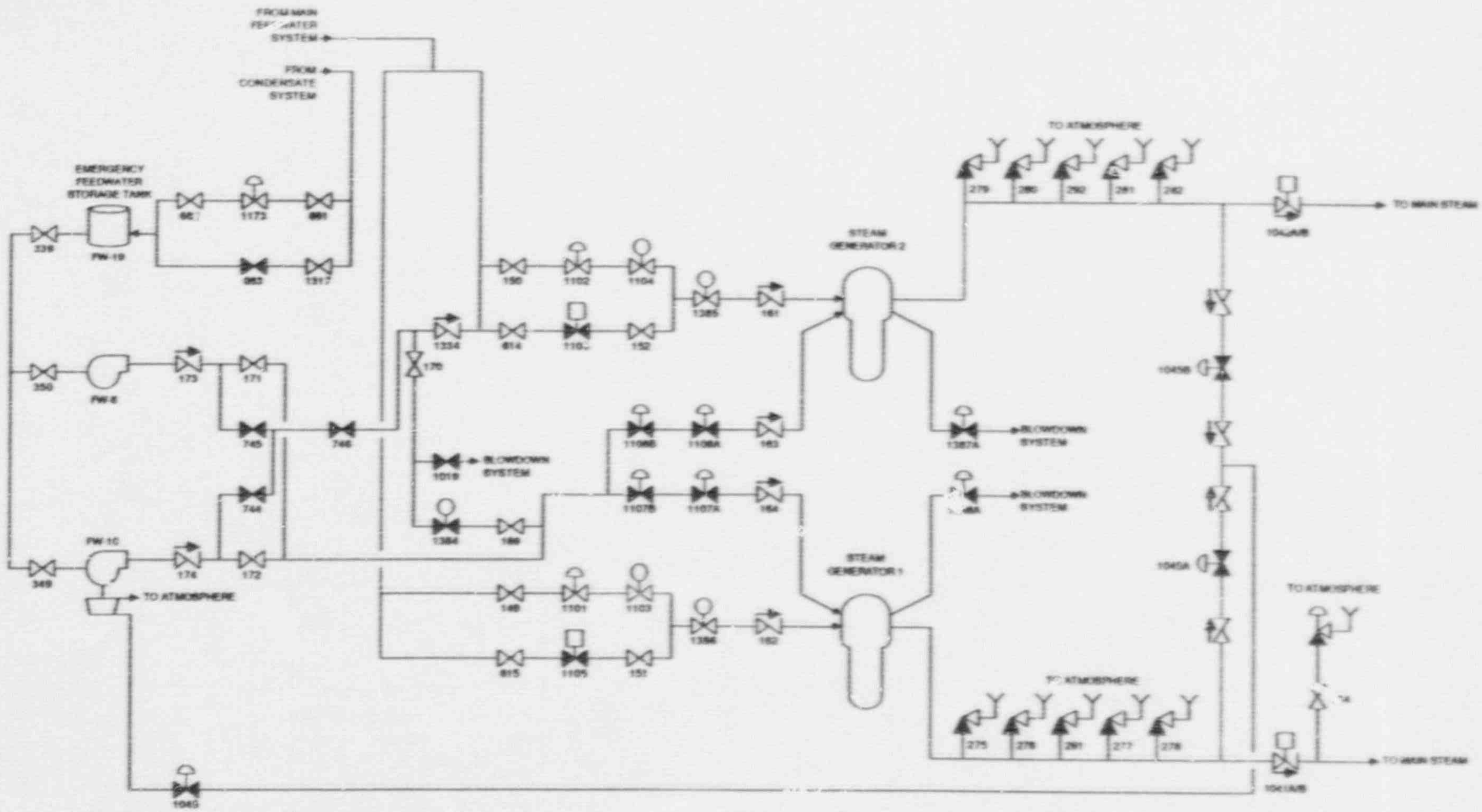

Figure 3.2-1. Fort Calhoun Auxiliary Feedwater and Secondary Steam Relief Systems

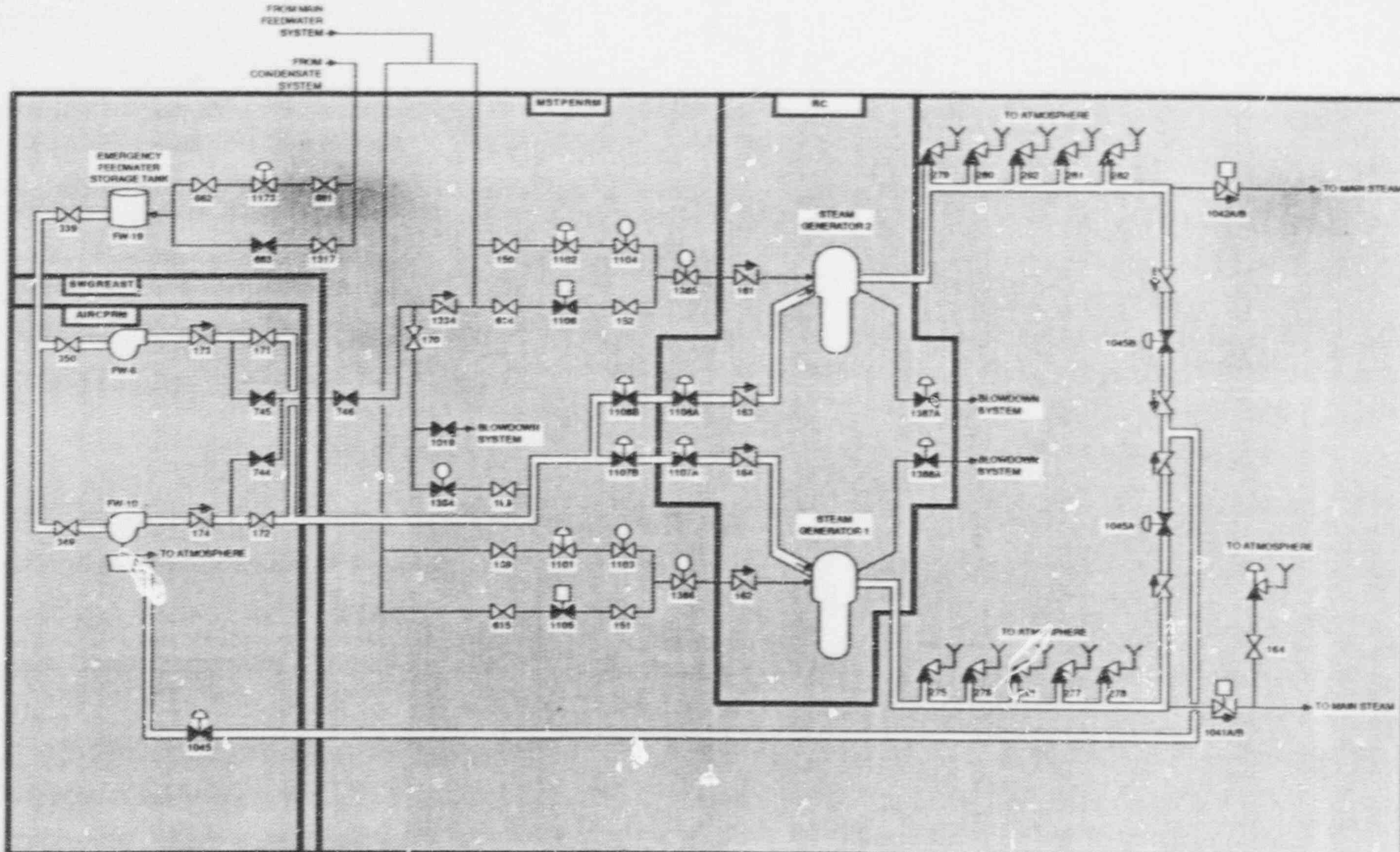

Figure 3.2-2. Fort Calhoun Auxiliary Feedwater and Secondary Steam Relief Systems Showing Component Locations

Table 3.2-1. Ft. Calhoun Auxiliary Feedwater System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
FW-10	TDP	AIRCPRM				
FW-19	TANK	MSTPENRM				
FW-6	MDP	AIRCPRM	BUS-1A3	4160	SWGREAST	AC/A
RC-2A	SG	RC				
RC-2B	SG	RC				

3.3 SAFETY INJECTION SYSTEM (SIS)

3.3.1 System Function

The Safety Injection System (SIS) provides for reactor core cooling and coolant inventory control following the loss-of-coolant-accident (LOCA). The high-pressure safety injection (HPSI) subsystem of the SIS that performs the emergency coolant injection and recirculation functions to maintain reactor core coolant inventory and adequate decay heat removal following a small LOCA. The low-pressure safety injection (LPSI) subsystem of the SIS performs similar functions following a large 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 spray system (see Section 3.4) or the containment air cooling system (see Section 3.8).

3.3.2 System Definition

The Safety Injection System consists of the HPSI and LPSI subsystems and four safety injection tanks (accumulators). The HPSI subsystem has three pumps that take a suction on the Safety Injection and Refueling Water Tank (SIRWT) during the injection mode of operation, and are realigned to take a suction directly on the containment sump during the recirculation mode of operation. The LPSI subsystem has two pumps that are aligned to either the SIRWT or the containment sump, as described above. The HPSI and LPSI subsystems and the safety injection tanks all inject into the RCS cold legs.

Simplified drawings of the high pressure safety injection system are shown in Figures 3.3-1 and 3.3-2. Interfaces between this system and the RCS are shown in Section 3.1. A summary of data on selected high-pressure safety injection system components is presented in Table 3.3-1.

3.3.3 System Operation

During normal operation, the safety injection system is in standby. Following a LOCA, this system injects borated water into the RCS to increase shutdown margin and to keep the reactor core covered with coolant. The safety injection pumps are started automatically by the Engineered Safety Feature Actuation System (ESFAS, See Section 3.9). Borated water is initially pumped from the SIRW tank to the RCS. In addition, the safety injection actuation signal (SIAS) aligns the charging pumps, in the chemical and volume control system, to take suction from the concentrated boric acid storage tanks and starts all idle charging pumps. Water from the safety injection tanks (SITs) enter the RCS when RCS pressure drops below SIT pressure.

The recirculation actuation signal (RAS) automatically switches the pump suction to the containment recirculation inlet when the SIRWT level falls to a preset point. At this time, the flow path from the containment sump is opened, the SIRWT flow path is closed and water is recirculated from the sump by the safety injection pumps. Water from the containment sump is also circulated by the containment spray pumps and is cooled by the shutdown cooling heat exchangers.

3.3.4 System Success Criteria

LOCA mitigation requires both the emergency coolant injection and emergency coolant recirculation functions to be accomplished. The ECI success criteria for a large LOCA is the following (Ref. 1):

- 3 of 4 safety injection tanks provide makeup as RCS pressure drops below tank pressure, and
- Two high pressure safety injection pumps deliver 75% of their rated flow to the RCS, and
- One low pressure safety injection pump deliver 75% of its rated flow to the RCS

If the ECI success criteria is met, then the following large LOCA ECR success criteria will apply (Ref. 1):

- At least one high pressure safety injection pump is realigned for recirculation and takes a suction on the containment sump and injects into the RCS cold legs.

Success criteria for a small LOCA is not clearly defined in the FSAR, however, it should be noted that:

- The HPSI pump shutoff head is less than RCS normal operating pressure, therefore, a small LOCA must be of sufficient size to cause some RCS depressurization, or the RCS must be depressurized by other means if the HPSI pumps are to provide makeup. Options for depressurizing the RCS may include:
  - Opening power-operated relief valves on the pressurizer (two PORVs are available, see Section 3.1)
  - RCS cooldown (i.e. using auxiliary feedwater system, see Section 3.2)
- The combined capacity of the three positive displacement charging pumps (not part of the SIS) is 120 gpm (i.e. 40 gpm each).

3.3.5 Component Information

A. High pressure safety injection pumps HP-2A, HP-2B, and HP-2C
   1. Rated flow: 150 gpm @ 2,800 ft. head (1,214 psid)
   2. Maximum flow: 480 gpm @ 1,200 ft. head (520 psid)
   3. Shutoff head: 3,180 ft. (1,378 psid)
   4. Type: multi-stage, horizontal centrifugal

B. Low pressure safety injection pumps LP-1A and LP-1B
   1. Rated flow: 1,500 gpm @ 403 ft. head (174 psid)
   2. Shutoff head: 450 ft. (195 psid)
   3. Type: Single stage, horizontal centrifugal

C. Safety injection tanks (SI-6A, SI-6B, SI-6C, SI-6D)
   1. Volume: 1,300 ft^3
   2. Water volume (min): 825 ft^3
   3. Operating pressure (min): 240 psig
   4. Nominal Boron concentration: 1,700 ppm

D. Safety injection and refueling water tank
   1. Capacity: 314,000 gallons
   2. Design Pressure: atmospheric
   3. Nominal Boron Concentration: 1,700 ppm (estimated)

E. Shutdown cooling heat exchangers CS-4A and CS-4B
   1. Type: shell and tube
   2. Design duty: 87.5 x 10^6 BTU/hr

3.3.6 Support Systems and Interfaces

A. Control signals
   1. Automatic
      The safety injection system is automatically actuated by an SIAS signal. Conditions initiating an SIAS trip are:

      a. Containment high pressure
      b. Pressurizer low pressure coincident with pressurizer low water level

      The transition from the injection phase to the recirculation phase is automatic following a RAS signal based on a low water level in the SIRWT.
   2. Remote manual
      An SIAS signal can be initiated by remote manual means from the main control room. The transition from the injection to the recirculation phase of can be accomplished by remote manual actions.

B. Motive Power
   1. The safety injection pumps and motor-operated valves are Class 1E AC loads that can be supplied from the standby diesel generators.

C. Other
   1. Each HPSI pump has mechanical face seals backed up by a bushing. To prolong seal life, a portion of the pump discharge is diverted for seal lubrication. This lubrication flow can be cooled from redundant supplies from the mponent Cooling Water (CCW) and Raw Water (RW) systems (see Sections 3.6 and 3.7).
   2. The LPSI pumps can be cooled from redundant supplies from the CCW and RW systems (see Sections 3.6 and 3.7).

3.3.7 Section 3.3 References

1. Fort Calhoun Updated FSAR, Section 6.2.1

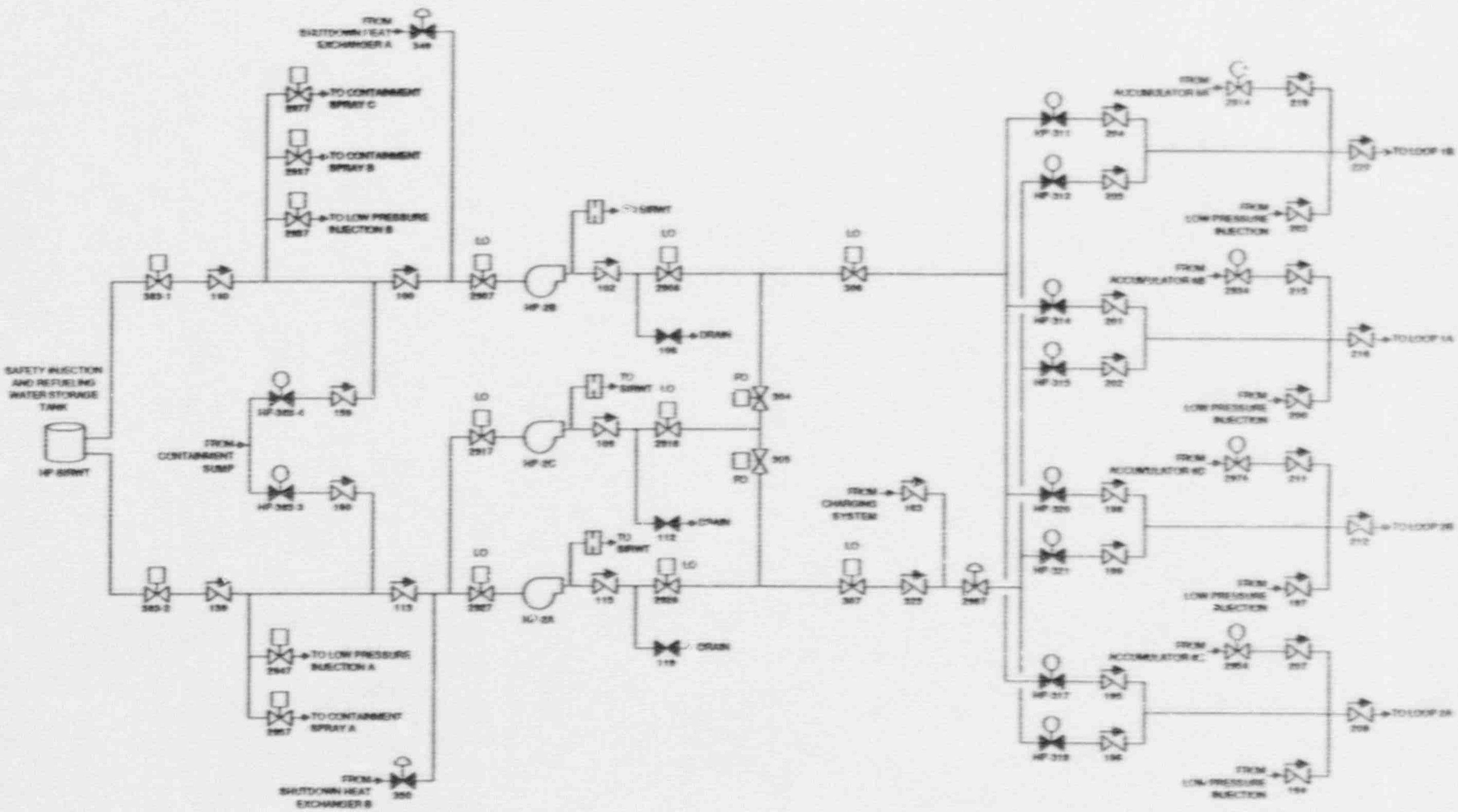

Figure 3.3-1. Fort Calhoun High Pressure Safety Injection System

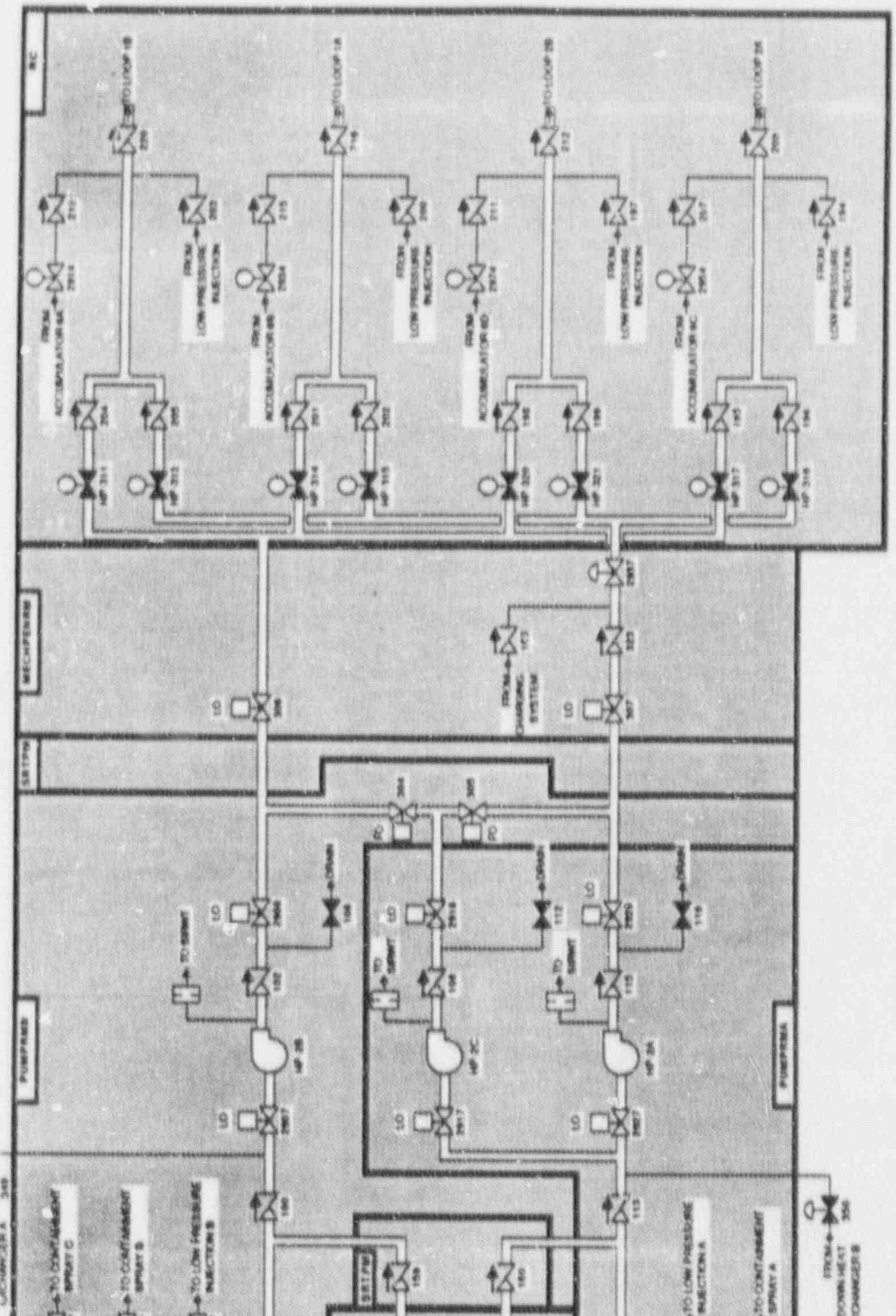

Figure 3.3-2. Fort Calhoun High Pressure Safety Injection System Showing Component Locations

Table 3.3-1. Ft. Calhoun High Pressure Safety Injection System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
HP-2A	MDP	PUMPRMA	BUS-1B3A	480	SWGREAST	AC/A
HP-2B	MDP	PUMPRMB	BUS-1B4C	480	SWGRWEST	AC/B
HP-2C	MDP	PUMPRMA	BUS-1B3A-4A	480	SWGREAST	AC/AB
HP-311	MOV	RC	MCC-3B1	480	EPENRMEAST	AC/A
HP-312	MOV	RC	MCC-4C1	480	EPENRMWEST	AC/B
HP-314	MOV	RC	MCC-3A1	480	EPENRMEAST	AC/A
HP-315	MOV	RC	MCC-4A1	480	EPENRMWEST	AC/B
HP-317	MOV	RC	MCC-3A1	480	EPENRMEAST	AC/A
HP-318	MOV	RC	MCC-4A1	480	EPENRMWEST	AC/B
HP-320	MOV	RC	MCC-3B1	480	EPENRMEAST	AC/A
HP-321	MOV	RC	MCC-4C1	480	EPENRMWEST	AC/B
HP-383-3	MOV	RC	MCC-3A2	480	3A2	AC/A
HP-383-4	MOV	RC	MCC-4C2	480	4C2	AC/B
HP-SIRWT	TANK	SIRWT				

3.4 CONTAINMENT SPRAY (CS) SYSTEM

3.4.1 System Function

The containment spray system is one of two systems that perform the functions of containment heat removal and containment pressure control following a loss of coolant accident. The Containment Air Cooling (CAC) system is the second system associated with these functions (see Section 3.8). In conjunction with the Safety Injection System (SIS, see Section 3.3), the CS system completes the post-LOCA heat transfer path from the reactor core to the ultimate heat sink.

3.4.2 System Definition

The containment spray system consists of the Safety Injection and Refueling Water Tank (SIRWT), three spray pumps, two heat exchanges (shutdown cooling heat exchangers), two spray headers inside containment, and associated piping, valves, and instrumentation. The pumps discharge borated water through the two heat exchangers to the two spray headers and spray nozzles in containment.

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

3.4.3 System Operation

During normal operation, the containment spray system is in standby. All three spray pumps are started by the safety injection actuation signal (SIAS). The containment spray actuation signal (CSAS) opens the spray header valves and brings the system to full operation.

Initially, the pumps take suction from the SIRWT. Upon reaching low tank level, the recirculation actuation signal (RAS) is initiated, automatically transferring the containment spray pump suction to the containment recirculation line. The recirculated water is cooled by the shutdown heat exchangers prior to being returned into containment atmosphere. Heat is transferred to either the Auxiliary Coolant Component Cooling Water (CCW) system (see Section 3.6), or the Raw Water (RW) system (see Section 3.7).

The low pressure safety injection (LPSI) pumps can be aligned to supply the containment spray headers when operating in the recirculation mode.

3.4.4 System Success Criteria

Both the CS and CAC systems have sufficient cooling capacity to independently perform the containment heat removal function. The containment spray system can independently perform the containment heat removal function if the following conditions are met (Ref. 1):

- Two of three containment spray pumps operate and supply water from the SIRWT to the spray headers during the injection phase
- The system is realigned for recirculation operation when required
- Either shutdown cooling heat exchanger provides cooling (CCW or RW available)

Partial CS and CAC success criteria may exist, but are not clearly defined in the FSAR.

3.4.5 Component Information

A. Containment Spray Pumps CS-3A, CS-3B, and CS-3C
   1. Rated flow: 2,000 gpm @ 437 ft head (189 psid)
   2. Rated capacity: 50%
   3. Type: horizontal centrifugal

B. Shutdown cooling heat exchanges CS-4A and CS-4B
   1. Type: shell and tube
   2. Design duty: 87.5×10^6 BTU/hr

3.4.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The containment spray system is automatically actuated by a SIAS signal.
   2. Remote manual
      All containment spray system components can be actuated by remote manual means from the central control room.

B. Motive Power
   1. The CS pumps and motor-operated sump suction valves are Class 1E AC loads that can be supplied from the standby diesel generators. Redundant loads are supplied from separate load groups.
   2. Hydraulic and pneumatic valves are served by accumulators that allow actuation of the valves following a loss of compressed air. DC power is required.

C. Cooling Water
   1. The Auxiliary Coolant Component Cooling Water (CCW) or the Raw Water (RW) systems provides cooling water to the shutdown cooling heat exchangers (see Sections 3.6 and 3.7).
   2. Each CS pump can be cooled from redundant supplies from the CCW and RW systems (see Sections 3.6 and 3.7).

3.4.7 Section 3.4 References

1. Fort Calhoun Updated FSAR, Section 6.3.2

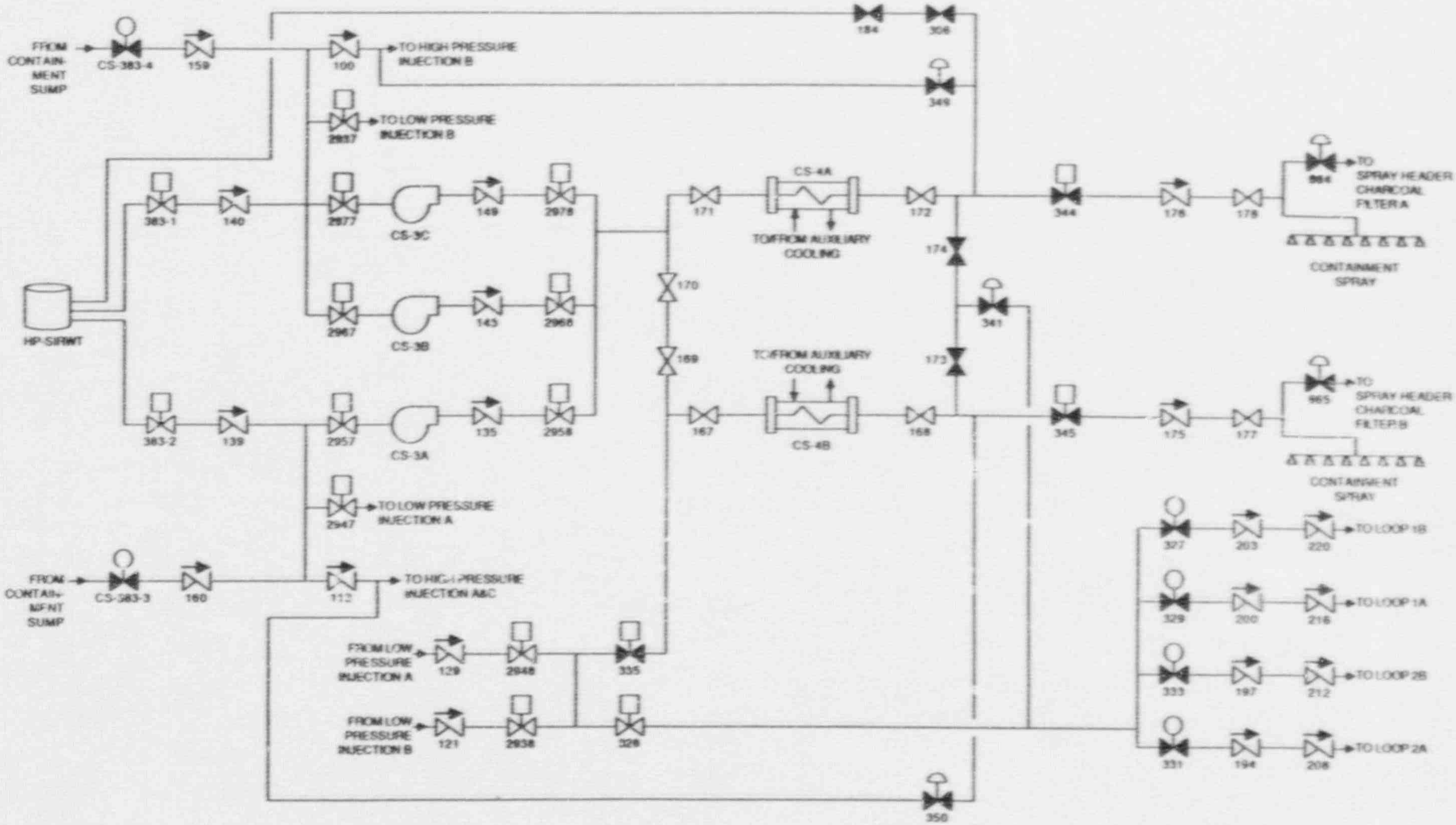

Figure 3.4-1. Fort Calhoun Containment Spray System

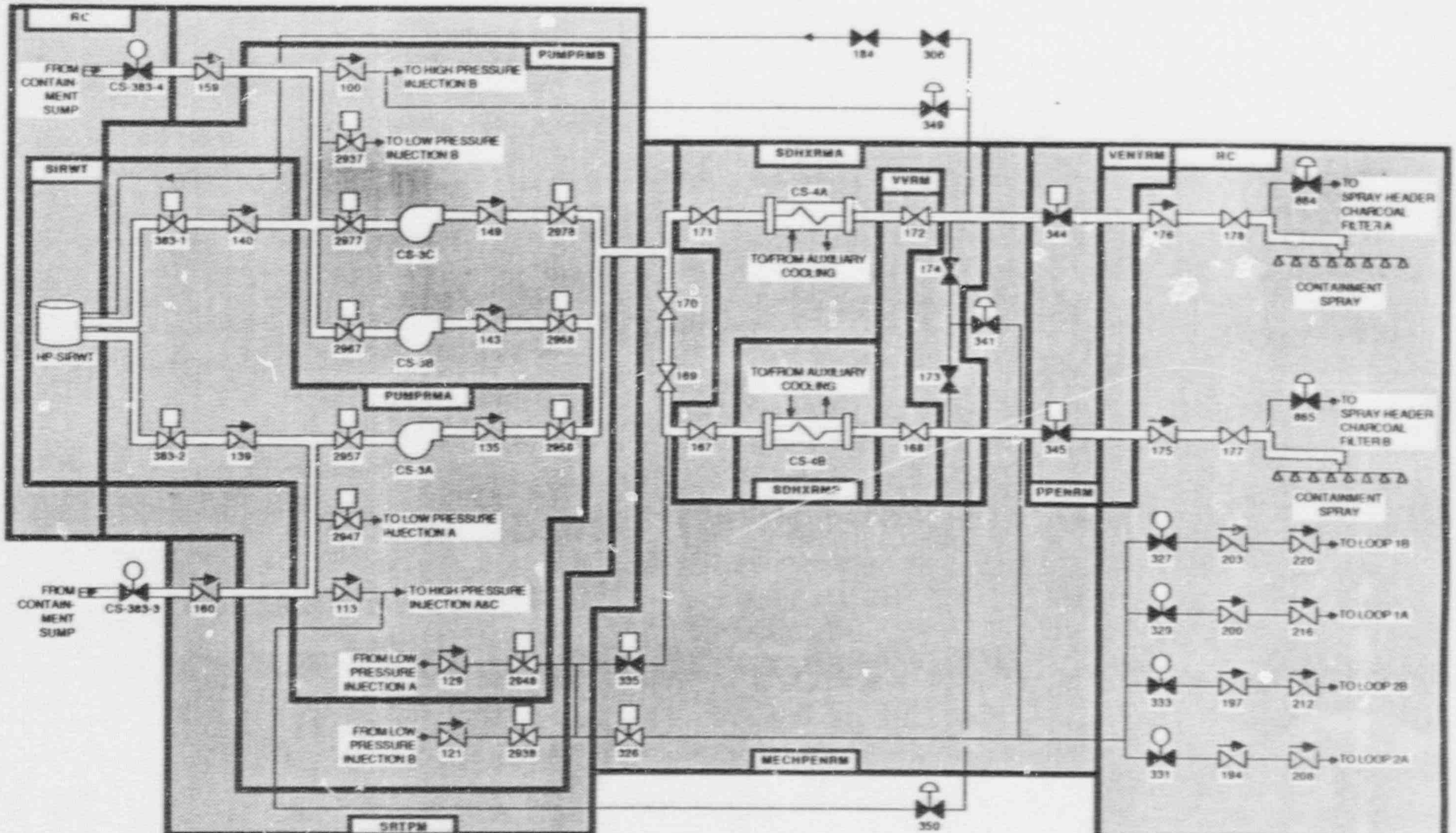

Figure 3.4-2. Fort Calhoun Containment Spray System Showing Component Locations

Table 3.4-1. Ft. Calhoun Containment Spray System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CS-3A	MDP	PUMPRMA	BUS-1B3C	480	SWGREAST	AC/A
CS-3B	MDP	PUMPRMB	BUS-1B4B	480	SWGRWEST	AC/B
CS-3C	MDP	PUMPRMB	BUS-1B3B-4B	480	SWGRWEST	AC/AB
CS-4A	HX	SDHXRMA				
CS-4B	HX	SDHXRMB				

3.5 ELECTRIC POWER SYSTEM

3.5.1 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.

3.5.2 System Definition

The onsite Class 1E electric power system consists of two 4160/480 VAC and 125 VDC load groups, or divisions, and four 120 VAC load groups. Each 4160/480 VAC load group consists of a diesel generator and distribution equipment needed to supply key AC electrical loads. Each 125 VAC load group includes a battery, battery chargers, and distribution equipment needed to supply DC loads. Each 120 VAC load group includes an inverter and distribution equipment to supply instrument loads. Simplified one-line diagrams of the Class 1E electric power system are shown in Figures 3.5-1 and 3.5-2. A summary of data on selected electric power system components is presented in Table 3.5-1. A partial listing of electrical sources and loads is resented in Table 3.5-2.

3.5.3 System Operation

During normal operation, the Class 1E electric power system is supplied by station service power from the main generator, the 345 kV switchyard or a combination of both. The automatic transfer from this preferred power source to diesel generators is accomplished automatically following a loss of offsite power by opening the normal source circuit breakers and then reenergizing the Class 1E portion of the electric power system from the diesel generators. Following a start command, each diesel generator is designed to reach rated speed and be capable of accepting loads within 13 seconds.

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 needed to start the diesel generators following loss of offsite power.

The 120 VAC vital buses normally receive power from DC buses through an inverter. The batteries will supply the vital bus inverters on loss of AC power.

3.5.4 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

3.5.5 Component Information

A. Standby diesel generators (2)
   1. Maximum continuous rating: 2402 kW
   2. 30-minute rating: 2853 kW
   3. Rated voltage: 4160 VAC
   4. Manufacturer: General Motors

B. Batteries (2)
   1. Type: Lead-calcium
   2. Rated voltage: 125 VDC
   3. Cells: 60
   4. Capacity: 8 hours of operation with design loads

3.5.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The standby diesel generators are automatically started based on:
      - Loss of voltage to the normal bus
      - Containment internal pressure high
      - Reactor coolant pressure low
      - Time delay undervoltage on the normal bus
   2. Remote manual
      The diesel generators can be started, and many distribution circuit breakers can be operated from the main control room.

B. Diesel Generator Auxiliary Systems
   1. Diesel Cooling System
      The cooling system for each engine is completely integral and requires no outside cooling water source.
   2. Diesel Starting System
      The air starting system for each diesel is capable of five start attempts without requiring AC power to recharge the starting air accumulators using air compressors.
   3. Diesel Fuel Oil Transfer and Storage System
      A 300 gallon "day tank" supplies the relatively short-term fuel needs of each diesel. The day tanks must be replenished from a common 18,000 gallon storage tank to maintain an uninterrupted supply of fuel to the diesel. Onsite fuel is sufficient for seven days.
   4. Diesel Lubrication System
      Each diesel generator has its own lubrication system.
   5. Combustion Air Intake and Exhaust System
      This system supplies fresh air to the diesel intake, and directs the diesel exhaust outside of the diesel building.
   6. Diesel Room Ventilation System
      Details of the diesel room ventilation system are not known.

C. Switchgear Room and Battery Room Ventilation Systems
   These systems maintain acceptable environmental conditions in the switchgear and battery rooms, and may be needed for long-term operation of the Electric power system. Details of these systems are not known.

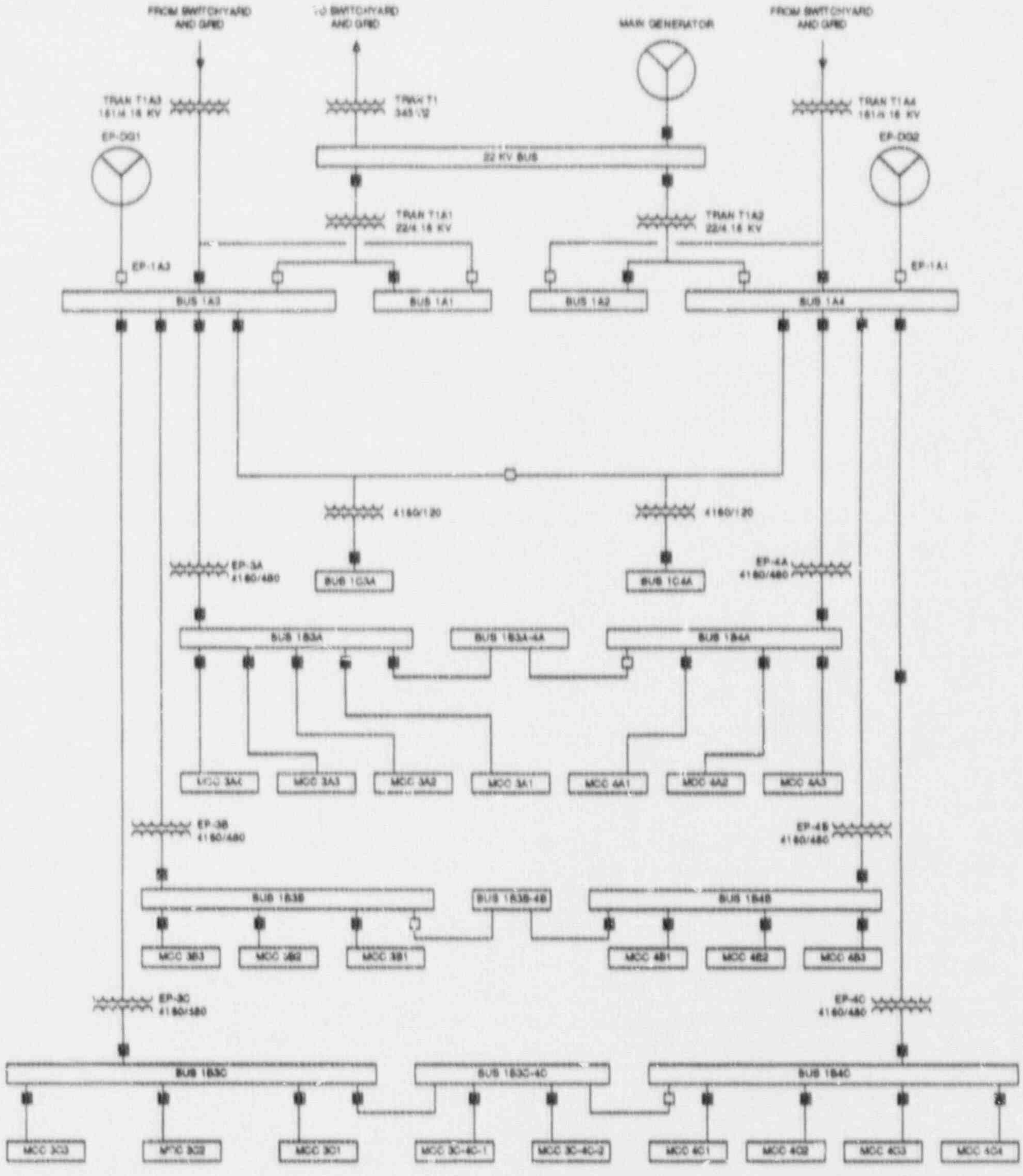

Figure 3.5-1. Fort Calhoun 4160 and 480 VAC Electric Power Distribution System

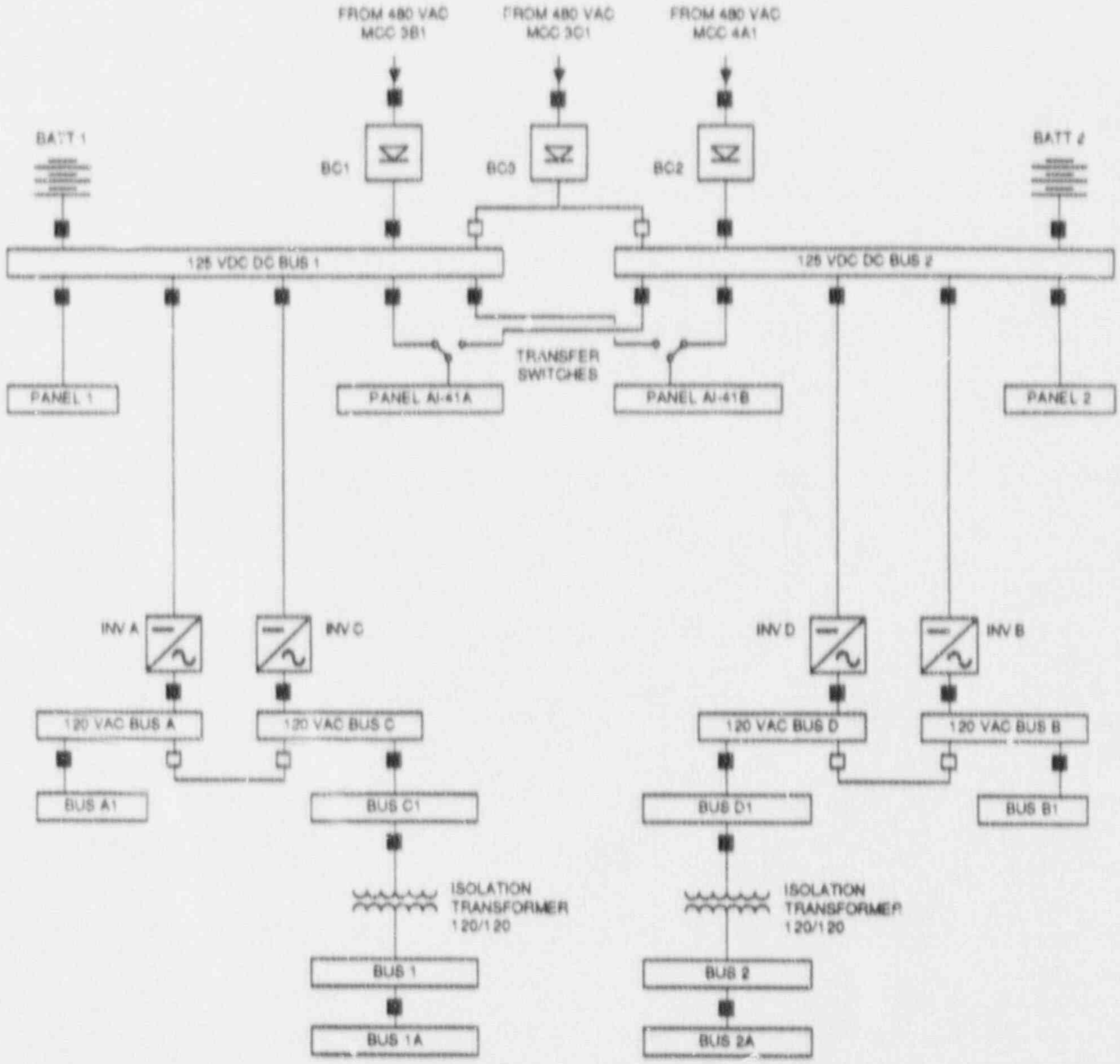

Figure 3.5-2. Fort Calhoun 125 VDC and 120 VAC Electric Power Distribution System

Table 3.5-1. Ft. Calhoun Electric Power System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
BATT-1	BATT	BATRM1		125		DC/A
BATT-2	BATT	BATRM2		125		DC/B
BC1	BC	SWGREAST	MCC-3B1	480	EPENRMEAST	AC/A
BC2	BC	SWGRWEST	MCC-4A1	480	EPENRMWEST	AC/B
BC3	BC	SWGRWEST	MCC-3C1	480	EPENRMEAST	AC/A
BUS-1A3	BUS	SWGREAST	EP-DG1	4160	DGRM1	AC/A
BUS-1A4	BUS	SWGRWEST	EP-DG2	4160	DGRM2	AC/B
BUS-1B3A	BUS	SWGREAST	EP-3A	480	SWGREAST	AC/A
BUS-1B3A-4A	BUS	SWGREAST	BUS-1B3A	480	SWGREAST	AC/AB
BUS-1B3A-4A	BUS	SWGREAST	BUS-1B4A	480	SWGRWEST	AC/AB
BUS-1B3B	BUS	SWGREAST	EP-3B	480	SWGREAST	AC/A
BUS-1B3B-4B	BUS	SWGRWEST	BUS-1B3B	480	SWGREAST	AC/AB
BUS-1B3B-4B	BUS	SWGRWEST	BUS-1B4B	480	SWGRWEST	AC/AB
BUS-1B3C	BUS	SWGREAST	EP-3C	480	SWGREAST	AC/A
BUS-1B3C-4C	BUS	SWGREAST	BUS-1B3C	480	SWGREAST	AC/AB
BUS-1B3C-4C	BUS	SWGREAST	BUS-1B4C	480	SWGRWEST	AC/AB
BUS-1B4A	BUS	SWGRWEST	EP-4A	480	SWGRWEST	AC/B
BUS-1B4B	BUS	SWGRWEST	EP-4B	480	SWGRWEST	AC/B
BUS-1B4C	BUS	SWGRWEST	EP-4C	480	SWGRWEST	AC/B
DC-BUS-1	BUS	SWGREAST	BATT-1	125	BATRM1	DC/A
DC-BUS-1	BUS	SWGREAST	BC1	125	SWGREAST	DC/A
DC-BUS-1	BUS	SWGREAST	BC3	125	SWGRWEST	DC/A
DC-BUS-2	BUS	SWGRWEST	BATT-2	125	BATRM2	DC/B
DC-BUS-2	BUS	SWGRWEST	BC2	125	SWGRWEST	DC/B
DC-BUS-2	BUS	SWGRWEST	BC3	125	SWGRWEST	DC/B
EP-1A3	CB	SWGREAST				
EP-1A4	CB	SWGRWEST				
EP-3A	TRAN	SWGREAST	BUS-1A3	4160	SWGREAST	AC/A
EP-3B	TRAN	SWGREAST	BUS-1A3	4160	SWGREAST	AC/A

Table 3.5-1. Ft. Calhoun Electric Power System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
EP-3C	TRAN	SWGREAST	BUS-1A3	4160	SWGREAST	AC/A
EP-4A	TRAN	SWGRWEST	BUS-1A4	4160	SWGRWEST	AC/B
EP-4B	TRAN	SWGRWEST	BUS-1A4	4160	SWGRWEST	AC/B
EP-4C	TRAN	SWGRWEST	BUS-1A4	4160	SWGRWEST	AC/B
EP-DG1	DG	DGRM1		4160		AC/A
EP-DG2	DG	DGRM2		4160		AC/B
MCC-3A1	MCC	EPENRMEAST	BUS-1B3A	480	SWGREAST	AC/A
MCC-3A2	MCC	3A2	BUS-1B3A	480	SWGREAST	AC/A
MCC-3B1	MCC	EPENRMEAST	BUS-1B3B	480	SWGREAST	AC/A
MCC-3C1	MCC	EPENRMEAST	BUS-1B3C	480	SWGREAST	AC/A
MCC-4A1	MCC	EPENRMWEST	BUS-1B4A	480	SWGRWEST	AC/B
MCC-4B1	MCC	EPENRMWEST	BUS-1B4B	480	SWGRWEST	AC/B
MCC-4C1	MCC	EPENRMWEST	BUS-1B4C	480	SWGRWEST	AC/B
MCC-4C2	MCC	4C2	BUS-1B4C	480	SWGRWEST	AC/B

TABLE 3.5-2. PARTIAL LISTING OF ELECTRICAL SOURCES AND LOADS AT FORT CALHOUN

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BATT-1	125	DC/A	BATRM1	EP	DC-BUS-1	BUS	SWGREAST
BATT-1	125	DC/A	BATRM1	FW	DC-BUS-1	BUS	SWGREAST
BATT-2	125	DC/B	BATRM2	EP	DC-BUS-2	BUS	SWGRWEST
BATT-2	125	DC-B	BATRM2	FW	DC-BUS-2	BUS	SWGRWEST
BC1	125	DC/A	SWGREAST	EP	DC-BUS-1	BUS	SWGREAST
BC2	125	DC/B	SWGRWEST	EP	DC-BUS-2	BUS	SWGRWEST
BC3	125	DC/A	SWGRWEST	EP	DC-BUS-1	BUS	SWGREAST
BC3	125	DC/B	SWGRWEST	EP	DC-BUS-2	BUS	SWGRWEST
BUS-1A3	4160	AC/A	SWGREAST	EP	EP-3A	TRAN	SWGREAST
BUS-1A3	4160	AC/A	SWGREAST	EP	EP-3B	TRAN	SWGREAST
BUS-1A3	4160	AC/A	SWGREAST	EP	EP-3C	TRAN	SWGREAST
BUS-1A3	4160	AC/A	SWGREAST	FW	FW-6	MDP	AIRCPRM
BUS-1A3	4160	AC/A	SWGREAST	RW	AC-10A	MDP	RWPMRM
BUS-1A3	4160	AC/A	SWGREAST	RW	AC-10C	MDP	RWPMRM
BUS-1A4	4160	AC/B	SWGRWEST	EP	EP-4A	TRAN	SWGRWEST
BUS-1A4	4160	AC/B	SWGRWEST	EP	EP-4B	TRAN	SWGRWEST
BUS-1A4	4160	AC/B	SWGRWEST	EP	EP-4C	TRAN	SWGRWEST
BUS-1A4	4160	AC/B	SWGRWEST	RW	AC-10B	MDP	RWPMRM
BUS-1A4	4160	AC/B	SWGRWEST	RW	AC-10D	MDP	RWPMRM
BUS-1B3A	480	AC/AB	SWGREAST	EP	BUS-1B3A-4A	BUS	SWGREAST
BUS-1B3A	480	AC/A	SWGREAST	EP	MCC-3A1	MCC	EPENRMEAST
BUS-1B3A	480	AC/A	SWGREAST	EP	MCC-3A2	MCC	3A2
BUS-1B3A	480	AC/A	SWGREAST	HP	HP-2A	MDP	PUMPRMA
BUS-1B3A	480	AC/A	SWGREAST	HP	HP-2A	MDP	PUMPRMA
BUS-1B3A	480	AC/A	SWGREAST	VA	VA-3A	FAN	RC
BUS-1B3A-4A	480	AC/AB	SWGREAST	HP	HP-2C	MDP	PUMPRMA
BUS-1B3A-4A	480	AC/AB	SWGREAST	HP	HP-2C	MDP	PUMPRMA
BUS-1B3B	480	AC/A	SWGREAST	AC	AC-3A	MDP	VENTRM
BUS-1B3B	480	AC/AB	SWGREAST	EP	BUS-1B3B-4B	BUS	SWGRWEST
BUS-1B3B	480	AC/A	SWGREAST	EP	MCC-3B1	MCC	EPENRMEAST
BUS-1B3B-4B	480	AC/AB	SWGRWEST	CS	CS-3C	MDP	PUMPRMB

TABLE 3.5-2. PARTIAL LISTING OF ELECTRICAL SOURCES AND LOADS AT FORT CALHOUN (CONTINUED)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS-1B3B-4B	480	AC/AB	SWGRWEST	VA	VA-7D	FAN	RC
BUS-1B3C	480	AC/A	SWGREAST	CS	CS-3A	MDP	PUMPRMA
BUS-1B3C	480	AC/AB	SWGREAST	EP	BUS-1B3C-4C	BUS	SWGREAST
BUS-1B3C	480	AC/A	SWGREAST	EP	MCC-3C1	MCC	EPENRMEAST
BUS-1B3C-4C	480	AC/AB	SWGREAST	AC	AC-3C	MDP	VENTRM
BUS-1B3C-4C	480	AC/AB	SWGREAST	VA	VA-7C	FAN	RC
BUS-1B4A	480	AC/B	SWGRWEST	AC	AC-3B	MDP	VENTRM
BUS-1B4A	480	AC/AB	SWGRWEST	EP	BUS-1B3A-4A	BUS	SWGREAST
BUS-1B4A	480	AC/B	SWGRWEST	EP	MCC-4A1	MCC	EPENRMWEST
BUS-1B4B	480	AC/B	SWGRWEST	CS	CS-3B	MDP	PUMPRMB
BUS-1B4B	480	AC/AB	SWGRWEST	EP	BUS-1B3B-4B	BUS	SWGRWEST
BUS-1B4B	480	AC/B	SWGRWEST	EP	MCC-4B1	MCC	EPENRMWEST
BUS-1B4C	480	AC/AB	SWGRWEST	EP	BUS-1B3C-4C	BUS	SWGREAST
BUS-1B4C	480	AC/B	SWGRWEST	EP	MCC-4C1	MCC	EPENRMWEST
BUS-1B4C	480	AC/B	SWGRWEST	EP	MCC-4C2	MCC	4C2
BUS-1B4C	480	AC/B	SWGRWEST	HP	HP-2B	MDP	PUMPRMB
BUS-1B4C	480	AC/B	SWGRWEST	HP	HP-2B	MDP	PUMPRMB
BUS-1B4C	480	AC/B	SWGRWEST	VA	VA-3B	FAN	RC
EP-3A	480	AC/A	SWGREAST	EP	BUS-1B3A	BUS	SWGREAST
EP-3B	480	AC/A	SWGREAST	EP	BUS-1B3B	BUS	SWGREAST
EP-3C	480	AC/A	SWGREAST	EP	BUS-1B3C	BUS	SWGREAST
EP-4A	480	AC/B	SWGRWEST	EP	BUS-1B4A	BUS	SWGRWEST
EP-4B	480	AC/B	SWGRWEST	EP	BUS-1B4B	BUS	SWGRWEST
EP-4C	480	AC/B	SWGRWEST	EP	BUS-1B4C	BUS	SWGRWEST
EP-DG1	4160	AC/A	DGRM1	EP	BUS-1A3	BUS	SWGREAST
EP-DG2	4160	AC/B	DGRM2	EP	BUS-1A4	BUS	SWGRWEST
MCC-3A1	480	AC/A	EPENRMEAST	HP	HP-314	MOV	RC
MCC-3A1	480	AC/A	EPENRMEAST	HP	HP-314	MOV	RC
MCC-3A1	480	AC/A	EPENRMEAST	HP	HP-317	MOV	RC
MCC-3A1	480	AC/A	EPENRMEAST	HP	HP-317	MOV	RC
MCC-3A2	480	AC/A	3A2	CS	CS-383-3	MOV	RC

TABLE 3.5-2. PARTIAL LISTING OF ELECTRICAL SOURCES AND LOADS AT FORT CALHOUN (CONTINUED)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-3A2	480	AC/A	3A2	HP	HP-383-3	MOV	RC
MCC-3B1	480	AC/A	EPENRMEAST	EP	BC1	BC	SWGREAST
MCC-3B1	480	AC/A	EPENRMEAST	HP	HP-311	MOV	RC
MCC-3B1	480	AC/A	EPENRMEAST	HP	HP-311	MOV	RC
MCC-3B1	480	AC/A	EPENRMEAST	HP	HP-320	MOV	RC
MCC-3B1	480	AC/A	EPENRMEAST	HP	HP-320	MOV	RC
MCC-3B1	480	AC/A	EPENRMEAST	RCS	RC-150	MOV	RC
MCC-3B1	480	AC/A	EPENRMEAST	RCS	RC-348	MOV	RC
MCC-3C1	480	AC/A	EPENRMEAST	EP	BC3	BC	SWGRWEST
MCC-3C1	480	AC/A	EPENRMEAST	RCS	RC-102-1	SOV	RC
MCC-4A1	480	AC/B	EPENRMWEST	EP	BC2	BC	SWGRWEST
MCC-4A1	480	AC/B	EPENRMWEST	HP	HP-315	MOV	RC
MCC-4A1	480	AC/B	EPENRMWEST	HP	HP-315	MOV	RC
MCC-4A1	480	AC/B	EPENRMWEST	HP	HP-318	MOV	RC
MCC-4A1	480	AC/B	EPENRMWEST	HP	HP-318	MOV	RC
MCC-4A1	480	AC/B	EPENRMWEST	RCS	RC-151	MOV	RC
MCC-4B1	480	AC/B	EPENRMWEST	RCS	RC-102-2	SOV	RC
MCC-4C1	480	AC/B	EPENRMWEST	HP	HP-312	MOV	RC
MCC-4C1	480	AC/B	EPENRMWEST	HP	HP-312	MOV	RC
MCC-4C1	480	AC/B	EPENRMWEST	HP	HP-321	MOV	RC
MCC-4C1	480	AC/B	EPENRMWEST	HP	HP-321	MOV	RC
MCC-4C2	480	AC/B	4C2	CS	CS-383-4	MOV	RC
MCC-4C2	480	AC/B	4C2	HP	HP-383-4	MOV	RC
MCC-4C2	480	AC/B	4C2	RCS	RC-347	MOV	MECHPENRM

3.6 AUXILIARY COOLANT COMPONENT COOLING WATER (CCW) SYSTEM

3.6.1 System Function

The CCW is designed to cool components carrying radioactive or potentially radioactive fluids. It also serves as a cooling medium for the containment air coolers and the control room air conditioning equipment. The system provides a monitored intermediate cooling loop between those fluids and the raw water system which transfers the heat to the ultimate heat sink (see Section 3.7).

3.6.2 System Definition

The system is a closed loop consisting of three motor driven circulating pumps, four heat exchangers, a surge tank, valves, piping, instrumentation and controls. The systems which are supported by the CCW include the following:

- Safety injection/ system pump cooling
- Containment spray system pump cooling
- Containment air cooling system heat exchanger cooling
- Shutdown heat exchanger cooling
- Letdown heat exchanger
- Reactor coolant pump lube oil coolers
- Spent fuel pool heat exchangers
- Charging pump lube oil coolers

Simplified drawings of the auxiliary coolant component cooling water system are shown in Figures 3.6-1 and 3.6.-2. A summary of the data on selected CCW components is presented in Table 3.6-1. Note that the plant refers to this system as auxiliary coolant (AC) as well as CCW.

3.6.3 System Operation

During normal operation, one of three CCW pumps and three of four CCW heat exchangers are in service. One pump is in continuous service, while the other two are kept at ready standby. Both standby pumps automatically start in the event that the pump in service trips off.

Make up to the CCW is pumped to the surge tank from the demineralized water system through an automatic valve which is actuated by a level control switch on the surge tank. Flow distribution in the system is monitored in the control room and adjustments are made by remote valve operation.

During shutdown cooling, two of three CCW pumps and three of four CCW heat exchangers provide adequate cooling capacity.

3.6.4 System Success Criteria

Following a design basis accident (DBA), the following success criteria applies to the CCW system (Ref. 1).

- Two-out-of-three CCW pumps operate successfully
- Three-out-of-four CCW heat exchangers are available
- Raw Water System success (see Section 3.7)

Note that the Raw Water System is a redundant cooing water source for most of the components served by the CCW system, therefore the RW system can perform the same function as the CCW. Since CCW success is dependent on RW success, the CCW system is actually unnecessary under emergency conditions.

3.6.5 Component Information

A. Auxiliary coolant CCW pumps AC-3A, AC-3B, and AC-3C
   1. Rated flow: 5400 gpm @ 150 ft head (65 psid)
   2. Rated Capacity: 100% normal, 50% shutdown cooling and DBA
   3. Type: horizontal centrifugal

B. Auxiliary coolant CCW heat exchangers AC-1A, AC-1B, AC-1C, and AC-1D
   1. Type: shell and straight tube
   2. Rated heat removal: 12.1 x 10^6 Btu/hr normal, 134 x 10^6 Btu/hr DBA
   3. Rated capacity: 33%

3.6.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The three pumps are automatically started following a safety injection actuation signal (SIAS). Non-essential cooling loads are shut off following the SIAS.
   2. Remote Manual
      All CCW components can be manipulated from the central control room.

B. Motive Power
   1. The CCW motor-driven pumps and motor-operated valves are Class 1E loads that can be supplied by the standby diesel generators.
   2. The hydraulic and pneumatic valves in the system have accumulators so that valve operations can be performed following loss of the compressed air system. DC control power is still needed.

C. Other
   1. The CCW heat exchanges are cooled by the Raw Water System (see Section 3.7).
   2. The CCW pumps do not require external cooling support.

3.6.7 Section 3.6 References

1. Fort Calhoun Update FSAR, Section 9.7.4.3.

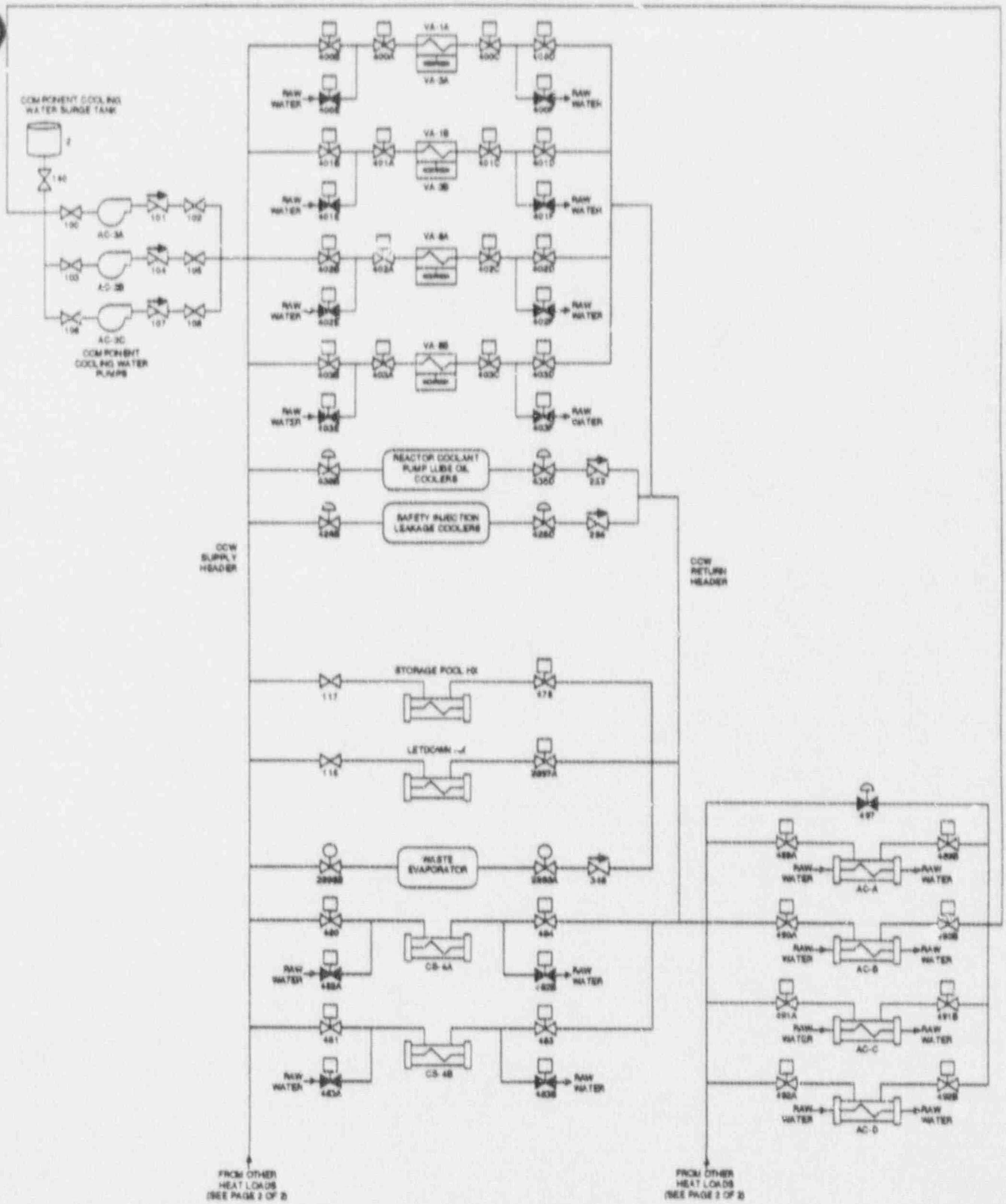

Figure 3.6-1. Fort Calhoun Auxiliary Coolant Component Cooling Water System (Page 1 of 2)

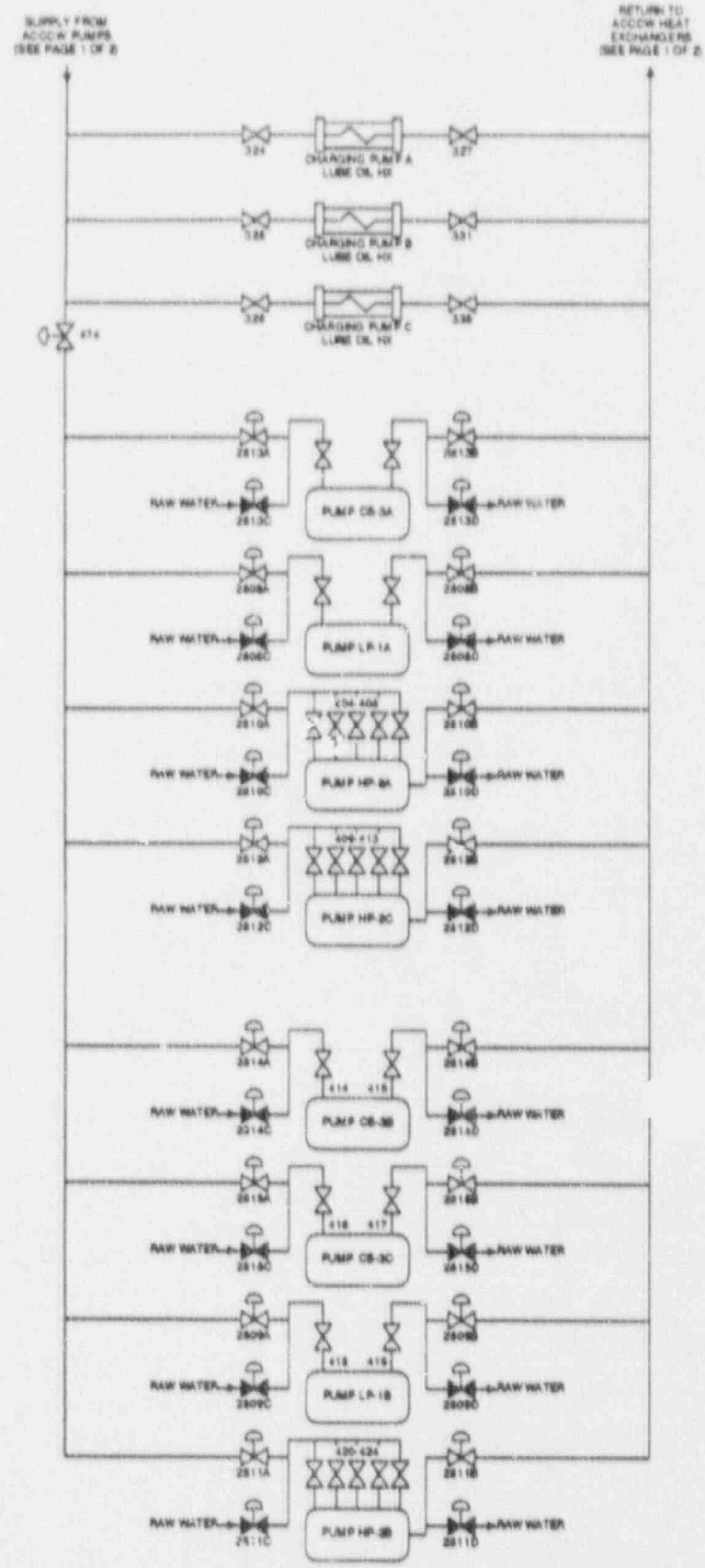

Figure 3.6-1. Fort Calhoun Auxiliary Coolant Component Cooling Water System (Page 2 of 2)

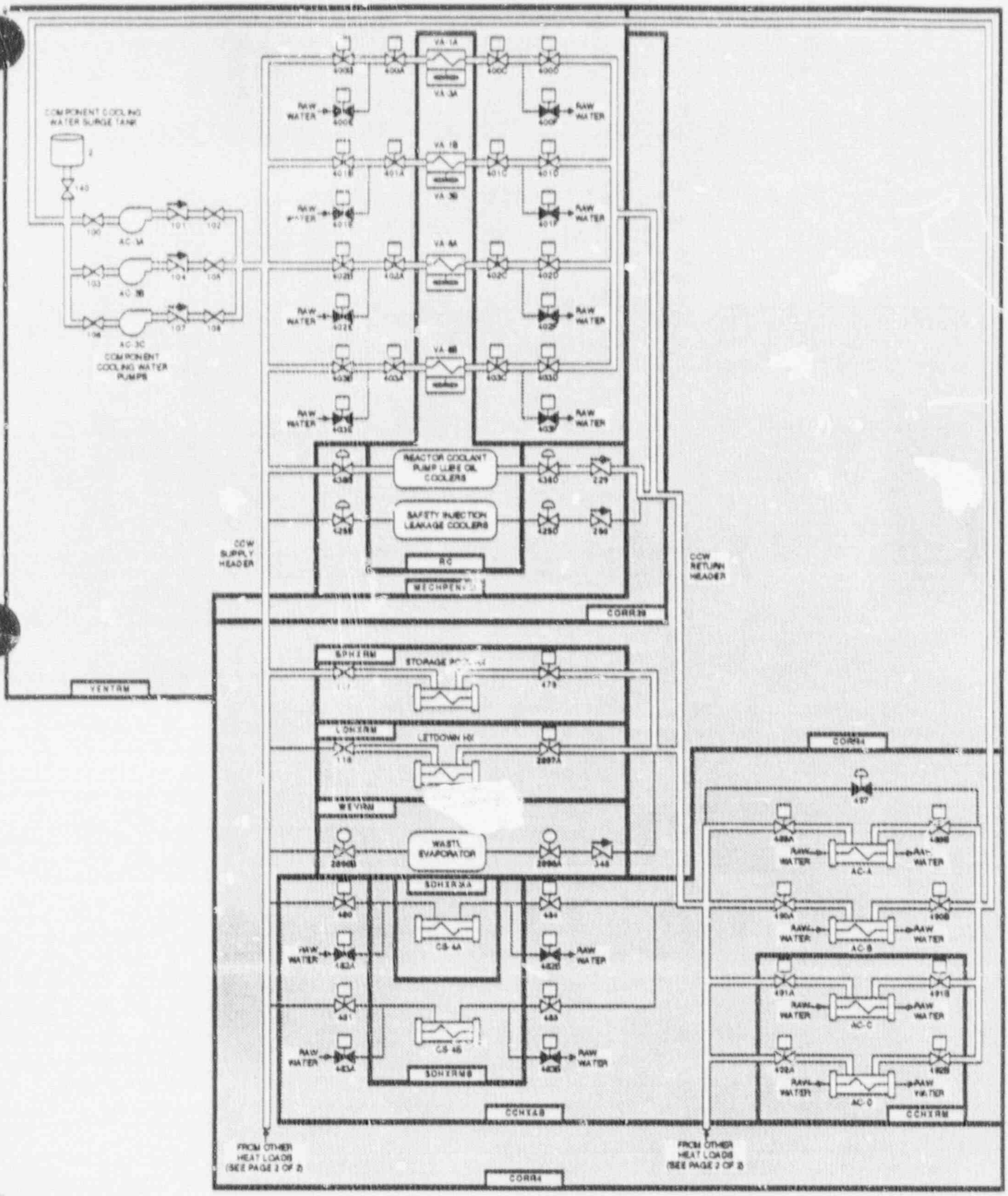

Figure 3.6-2 Fort Calhoun Auxiliary Coolant Component Cooling Water System Showing Component Locations (Page 1 of 2)

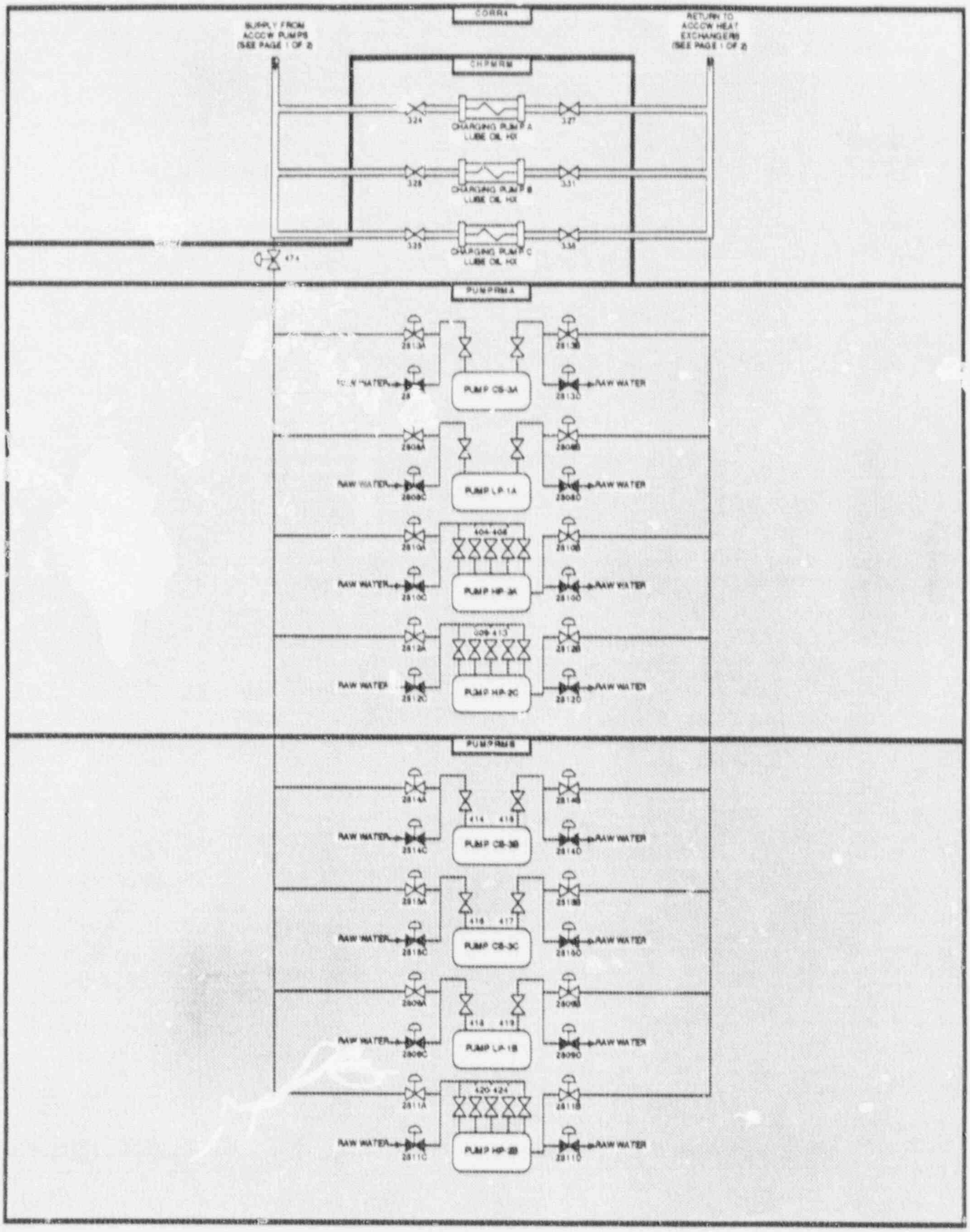

Figure 3.6-2. Fort Calhoun Auxiliary Coolant Component Cooling Water System Showing Component Locations (Page 2 of 2)

Table 3.6-1. Ft. Calhoun Auxiliary Coolant Component Cooling Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
AC-3A	MDP	VENTRM	BUS-1B3B	480	SWGREAST	AC/A
AC-3B	MDP	VENTRM	BUS-1B4A	480	SWGRWEST	AC/B
AC-3C	MDP	VENTRM	BUS-1B3C-4C	480	SWGREAST	AC/AB
AC-A	HX	CCHXAB				
AC-B	HX	CCHXAB				
AC-C	HX	CCHXRM				
AC-D	HX	CCHXRM				

3.7 RAW WATER (RW) SYSTEM

3.7.1 System Function

The raw water system was designed to provide a cooling medium for the component cooling water system. The heat transferred to the raw water is discharged to the ultimate heat sink (the Missouri River). The raw water system can be aligned to directly cool engineered safeguards equipment that normally is cooled by the CCW system.

3.7.2 System Definition

Four raw water pumps are installed in the intake structure pump house to provide screened river water to the CCW heat exchangers. The pump discharge piping is arranged as two headers which are interconnected and valved at the pumps and in the auxiliary buildings. Raw water can be utilized for direct cooling of the following:

- High pressure injection/recirculation system pumps lubrication cooling
- Containment spray system pumps lubrication cooling
- Containment air cooling system heat exchanger cooling
- Shutdown heat exchanger cooling

The RW system can also cool the control room air conditioning units and the low pressure injection pumps lubrication cooling.

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

3.7.3 System Operation

The system is remotely operable from the control room Normally only one RW pump is running during plant operation; during shutdown cooling two raw water pumps are in operation. All four pumps are started automatically from the safety injection actuation signal (SIAS). The operator selects two pumps to remain operating and shut down the other two pumps.

3.7.4 System Success Criteria

Following a design basis accident, two RW pumps are needed to provide the required cooling water flow (Ref. 1).

3.7.5 Component Information

A. Raw water pumps AC-10A, AC-10B, AC-10C, and AC-10D
   1. Rated flow: 5415 gpm @ 118 ft head normal (51 psid),
      3100 gpm @ 144 ft head accident (62 psid)
   2. Rated capacity: 100% normal, 50% shutdown
   3. Type: vertical , mixed flow

3.7.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The four pumps are automatically started following a safety injection actuation signal (SIAS).
   2. Remote Manual
      All RW components can be manipulated from the central control room.

B. Motive Power

1. The RW motor-driven pumps are Class 1E loads that can be supplied by the standby diesel generators.
2. The hydraulic and pneumatic valves in the system have accumulators so that valve operation can be performed following loss of the compressed air system. DC control power is still needed.

3.7.7 Section 3.7 References

1. Fort Calhoun Updated FSAR, Section 9.8.4.

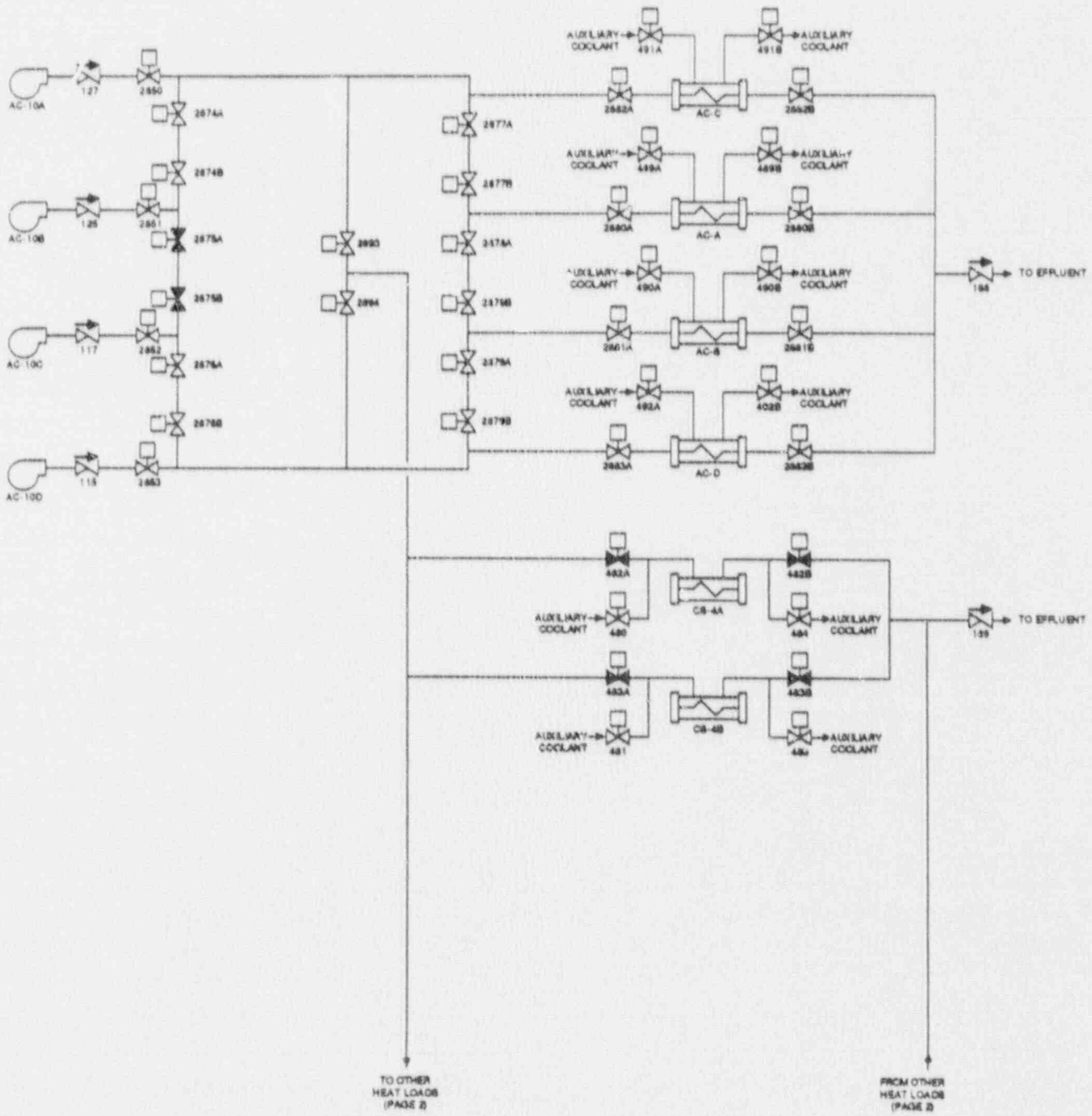

Figure 3.7-1. Fort Calhoun Raw Water System (Page 1 of 2)

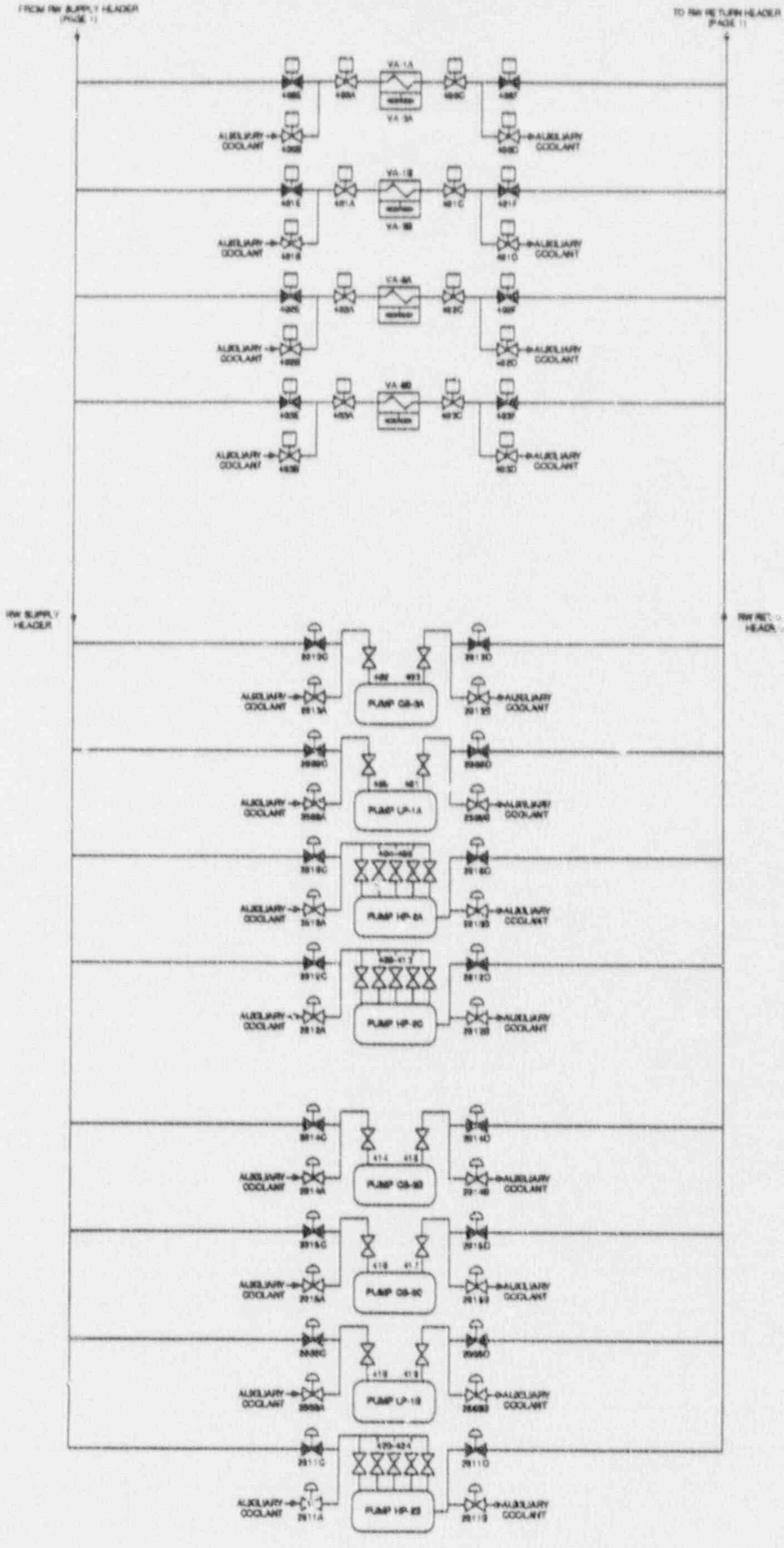

Figure 3.7-1. Fort Calhoun Raw Water System (Page 2 of 2)

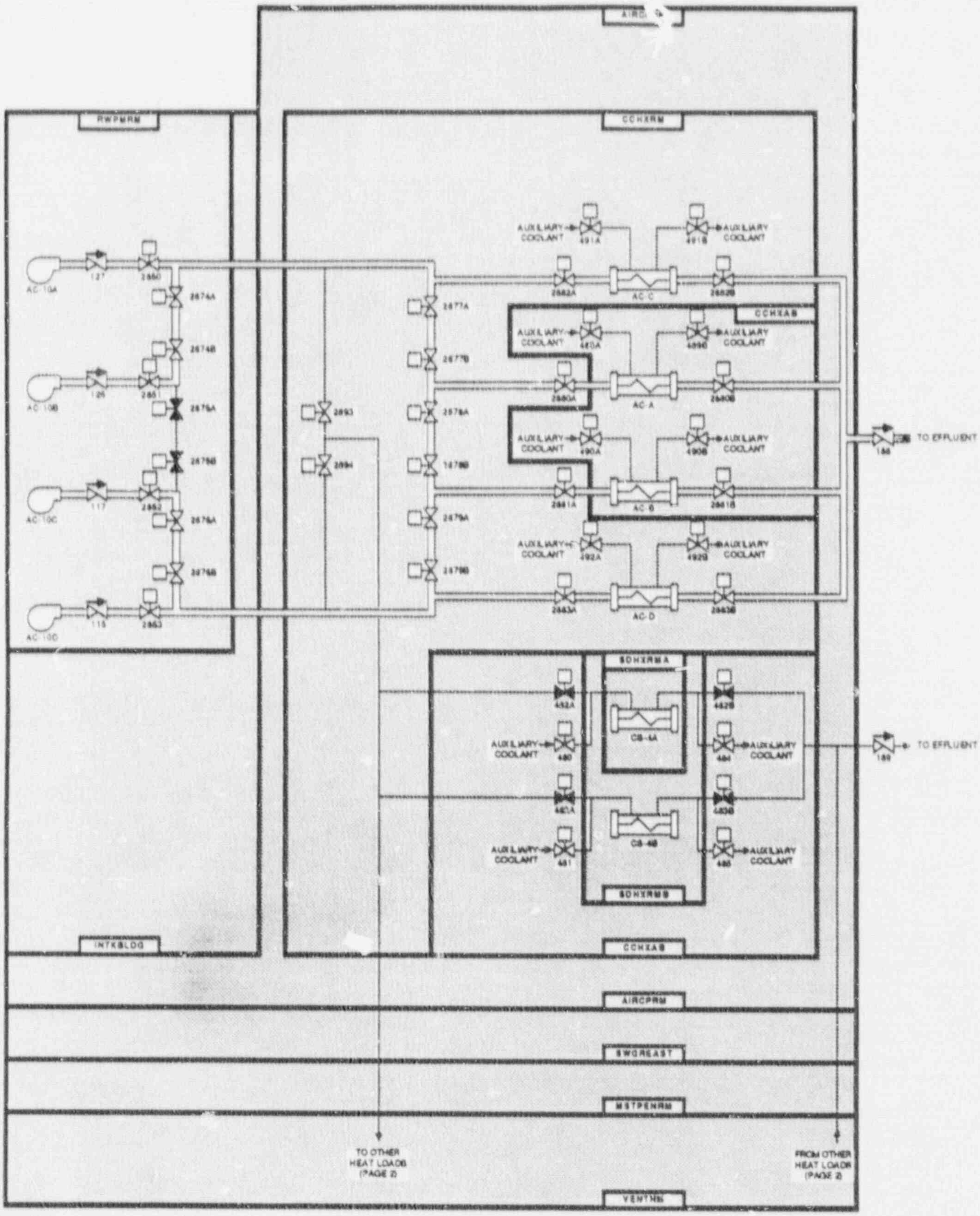

Figure 3.7-2. Fort Calhoun Raw Water System Showing Component Locations (Page 1 of 2)

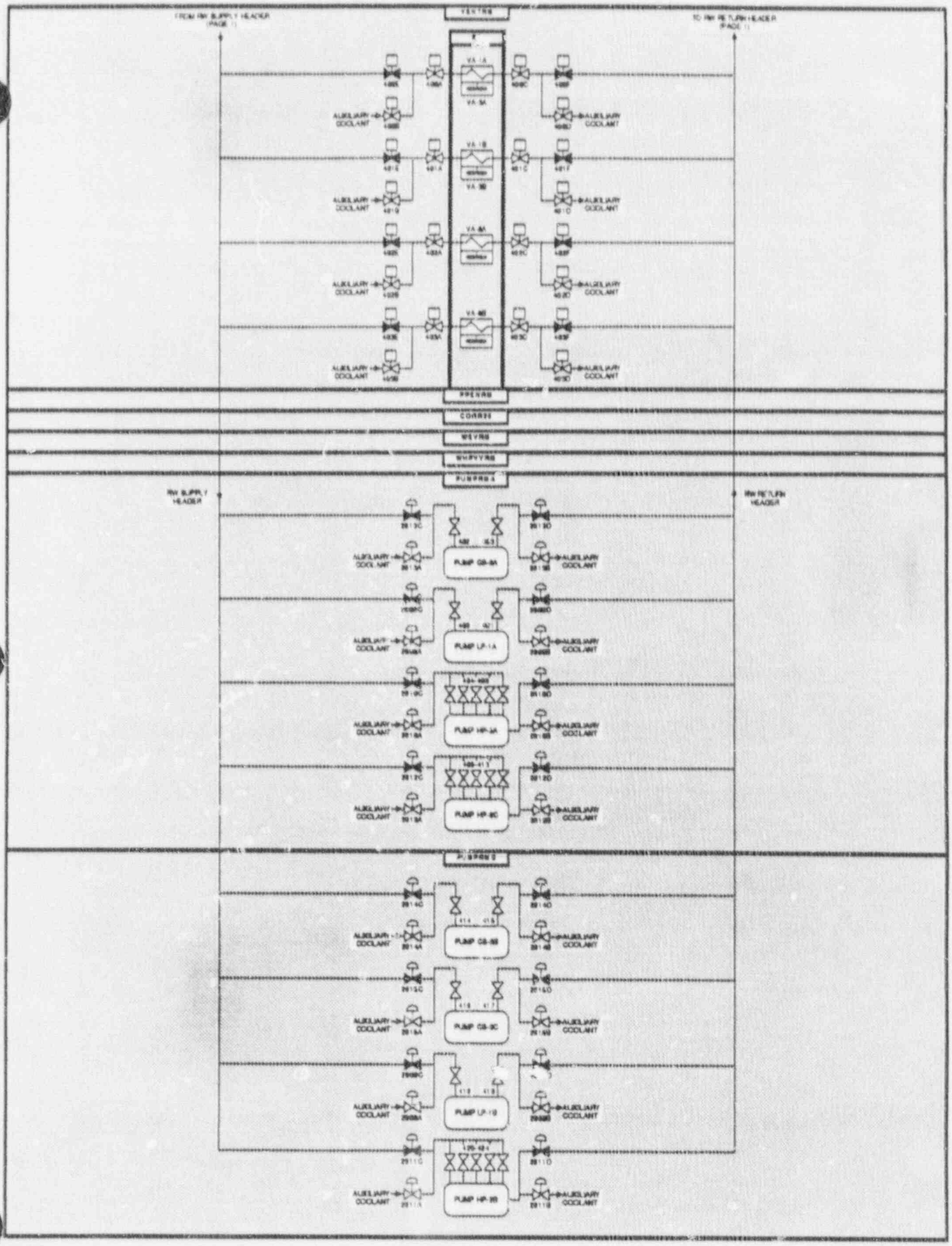

Figure 3.7-2. Fort Calhoun Raw Water System Showing Component Locations (Page 2 of 2)

Table 3.7-1. Ft. Calhoun Raw Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
AC-10A	MDP	RWPMRM	BUS-1A3	4160	SWGREAST	AC/A
AC-10B	MDP	RWPMRM	BUS-1A4	4160	SWGRWEST	AC/B
AC-10C	MDP	RWPMRM	BUS-1A3	4160	SWGREAST	AC/A
AC-10D	MDP	RWPMRM	BUS-1A4	4160	SWGRWEST	AC/B

3.8 CONTAINMENT AIR COOLING (CAC) SYSTEM

3.8.1 System Function

The CAC was designed to remove heat relea' ' to containment atmosphere during an accident to the extent necessary to initial!y m. ain that structure below the design pressure and then reduce the pressure to near atmospheric. The system also adsorbs iodine in filter banks and prevents accumulation of hydrogen pockets by circulating air in the containment following a design basis accident (DBA). The cooling capability of the CAC system is redundant to that of the containment spray system (see Section 3.4).

3.8.2 System Definition

The CAC system consists of four air handling units, each with its own fan, a common plenum discharge system, and instrumentation and controls. There are two types of units; two have filtering capacity and the other two have no filtering capacity. Those units with filtering capability have larger flow rates than the other units.

The CAC cooing units are shown in of Figures 3.6-1 and 3.7-1 as heat loads for the CCW and RW systems. A summary of data on selected CAC components is presented in Table 3.8-1.

3.8.3 System Operation

During normal operation the CAC air cooling units are running, and cooled air is discharged from the plenum through a duct system to those areas where cooling is required. The system is normally manually operated from the central control room but in the event of a LOCA, it is automatically aligned for the emergency operation. Temperature activated hatches and dampers direct airflow from the fan discharge plenum to distribute air in the containment following a DBA.

3.8.4 System Success Criteria

Both the CAC and the CS systems have sufficient cooling capacity to independently perform the containment heat removal function. The CAC system can independently perform the containment heat removal function if the following conditions are met (Ref. 1).

- Any three fan coolers are operating or both the larger fan coolers are operating
- Either CCW or RW is providing heat exchanger cooling

Partial CS and CAC success criteria may exist but are not clearly defined in the FSAR.

3.8.5 Component Information

A. Fans VA-3A and VA-3B
   1. Rated flow: 90,000 cfm normal, 86,500 cfm accident
   2. Type: vane axial

B. Fans VA-7C and VA-7D
   1. Rated flow: 50,000 cfm normal, 52,000 cfm accident
   2. Type: vane axial

C. Cooling Units VA-1A and VA-1B
   1. Rated heat removal: 140 x 10^6 Btu/hr accident
   2. Rated capacity: 50%

D. Cooling units VA-8A and VA-8B
   1. Rated heat removal: 70 x 10^6 Btu/hr accident
   2. Rated capacity: 25%

3.8.6 Support Systems and Interface

A. Control Signals
   1. Automatic
      The four CAC fans are automatically actuated a SIAS signal. Conditions initiating a SIAS are:
      - Containment high pressure
      - Pressurizer low pressure
   2. Remote Manual
      All containment air cooling system components can be actuated by remote manual means from the central control room.

B. Motive Power
   1. The CAC fans are Class 1E AC loads that can be supplied from the standby diesel generators.
   2. Dampers in the system are fail-safe. They will fail open on loss of control power.

C. Cooling Water
   1. The cooling units can be cooled by the CCW or the RW systems (see Sections 3.6 and 3.7).

3.8.7 Section 3.8 References

1. Fort Calhoun Updated FSAR, Section 6.4.

Table 3.8-1. Ft. Calhoun Containment Air Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
VA-1A	HX	RC				
VA-1B	HX	RC				
VA-3A	FAN	RC	BUS-1B3A	480	SWGREAST	AC/A
VA-3B	FAN	RC	BUS-1B4C	480	SWGRWEST	AC/B
VA-7C	FAN	RC	BUS-1B3C-4C	480	SWGREAST	AC/AB
VA-7D	FAN	RC	BUS-1B3B-4B	480	SWGRWEST	AC/AB
VA-8A	HX	RC				
VA-8B	HX	RC				

3.9 INSTRUMENTATION AND CONTROL (I&C) SYSTEMS

3.9.1 System Function

The instrumentation and control systems include the Reactor Protection System (RPS), the Engineered Safety Feature Actuation Systems (ESFAS), and systems for the display of plant information to the operators. 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. The RPS and 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.

3.9.2 System Definition

The RPS includes sensor and transmitter units, logic units, and output trip relays that operate reactor trip circuit breakers to cause a reactor scram. The ESFAS includes independent sensor and transmitter units, logic units and relays that interface with the control circuits for the many different sets of components that can be actuated by the ESFAS. The remote shutdown capability is provided by the Alternate Shutdown Panel (ASP). Local control panels also are provided for the auxiliary feedwater system.

3.9.3 System Operation

A. RPS

The Combustion Engineering RPS has four instrument channels and actuation trains (1, 2, 3, and 4). RPS potential trips are listed below:

- High rate-of-change of power
- High power level
- Low reactor coolant flow
- Low steam generator water level
- Low steam generator pressure
- High pressurizer pressure
- Thermal margin/low pressure
- Containment pressure high
- Axial power distribution
- Asymmetric steam generator transient
- Loss of load
- Manual

The reactor protection system consists of four trip paths operating through coincidence logic to maintain power to, or remove it from, the control element drive mechanisms. Individual channel trips occur when a measurement reaches a preselected setpoint. The channel trips are combined in multiple two-out-of-four logic. Each two-out-of-four logic system provides trip signals to one-out-of-six logic units, each of which causes a direct trip of the contractors in the AC supply to the control element drive mechanism (CEDM) clutch power suppliers.

B. ESFAS

The ESFAS has four input instrument channels and two output actuation trains. In general, the ESFAS "A" train controls equipment powered from Class 1E AC electrical Division A and the ESFAS "B" train controls redundant equipment powered from Division B. An individual component usually receives an

actuation signal from only one ESFAS train. The ESFAS generates the following signals: (1) auto-start of the diesel generators, (2) sequential starting of engineered safeguards equipment, (3) safety injection actuation signal (SIAS), (4) containment spray actuation signal (CSAS), (5) containment isolation actuation signal (CIAS), (6) ventilation isolation actuation signal (VIAS), (7) recirculation actuation signal (RAS), (8) auxiliary feedwater system start signal, and (9) offsite power low signal (OPLS). The control room operators can manually trip the various ESFAS logic subsystems. Details regarding ESFAS actuation logic are included in the system description for the actuated system.

C. Remote Shutdown

The Alternate Shutdown Panel (ASP) contains the necessary instrumentation and control equipment to allow the operator to safely bring the reactor to hot shutdown status and maintain that status until sufficient corrective measures can be taken to allow and maintain a cold shutdown. The Alternate Shutdown Panel is located in the auxiliary building electrical penetration room at elevation 1013' (see Section 4). Local controls panels are also provided outside the control room for the auxiliary feedwater system, diesel generators, control room air conditioning systems, and various other systems. The AFW Regulating Panel contains controls for the auxiliary feedwater valves and the electric motor driven and turbine driven auxiliary feedwater pumps and their associated recirculation control valves. The panel also contains a master transfer switch to transfer control of the auxiliary feedwater system from the control room to this point.

3.9.4 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 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 Fort Calhoun have not been determined.

B. ESFAS

A single component usually receives a signal from only one ESFAS output train although all swing components and both AFW pumps receive signals from both trains. 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 hinderance 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 Fort Calhoun 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.

3.9.5 Support Systems and Interfaces

A. Control Power

1. RPS

   The RPS is powered from the four separate independent instrument 120V AC buses as defined in Section 3.6.

2. ESFAS

   The ESFAS input instrument channels most likely are powered from 120 VAC instrument buses. The ESFAS Train A and B output logic is powered from the 125 VDC system.

3.9.6 Section 3.9 References

1. Fort Calhoun Updated FSAR, Section 7.6.4.

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Fort Calhoun Power Station is located on a 660 acre site on the west bank of the Missouri River. A general view of the Fort Calhoun site and vicinity is shown in Figure 4-1 (from Ref. 1). The site is approximately 19 miles north of Omaha, Nebraska. The plant is owned and operated by the Omaha Public Power District.

The principal plant structures are the containment building, the auxiliary building, the turbine and service building, the technical support center, the maintenance shop, and the intake structure. A site arrangement drawing is shown in Figure 4-2. About 85 percent of the site area is on relatively level ground at an elevation of 1007 feet.

The reactor, steam generators, reactor coolant pumps and pressurizer are located in the containment, together with other NSSS components. Access to the building is via a personnel airlock or an equipment hatch.

The reactor auxiliaries including waste treatment facilities, certain engineered safeguards components, the central control room, personnel facilities, emergency diesel generators, and fuel handling and storage facilities are located on the auxiliary building. This building surrounds about three-fourths of the containment building. The auxiliary building houses all piping and electrical feeds to the containment along with all emergency electric power switchgear.

The turbine and service buildings, located east of and next to the auxiliary building, house the turbine generator, condenser, condensate and feedwater pumps, feedwater heaters, other turbine heat cycle components, water treatment facilities, auxiliary boiler and conventional auxiliaries such as turbine lube oil conditioning equipment.

The main condenser cooling water and raw water pumps are located in the intake structure located east of and away from the turbine and service building. The Missouri River is the normal heat sink during power operation and also is the ultimate heat sink for safety-related heat loads.

4.2 FACILITY LAYOUT DRAWINGS

Figures 4-3 through 4-9 are simplified building layout drawings for the Fort Calhoun containment, auxiliary building and intake structure. The turbine and service building, maintenance shop, and technical support building are not shown on these drawings. 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 1, Oak Ridge National Laboratory, Nuclear Safety Information Center, December 1973.

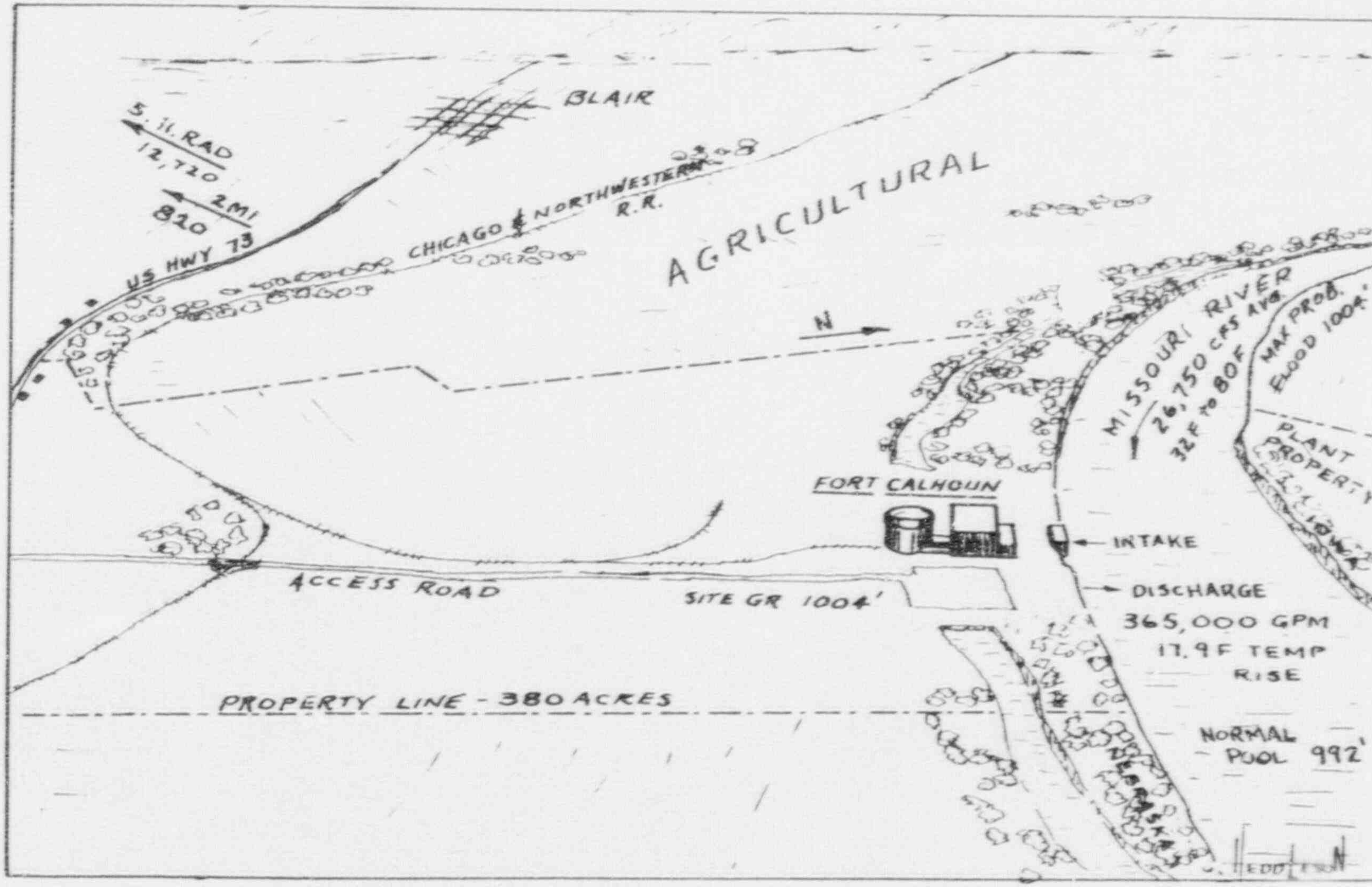

Figure 4-1. General View of Fort Calhoun Site and Vicinity

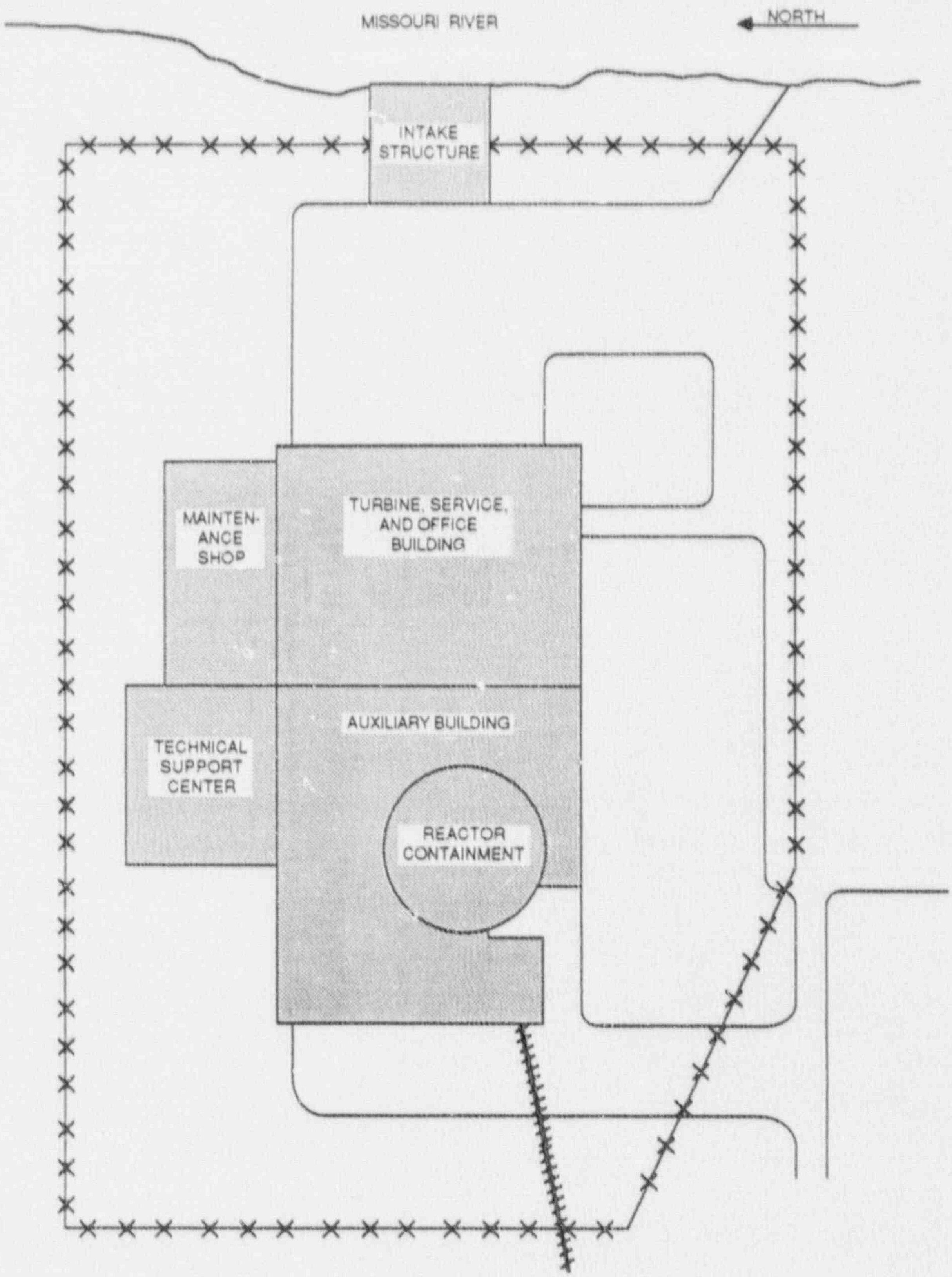

Figure 4-2. Fort Calhoun Plot Plan

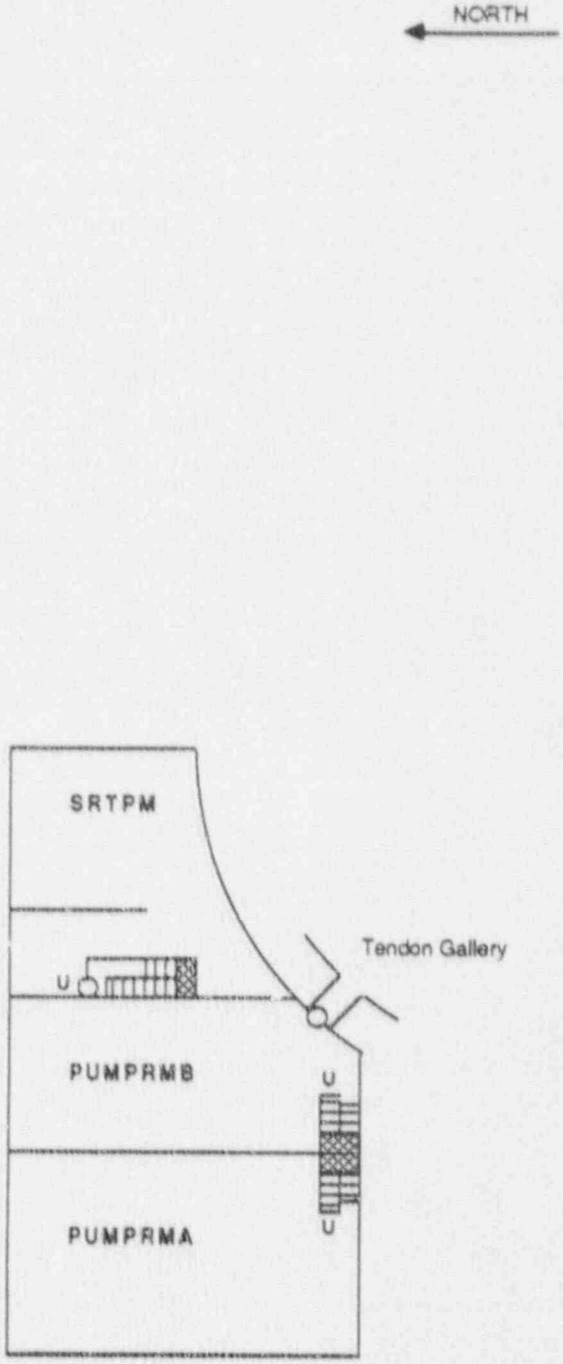

Figure 4-3. Fort Calhoun Auxiliary Building & Containment Sub-basement (Elevation 971')

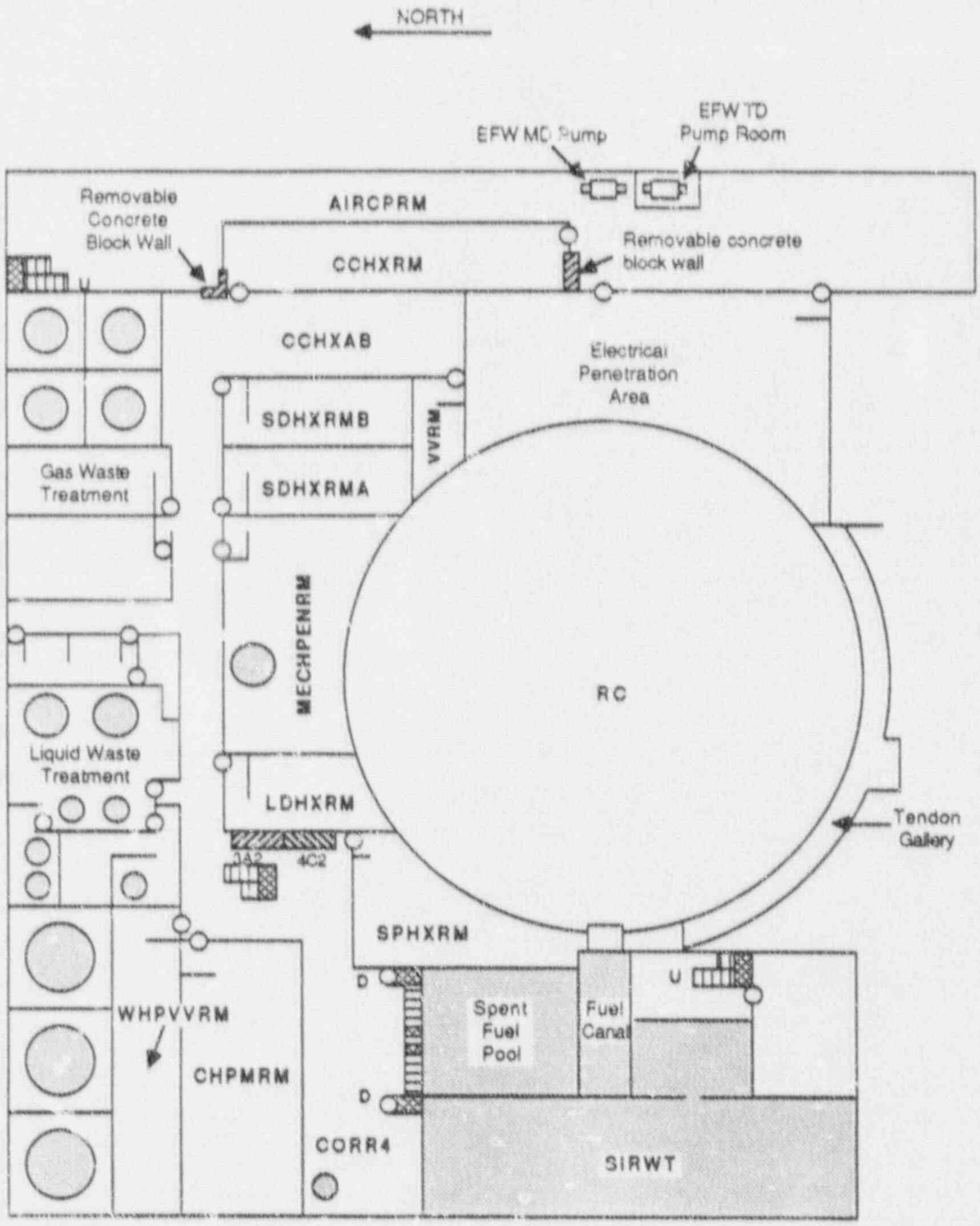

Figure 4-4. Fort Calhoun Auxiliary Building & Containment Basement (Elevation 989')

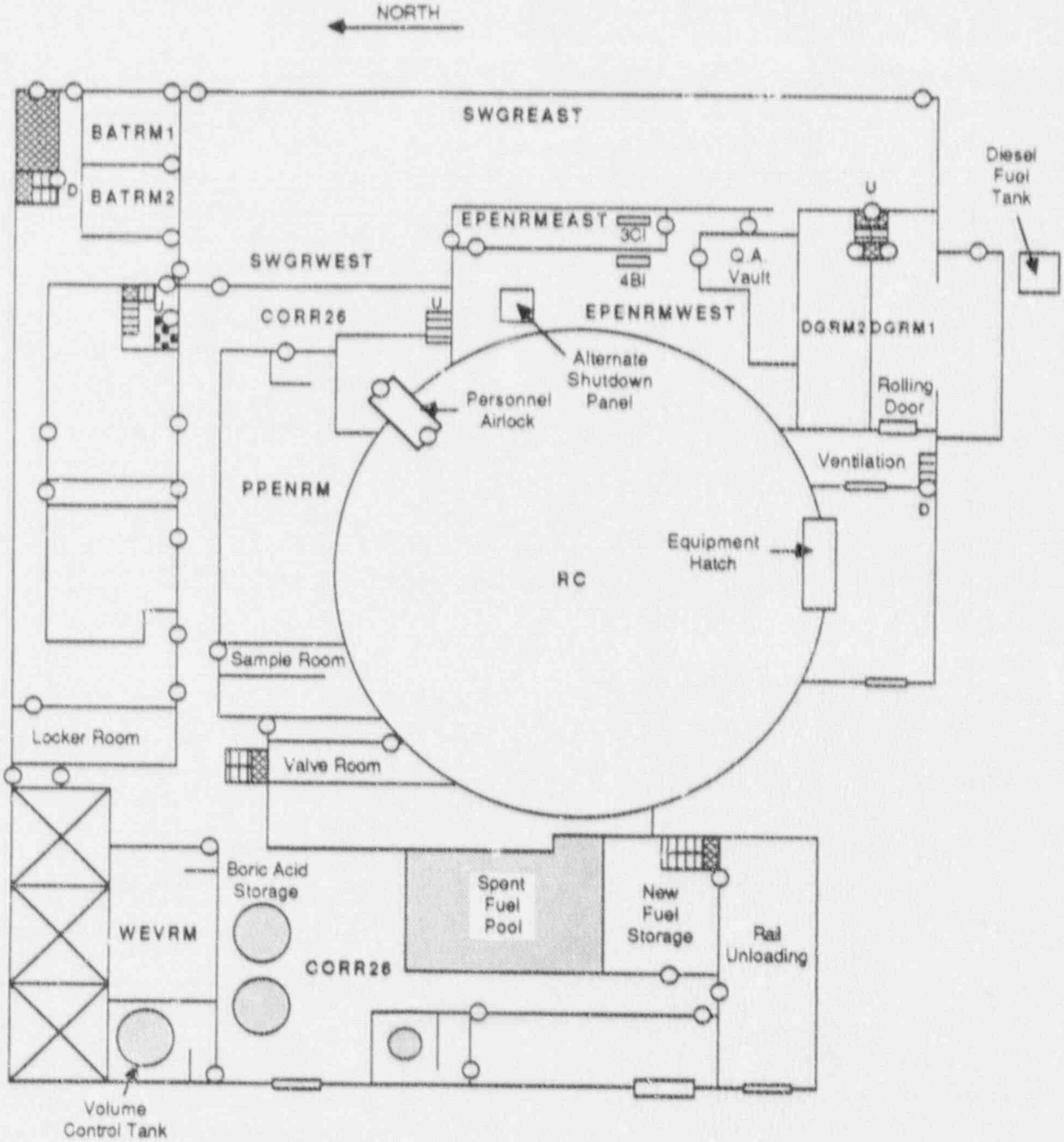

Figure 4-5. Fort Calhoun Auxiliary Building & Containment Ground Floor (Elevation 1007')

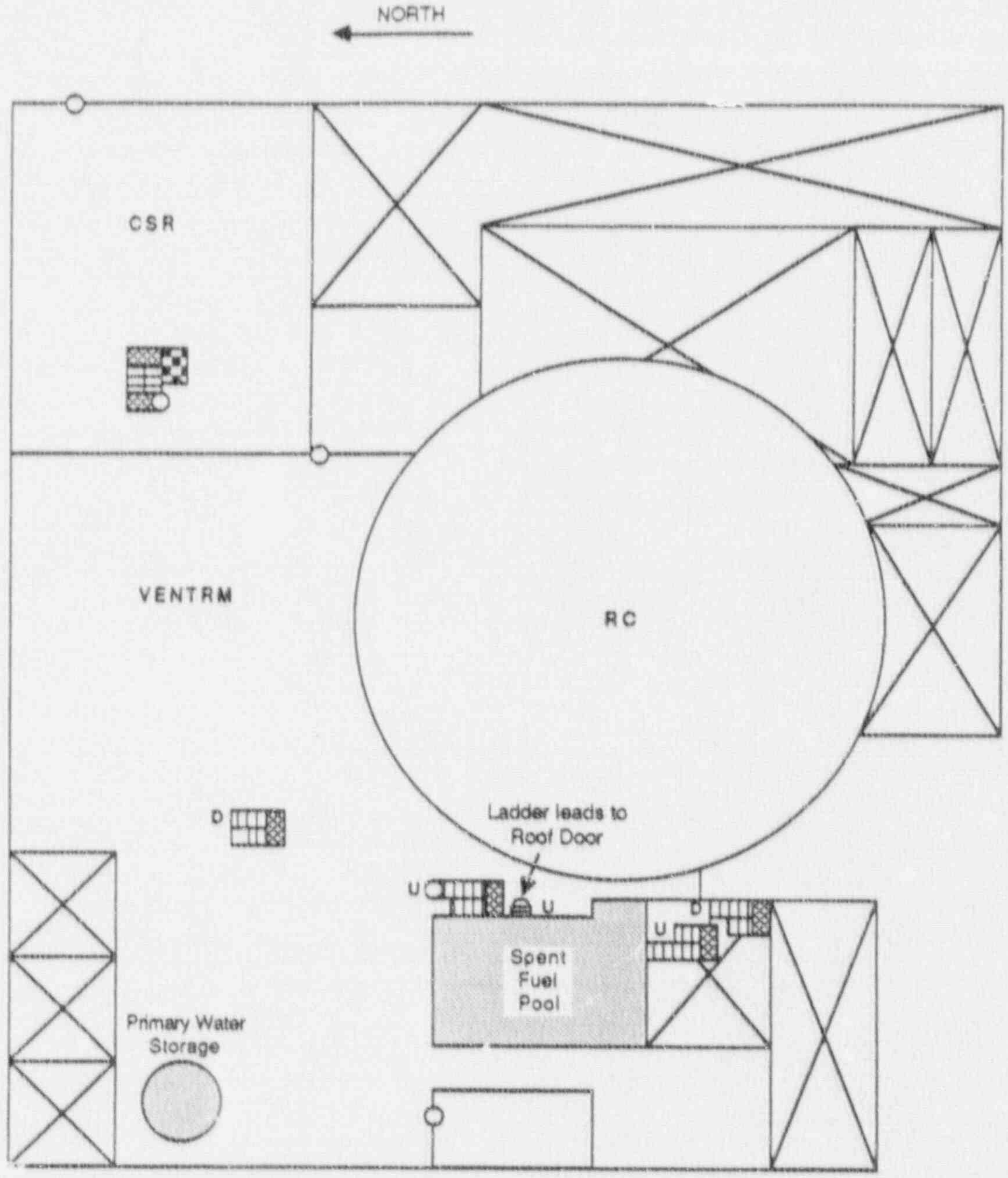

Figure 4-6. Fort Calhoun Auxiliary Building & Containment Intermediate Floor (Elevation 1025')

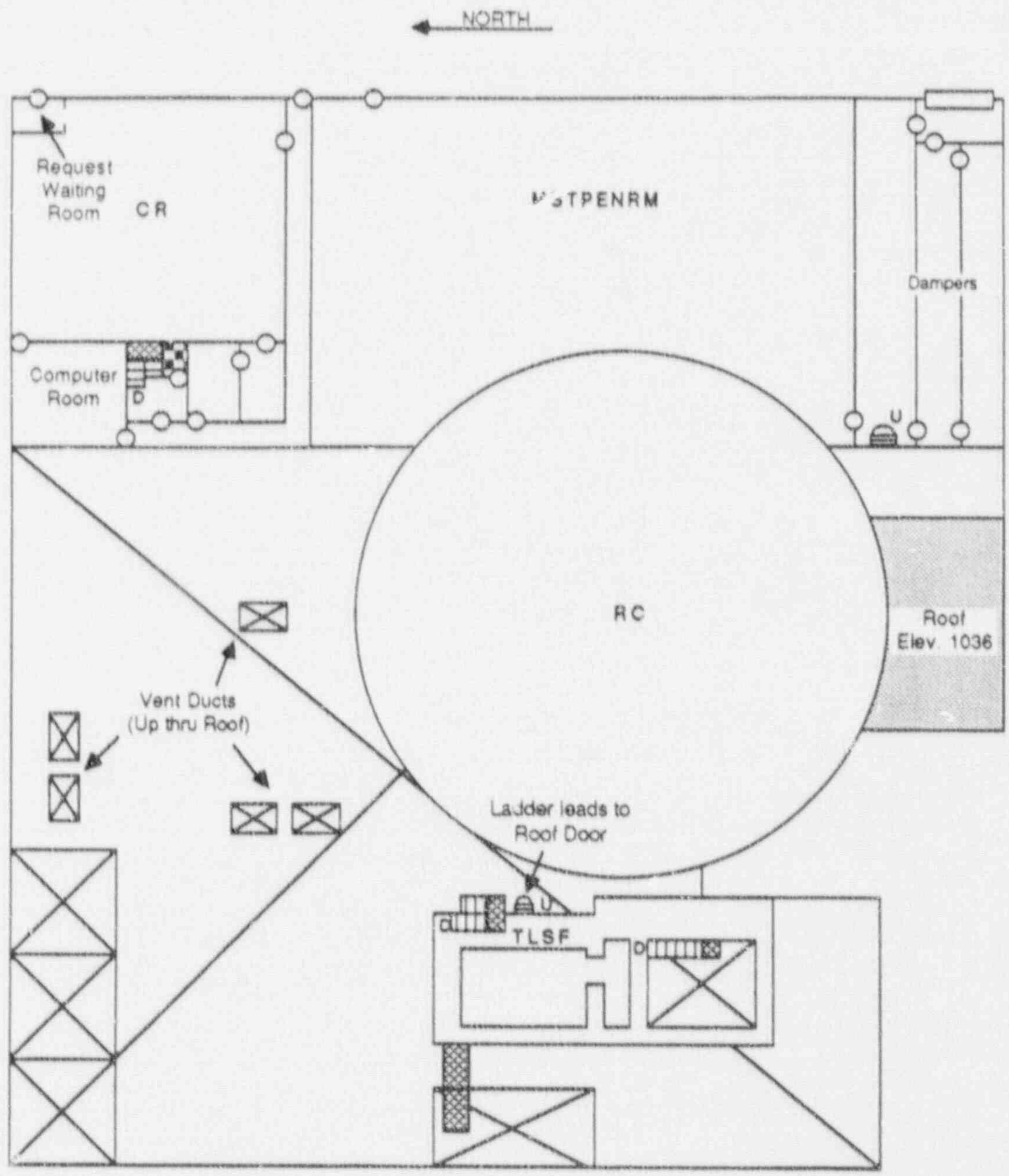

Figure 4-7. Fort Calhoun Auxiliary Building & Containment Operating Floor (Elevation 1036')

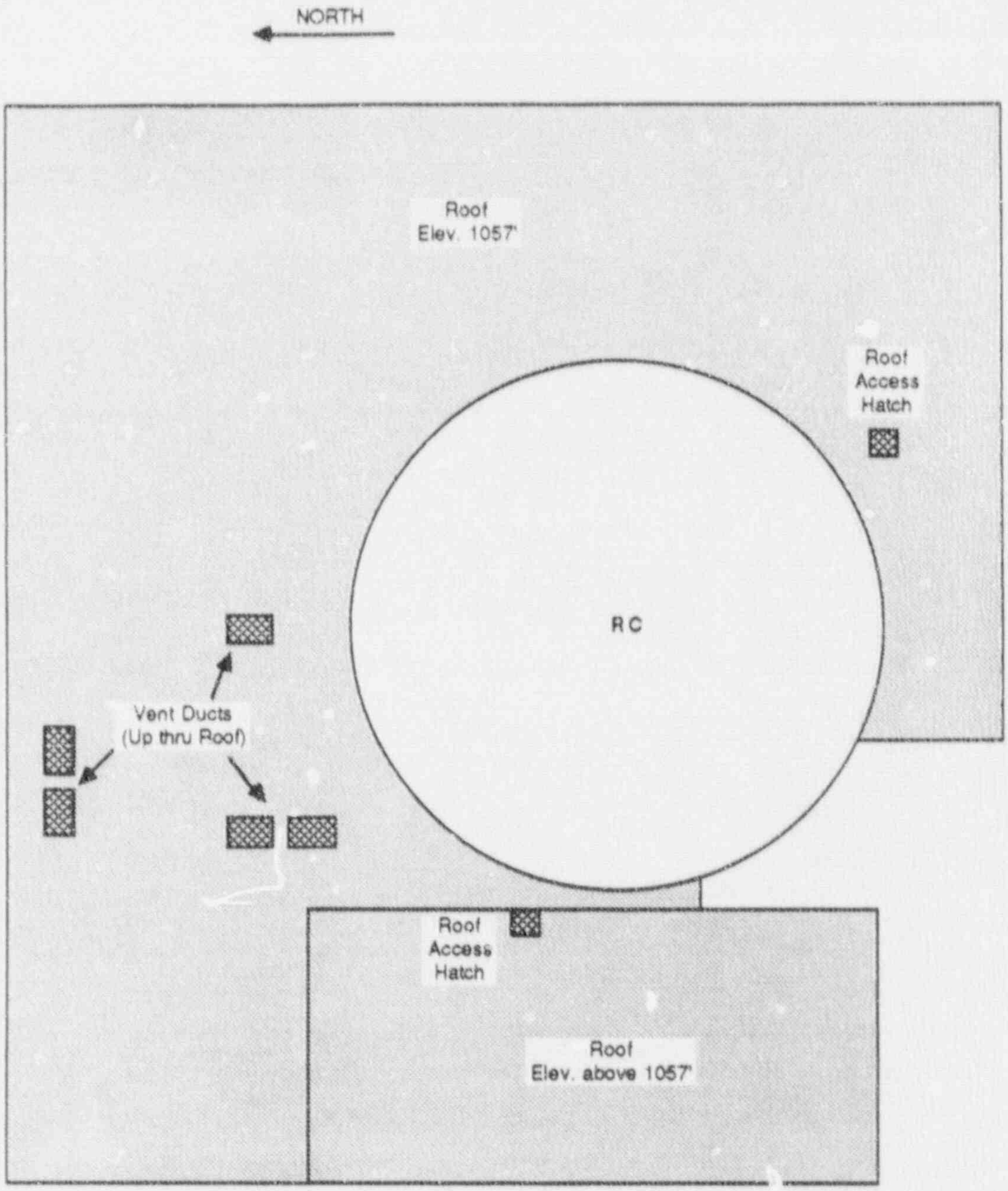

Figure 4-8. Fort Calhoun Auxiliary Building & Containment
(Elevation 1057')

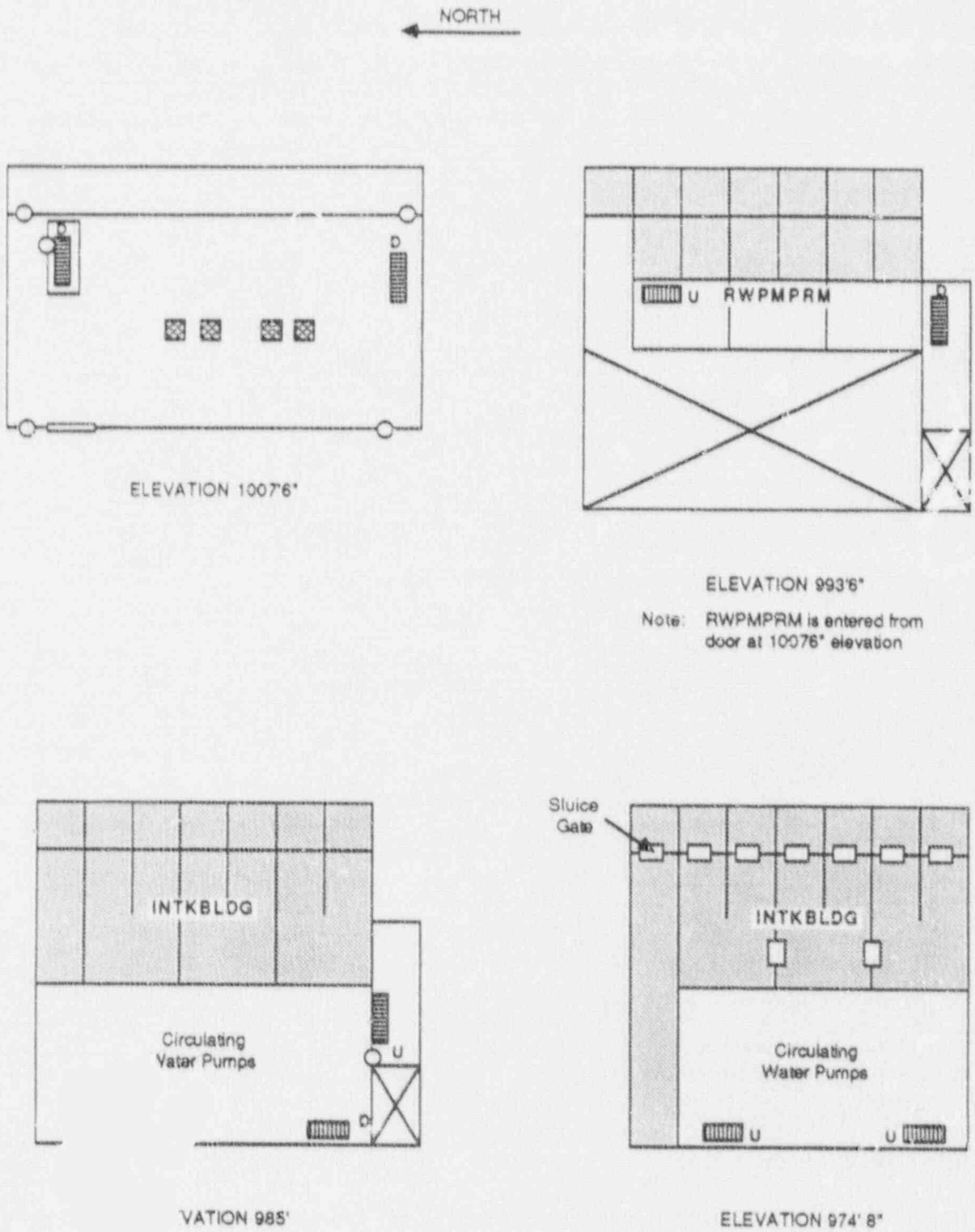

Figure 4-9. Fort Calhoun Intake Structure

Table 4-1. Definition of Fort Calhoun Building and Location Codes

	Codes	Descriptions
1.	3A2	Motor Control Center #3A2, located on the 989' elevation of the Auxiliary Building
2.	4C2	Motor Control Center #4C2, located on the 989' elevation of the Auxiliary Building
3.	AIRCPRM	Air Compressor Room, located on the 989' elevation of the Auxiliary Building - east side
4.	BATRM1	Battery Room #1, located on the 1011' elevation of the Auxiliary Building - northeast corner
5.	BATRM2	Battery Room #2, located on the 1011' elevation of the Auxiliary Building - northeast corner
6.	CCHXAB	Component Cooling Heat Exchanger Room, located on the 989' elevation of the Auxiliary Building - east side - contains Component Cooling Heat Exchangers 1A and 1B
7.	CCHXRM	Component Cooling Heat Exchanger Room, located on the 989' elevation of the Auxiliary Building - east side - contains Component Cooling Heat Exchangers 1C and 1D
8.	CHPMRM	Charging Pump Room, located on the 989' elevation of the Auxiliary Building - northwest corner
9.	CORR26	Corridor #26, located on the 1007' elevation of the Auxiliary Building
10.	CORR4	Corridor #4, located on the 989' of the Auxiliary Building
11.	CR	Control Room, located on the 1036' elevation of the Auxiliary Building
12.	CSR	Cable Spreading Room, located on the 1025' elevation in the Auxiliary Building -northeast corner
13.	DGRM1	Diesel Generator Room #1, located on the 1007' elevation of the Auxiliary Building - south side
14.	DGRM2	Diesel Generator Room #2, located on the 1007' elevation of the Auxiliary Building - south side
15.	EPENRMEAST	East side of the Electrical Penetration Room, located on the 1013' elevation of the Auxiliary Building

Table 4-1. Definition of Fort Calhoun Building and Location Codes (Continued)

	Codes	Descriptions
16.	EPENRMWEST	West side of the Electrical Penetration Room, located on the 1013' elevation of the Auxiliary Building
17.	INTKBLDG	Intake Building, located east of the Turbine Room and Service Building
18.	LDHXRM	Letdown Heat Exchanger Room, located on the 989' elevation of the Auxiliary Building
19.	MECHPENRM	Mechanical Penetration Room, located on the 989' elevation of the Auxiliary Building
20.	MSTPENRM	Main Steam Penetration Room, located on the of the Auxiliary Building - east side
21.	PPENRM	Pipe Penetration Room, located on the 1007' elevation of the Auxiliary Building
23.	PUMPRMA	Pump Room #A, located on the 971' elevation of the Auxiliary Building - northwest corner
24.	PUMPRMB	Pump Room #B, located on the 971' elevation of the Auxiliary Building - northwest corner
25.	RC	Reactor Containment
26.	RWPMRM	Raw Water Pump Room, located in the Intake Building
27.	SDHXRMA	Shutdown Heat Exchanger Room #A, located on the 989' elevation of the Auxiliary Building - northeast corner
28.	SDHXRMB	Shutdown Heat Exchanger Room #B, located on the 989' elevation of the Auxiliary Building - northeast corner
29.	SIRWT	Safety Injection and Refueling Water Tank, located on the 989' of the Auxiliary Building - west side
30.	SPHXRM	Storage Pool Heat Exchanger Room, located on the 989' elevation of the Auxiliary Building
31.	SRTPM	Spent Regenerant Tank and Pump Room, located on the 971' elevation of the Auxiliary Building - north side
32.	SWGREAST	East side of the Switchgear Room, located on the 1011' of the Auxiliary Building

Table 4-1. Definition of Fort Calhoun Building and Location Codes (Continued)

	Codes	Descriptions
33.	SWGRWEST	West side of the Switchgear Room, located on the 1011' elevation of the Auxiliary Building
34.	TLSF	Top Level of the Spent Fuel Pool, located on th 1038' elevation of the Auxiliary Building
35.	VENTRM	Ventilation Room, located on the 1025' elevation of the Auxiliary Building
36.	VVRM	Valve Room, located on the 989' elevation of the Auxiliary Building - northeast corner
37.	WEVRM	Waste Evaporator Room, located on the 1007' elevation of the Auxiliary Building - northwest corner
38.	WHPVVRM	Waste Hold-Up Pump Valve Room, located on the 989' elevation of the Auxiliary Building - northwest corner

TABLE 4-2. PARTIAL LISTING OF COMPONENTS BY LOCATION AT FORT CALHOUN

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
3A2	EP	MCC-3A2	MCC
4C2	EP	MCC-4C2	MCC
AIRCPRM	FW	FW-6	MDP
AIRCPRM	FW	FW-10	TDP
BATRM1	EP	BATT-1	BATT
BATRM2	EP	BATT-2	BATT
CCHXAB	AC	AC-A	HX
CCHXAB	AC	AC-B	HX
CCHXRM	AC	AC-C	HX
CCHXRM	AC	AC-D	HX
DGRM1	EP	EP-DG1	DG
DGRM2	EP	EP-DG2	DG
EPENRMEAST	EP	MCC-3B1	MCC
EPENRMEAST	EP	MCC-3[illegible]	MCC
EPENRMEAST	EP	MCC-3A1	MCC
EPENRMWEST	EP	MCC-4A1	MCC
EPENRMWEST	EP	MCC-4C1	MCC
EPENRMWEST	EP	MCC-4B1	MCC
MECHPENRM	RCS	RC-347	MOV
MECHPENRM	RCS	RC-204	NV
MSTPENRM	FW	FW-19	TANK
PUMPRMA	CS	CS-3A	MDP
PUMPRMA	HP	HP-2A	MDP
PUMPRMA	HP	HP-2C	MDP
PUMPRMA	HP	HP-2A	MDP
PUMPRMA	HP	HP-2C	MDP
PUMPRMB	CS	CS-3B	MDP
PUMPRMB	CS	CS-3C	MDP
PUMPRMB	HP	HP-2B	MDP
PUMPRMB	HP	HP-2B	MDP
RC	AC	VA-1A	HX

TABLE 4-2. PARTIAL LISTING OF COMPONENTS BY LOCATION AT FORT CALHOUN (CONTINUED).

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	AC	VA-1B	HX
RC	AC	VA-8A	HX
RC	AC	VA-8B	HX
RC	CS	CS-383-3	MOV
RC	CS	CS-383-4	MOV
RC	FW	RC-2A	SG
RC	FW	RC-2B	SG
RC	HP	HP-311	MOV
RC	HP	HP-312	MOV
RC	HP	HP-314	MOV
RC	HP	HP-315	MOV
RC	HP	HP-317	MOV
RC	HP	HP-318	MOV
RC	HP	HP-320	MOV
RC	HP	HP-321	MOV
RC	HP	HP-383-3	MOV
RC	HP	HP-311	MOV
RC	HP	HP-312	MOV
RC	HP	HP-314	MOV
RC	HP	HP-315	MOV
RC	HP	HP-317	MOV
RC	HP	HP-318	MOV
RC	HP	HP-320	MOV
RC	HP	HP-321	MOV
RC	HP	HP-383-4	MOV
RC	RCS	RC-348	MOV
RC	RCS	RC-102-2	SOV
RC	RCS	RC-150	MOV
RC	RCS	RC-102-1	SOV
RC	RCS	RC-151	MOV
RC	RCS	RC-101-2	HV

TABLE 4-2. PARTIAL LISTING OF COMPONENTS BY LOCATION AT FORT CALHOUN (CONTINUED).

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	RCS	RC-202	NV
RC	RW	VA-1A	HX
RC	RW	VA-8A	HX
RC	RW	VA-8B	HX
RC	RW	VA-1B	HX
RC	VA	VA-1A	HX
RC	VA	VA-3A	FAN
RC	VA	VA-1B	HX
RC	VA	VA-3B	FAN
RC	VA	VA-8A	HX
RC	VA	VA-7C	FAN
RC	VA	VA-8B	HX
RC	VA	VA-7D	FAN
RWPMRM	RW	AC-10A	MDP
RWPMRM	RW	AC-10B	MDP
RWPMRM	RW	AC-10C	MDP
RWPMRM	RW	AC-10D	MDP
SDHXRMA	CS	CS-4A	HX
SDHXRMB	CS	CS-4B	HX
SIRWT	HP	HP-SIRWT	TANK
SWGREAST	EP	BUS-1A3	BUS
SWGREAST	EP	EP-1A3	CB
SWGREAST	EP	BUS-1B3A	BUS
SWGREAST	EP	EP-3A	TRAN
SWGREAST	EP	BUS-1B3C	BUS
SWGREAST	EP	EP-3C	TRAN
SWGREAST	E[illegible]	BUS-1B3B	BUS
SWGREAST	EP	EP-3B	TRAN
SWGREAST	EP	DC-BUS-1	BUS
SWGREAST	EP	BUS-1B3C-4C	BUS
SW[illegible]EAST	EP	BUS-1B3C-4C	BUS

TABLE 4-2. PARTIAL LISTING OF COMPONENTS BY LOCATION AT FORT CALHOUN (CONTINUED).

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
SWGREAST	EP	DC-BUS-1	BUS
SWGREAST	EP	DC-BUS-1	BUS
SWGREAST	EP	BC1	BC
SWGREAST	EP	BUS-1B3A-4A	BUS
SWGREAST	EP	BUS-1B3A-4A	BUS
SWGREAST	FW	DC-BUS-1	BUS
SWGRWEST	EP	BUS-1A4	BUS
SWGRWEST	EP	EP-1A4	CB
SWGRWEST	EP	BUS-1B4A	BUS
SWGRWEST	EP	EP-4A	TRAN
SWGRWEST	EP	BUS-1B4B	BUS
SWGRWEST	EP	EP-4B	TRAN
SWGRWEST	EP	BUS-1B4C	BUS
SWGRWEST	EP	EP-4C	TRAN
SWGRWEST	EP	DC-BUS-2	BUS
SWGRWEST	EP	BUS-1B3B-4B	BUS
SWGRWEST	EP	BUS-1B3B-4B	BUS
SWGRWEST	EP	BC3	BC
SWGRWEST	EP	DC-BUS-2	BUS
SWGRWEST	EP	DC-BUS-2	BUS
SWGRWEST	EP	BC2	BC
SWGRWEST	FW	DC-BUS-2	BUS
VENTRM	AC	AC-3A	MDP
VENTRM	AC	AC-3B	MDP
VENTRM	AC	AC-3C	MDP

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