NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

LIMERICK 1 & 2

50-352 and 50-353

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SAIC 89/1023

NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

LIMERICK 1 & 2

50-352 and 50-353

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Prepared for:

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Contract NRC-03-87-029
FIN D-1763

SAIC

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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:

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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.

LIMERICK 1 & 2
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	2/89	Original report

LIMERICK SYSTEM SOURCEBOOK

This sourcebook contains summary information on Limerick 1 & 2. 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 Limerick 1 nuclear power plant is listed below:

- Docket number	50-352 and -353
- Operator	Philadelphia Electric Co.
- Location	Pottstown, Pennsylvania
- Commercial operation date	2/86 (Unit 1), 2/90 (Unit 2, planned)
- Reactor type	BWR/4
- NSSS vendor	General Electric
- Power (MWt/MWe)	3293/1055
- Architect-engineer	Bechtel
- Containment type	Steel lined reinforced concrete drywell/ pressure suppression system with secondary containment (Mark II)

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

The Limerick 1 & 2 units each contain a General Electric BWR/4 nuclear steam supply system with a Mark II containment incorporating the drywell/pressure suppression concept. The plant also has a secondary containment structure of reinforced concrete. Other BWR/4 plants in the United States are as follows:

- Duane Arnold
- Browns Ferry 1, 2, and 3
- Brunswick 1 and 2
- Cooper
- Fermi
- Fitzpatrick
- Hatch 1 and 2
- Hope Creek 1
- Limerick 2
- Peach Bottom 2 and 3
- Shoreham
- Susquehanna 1 and 2
- Vermont Yankee

Most BWR/4 plants have a Mark I containment. The only other BWR/4 plants having a Mark II containment are Shoreham and Susquehanna. BWR/5 plants also have a Mark II containment.

Limerick 1 uses a high pressure coolant injection system, a reactor core isolation cooling system, a low pressure core spray system, and a multi-mode RHR system. The reactor core isolation cooling and RHR systems include the capability for steam condensing.

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at Limerick 1 and 2 in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at Limerick 1 and 2 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 Limerick 1 & 2 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
- Reactor Core Isolation Cooling (RCIC) Systems	Same	3.2	5.4.6
- Emergency Core Cooling Systems (ECCS)	Same	-	-
- High-Pressure Injection & Recirculation	High-Pressure Coolant Injection (HPCI) System	3.3	6.3.1.2.1, 6.3.2.2.1
- Low-pressure Injection & Recirculation	Core Spray (CS) System,	3.3	6.3.1.2.2, 6.3.2.2.3
	Low-Pressure Coolant Injection (LPCI) Mode (an operating mode of the RHR system	3.3	5.4.7.1.1.2, 6.3.1.2.3, 6.3.2.2.4
- Automatic Depressurization System (ADS)	Same	3.3	6.3.1.2.4, 6.3.2.2.2
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Residual Heat Removal (RHR) System (a multi-mode system)	3.3	5.4.7
- Main Steam and Power Conversion Systems	Main Steam Supply System,	X	10.3
	Condensate and Feedwater Systems,	X	10.4.7
	Circulating Water System	X	10.4.5
- Other Heat Removal Systems	Steam-condensing RHR/RCIC operation	3.2	5.4.6.1, 5.4.7.1.1.5, 5.4.7.2.6

Table 3-1. Summary of Limerick 1 & 2 Systems Covered in this Report (Continued)

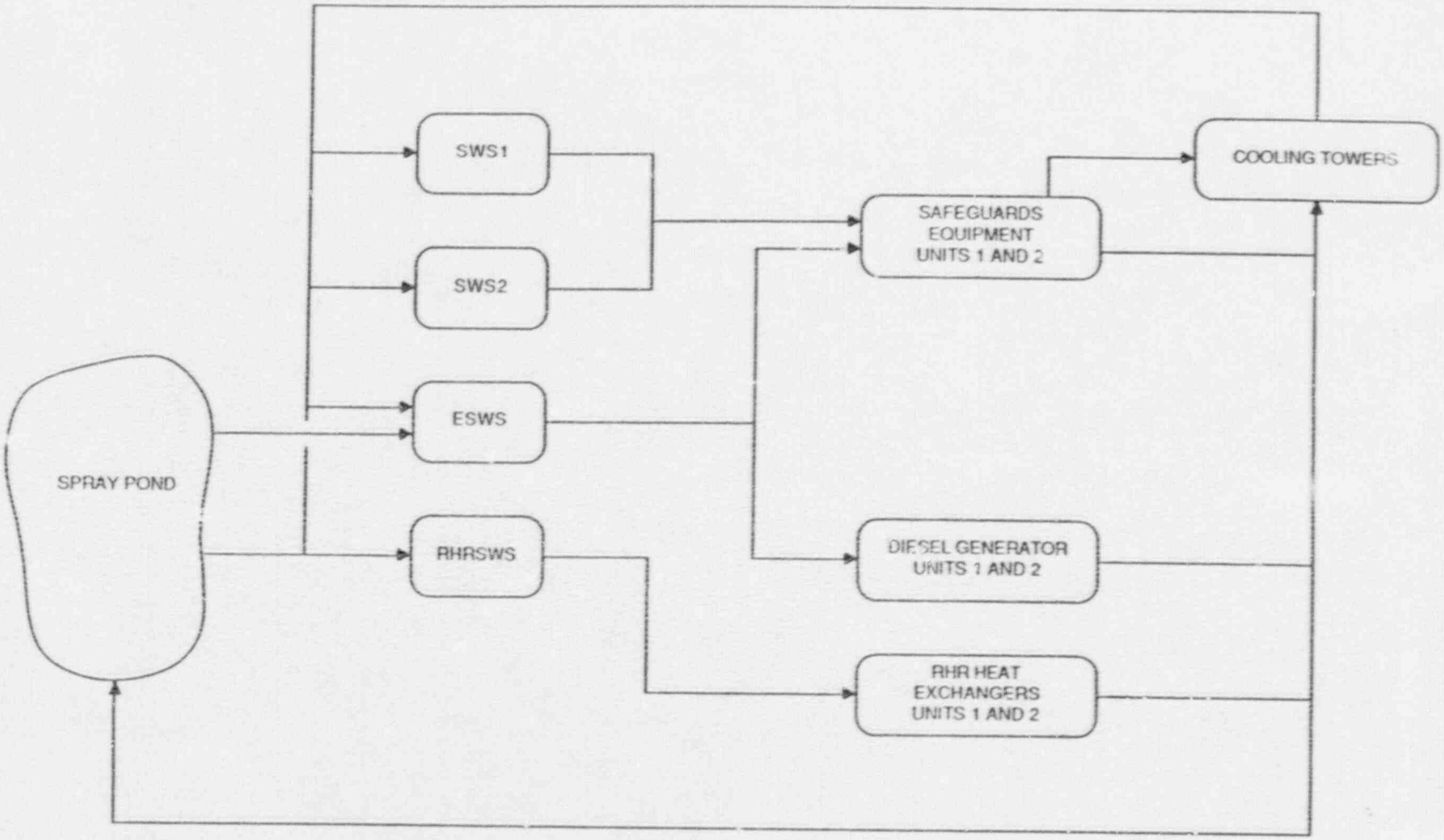
Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor Coolant Inventory Control Systems			
- Reactor Water Cleanup (RWCU) System	Same	X	5.4.8
- ECCS	See above	-	-
- Control Rod Drive Hydraulic System (CRDHS)	Same	3.6	4.6.1.2.4
Containment Systems			
- Primary Containment	Same (drywell and pressure suppression chamber)	X	6.2.1
- Secondary Containment	Same	X	6 2.3
- Standby Gas Treatment System (SGTS)	Same	X	6.2.3
- Containment Heat Removal Systems			
- Suppression Pool Cooling System	Same (an operating mode of the RHR system)	3.3	5.4.7.1.1.3, 6.2.2
- Containment Spray System	Same (an operating mode of the RHR system)	3.3	5.4.7.1.1.4, 6.2.2
- Containment Fan Cooler System	Drywell Air Cooling System	X	9.4.5.2

Table 3-1. Summary of Limerick 1 & 2 Systems Covered in this Report (Continued)

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Containment Systems (continued)			
- Containment Normal Ventilation Systems	Reactor Enclosure and Refueling Area Ventilation Systems,	X	9.4.2
	Primary Containment Ventilation System	X	9.4.5
- Combustible Gas Control Systems	Containment Atmospheric Control System (Containment Hydrogen Recombiner and Containment Gas Analyzer Subsystems and Controlled Purge Capability),	X	6.2.5, 9.4.5.1
	Drywell Air Cooling System (mixes atmosphere in containment)	X	6.2.5, 9.4.5.2
Reactor and Reactivity Control Systems			
- Reactor Core	Same	X	4
- Control Rod System	Control Rod Drive System	X	4.6
- Chemical Poison System	Standby Liquid Control System (SLCS)	X	9.3.5
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Reactor Trip System	3.4	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Same	3.4	7.3
- Remote Shutdown System	Same	3.4	7.4.1.4
- Other I&C Systems	Various other systems	X	7.4 to 7.7

Table 3-1. Summary of Limerick 1 & 2 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	3.5	8.3
- Non-Class 1E Electric Power System	Same	X	8
- Diesel Generator Auxiliary Systems	Same	3.5	9.4.6, 9.5.4 to 9.5.8
- Component Cooling Water (CCW) System	Reactor Enclosure Cooling Water System	X	9.2.8
- Service Water System (SWS)	Same, also Emergency Service Water System	X 3.7	9.2.1 9.2.2
- Residual Heat Removal Service Water (RHRSW) System	Same	3.8	9.2.3
- Other Cooling Water Systems	Turbine Enclosure Cooling Water System	X	9.2.9
- Fire Protection Systems	Same	X	9.5.1
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Same	X	9.4
- Instrument and Service Air Systems	Compressed Air and Gas Systems	X	9.3.1
- Refueling and Spent Fuel Systems	Fuel Storage and Handling Systems	X	9.1
- Radioactive Waste Systems	Radioactive Waste Management Systems	X	11
- Radiation Protection Systems	Same	X	12



ESWS = Emergency Service Water System
RHRSWS = Residual Heat Removal Service Water System
SWS = Service Water System

Figure 3-1. Cooling Water System Functional Diagram for Limerick 1 and 2

3.1 REACTOR COOLANT SYSTEM (RCS)

3.1.1 System Function

The RCS, also called the Nuclear Steam Supply System (NSSS), is responsible for directing the steam produced in the reactor to the turbine where it is used to rotate a generator and produce electricity. 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) two recirculation loops, (c) recirculation pumps, (d) 14 safety/relief valves, and (e) 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 recirculation pump in each of the two recirculation loops and the associated jet pumps internal to the reactor vessel. The steam water mixture flows upward in the core to the steam dryers and separators where the entrained liquid is removed. The steam is piped through the main steam lines to the turbine. The separated liquid returns to the core, mixed with the feedwater and is recycled again.

A portion of the liquid in the downcomer region of the reactor vessel is drawn off by the recirculation pumps. The discharge of these pumps is returned to the inlet nozzles of the jet pumps at high velocity. As the liquid enters the jet pumps the slow moving liquid in the upper region of the downcomer is induced to flow through the jet pumps, producing reactor coolant circulation.

The steam that is produced by the reactor is piped to the turbine via the four main steam lines. There are two main steam isolation valves (MSIVs) in each main steam line. Condensate from the turbine is returned to the RCS as feedwater.

Following a transient that involves the loss of the main condenser or loss of feedwater, heat from the RCS is dumped to the suppression chamber via safety/relief valves on the main steam lines. A LOCA inside containment or operation of the Automatic Depressurization System (ADS) also dumps heat to the suppression chamber. Makeup to the RCS is provided by the Reactor Core Isolation Cooling (RCIC) system (see Section 3.2) or by the Emergency Core Cooling System (ECCS, see Section 3.3). Heat is transferred from the containment to the ultimate heat sink by the Residual Heat Removal (RHR) system operating in the suppression pool cooling mode. Actuation systems provide for automatic closure of the MSIVs and isolation of other lines connected to the RCS.

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. Total volume: 22,424 ft^3
2. Water volume: 14,490 ft^3 (including recirculation loops).
3. Steam volume: 7934 ft^3
4. Steam flow: 14.159 x 10^6 lb/hr.
5. Normal operating pressure: 1020 psia

B. Safety/Relief Valves (14)
1. Set pressure: 1130 to 1150 psig
2. Relief capacity: 901,500 to 917,000 lb/hr (each)

C. Recirculation Pumps (2)
1. Rated flow: 45,200 gpm @ 710 ft. head (308 psid)
2. Type: Vertical centrifugal

D. Jet Pumps (20)
1. Total flow: 102.6 x 10^6 lb/hr @ 81.5 ft. head (35 psid)

RCS water volume is the sum of the volumes of the lower plenum core, upper plenum and separators, downcomer region, and recirculation loops. Steam volume is the volume of the dome (above normal water level). Total RCS volume is the sum of the water and steam volumes. All volumes were obtained from Figure 5.1-2 in Ref. 1.

3.1.6 Support Systems and Interfaces

A. Motive Power
1. The recirculation pumps are supplied with Nonclass 1E power from an AC motor generator set.

B. MSIV Operating Power
The instrument air system supports normal operation of the MSIVs. Valve operation is controlled by an AC and DC solenoid pilot valve. Both solenoid valves must be deenergized to cause MSIV closure. This design prevents spurious closure of an MSIV if a single solenoid valve should fail. MSIVs are designed to fail closed if instrument air is lost or if both AC and DC control power is lost to the solenoid pilot valves. This is achieved by a local dedicated air accumulator for each MSIV and an independent valve closing spring.

C. Recirculation Pump Cooling
The reactor plant component cooling water system provides cooling water to the recirculation pump coolers.

3.1.7 Section 3.1 References

1. Limerick Generating Station Final Safety Analysis Report, Philadelphia Electric Co., Philadelphia, PA.

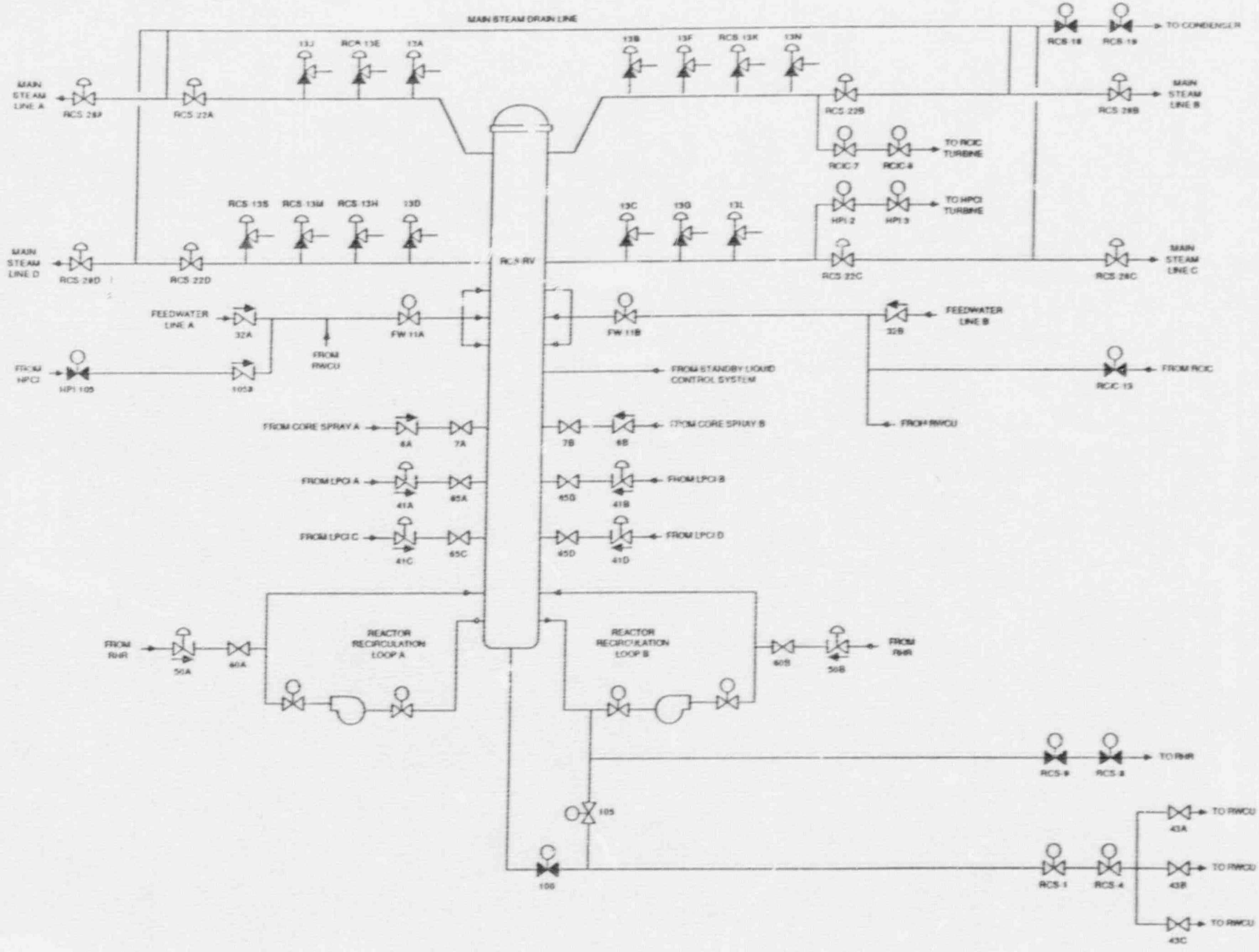


Figure 3.1-1. Limerick 1 Reactor Coolant System

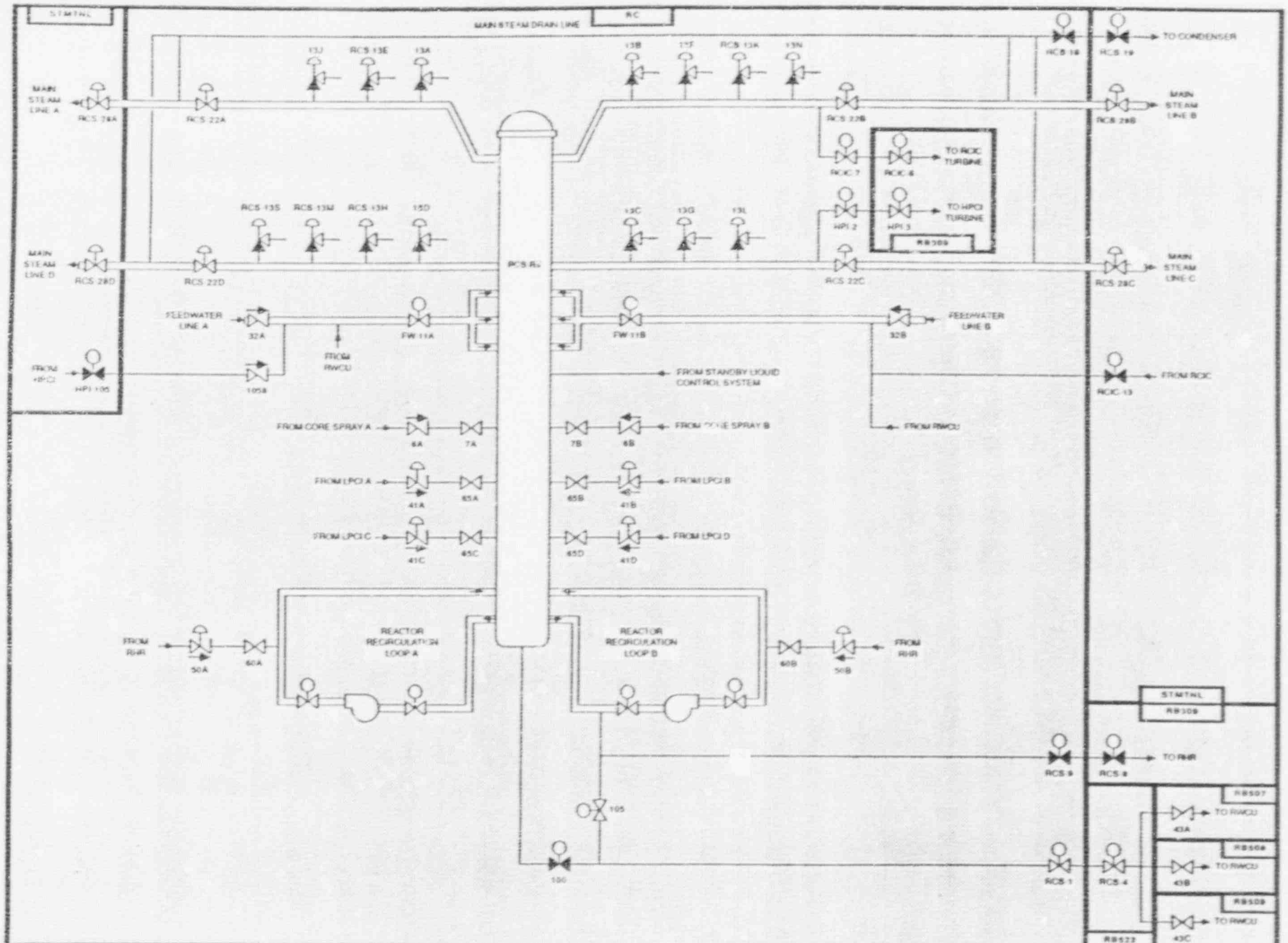


Figure 3.1-2. Limerick 1 Reactor Coolant System Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
HPI-2	MOV	RC	MCC-144RE	440	RB402	AC/D
HPI-3	MOV	RB309	UNKNOWN		RB304	
RCIC-7	MOV	RC	MCC-134RE	440	RB402	AC/C
RCIC-8	MOV	RB309	UNKNOWN		RB304	
RCS-1	MOV	RC	MCC-114RG	440	RB304	AC/A
RCS-16	MOV	RC	MCC-114RG	440	RB304	AC/A
RCS-19	MOV	STMTNL	UNKNOWN		RB304	
RCS-22A	NV	RC				
RCS-22B	NV	RC				
RCS-22C	NV	RC				
RCS-22D	NV	RC				
RCS-28A	NV	STMTNL				
RCS-28B	NV	STMTNL				
RCS-28C	NV	STMTNL				
RCS-28D	NV	STMTNL				
RCS-4	MOV	RB522	MCC-124RG	440	RB304	AC/B
RCS-8	MOV	RB309	UNKNOWN		RB304	
RCS-9	MOV	RC	MCC-114RG	440	RB304	AC/A
RCS-RV	RV	RC				

3.2 REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

3.2.1 System Function

The reactor core isolation cooling system provides adequate core cooling in the event that reactor isolation is accompanied by loss of feedwater flow. This system provides makeup at reactor operating pressure and does not require RCS depressurization. The RCIC system is not considered to be part of the Emergency Core Cooling System (ECCS, see Section 3.3) and does not have a LOCA mitigating function.

3.2.2 System Definition

The reactor core isolation cooling system consists of a steam-driven turbine pump and associated valves and piping for delivering makeup water from the condensate storage tank or the suppression pool to the reactor pressure vessel. The RCIC can also operate in conjunction with the RHR system in the steam condensing mode, in which condensed steam is delivered from the RHR heat exchanger outlets to the RCIC pump suction, for return to the RCS.

The RCIC turbine is driven by steam from main steam line B. The turbine exhausts to the suppression pool.

Simplified drawings of the reactor core isolation cooling system are shown in Figures 3.2-1 and 3.2-2. Interfaces between the RCIC and the RCS are shown in Section 3.1. A summary of data on selected RCIC system components is presented in Table 3.2-1.

3.2.3 System Operation

During normal operation the RCIC is in standby with the steam supply valves to the RCIC turbine driven pump closed and the pump suction aligned to the condensate storage tank.

Upon receipt of an RPV low water level signal, the turbine-pump steam supply valves are opened and makeup water is supplied to the RPV via feedwater line B. The primary water supply for the RCIC is the condensate storage tank (CST). The suppression pool is used as a backup water supply. Reactor core heat is dumped to the suppression pool via the safety/relief valves which cycle as needed to limit RCS pressure. The RCIC turbine also exhausts to the suppression pool.

The RCIC can also operate in conjunction with the RHR system in the steam condensing mode, in which condensed steam is delivered from the RHR heat exchanger outlets to the RCIC pump suction, for return to the RCS. In this mode of operation, reactor core heat is transferred to the RHR system rather than to the suppression pool. The RCIC turbine still exhausts to the suppression pool.

3.2.4 System Success Criteria

For the RCIC system to be successful there must be at least one water source and supply path to the turbine-driven pump, an open steam supply path to the turbine, an open discharge path to the RCS, and an open turbine exhaust path to the suppression pool.

3.2.5 Component Information

A. Steam turbine-driven RCIC pump:
   1. Rated Flow: 625 gpm @ 2800 ft. head (1214 psid)
   2. Rated Capacity: 100%
   3. Type: centrifugal

B. Condensate Storage Tank
   1. Capacity: 200,000 gal

3.2.6 Support System and Interfaces

A. Control Signals

1. Automatic
    a. The RCIC pump is automatically actuated on a reactor vessel low water level signal. The system automatically shuts down when the reactor vessel water level reaches a specified level (referred to as level 8), and automatically restarts if the level returns to the low level trip point.
    b. The RCIC pump suction is automatically switched to the suppression pool upon low condensate storage tank level.
2. Remote Manual
   The RCIC pump can be actuated by remote manual means from the control room or the remote shutdown panel. Manual action is required to place the RCIC in the RHR steam condensing mode.

B. Motive Power

1. The RCIC turbine driven pump is supplied with steam from main steam loop B, upstream of the main steam isolation valves.
2. The RCIC motor-operated valves are either Class 1E AC or Class 1E DC loads that can be supplied from the standby diesel generators or the station batteries, respectively, as described in Section 3.5.

C. Other

1. Lubrication and cooling for the turbine-driven pump are assumed to be supplied locally.
2. A room ventilation system cooled by the emergency service water system (see Section 3.7) provides RCIC room cooling.

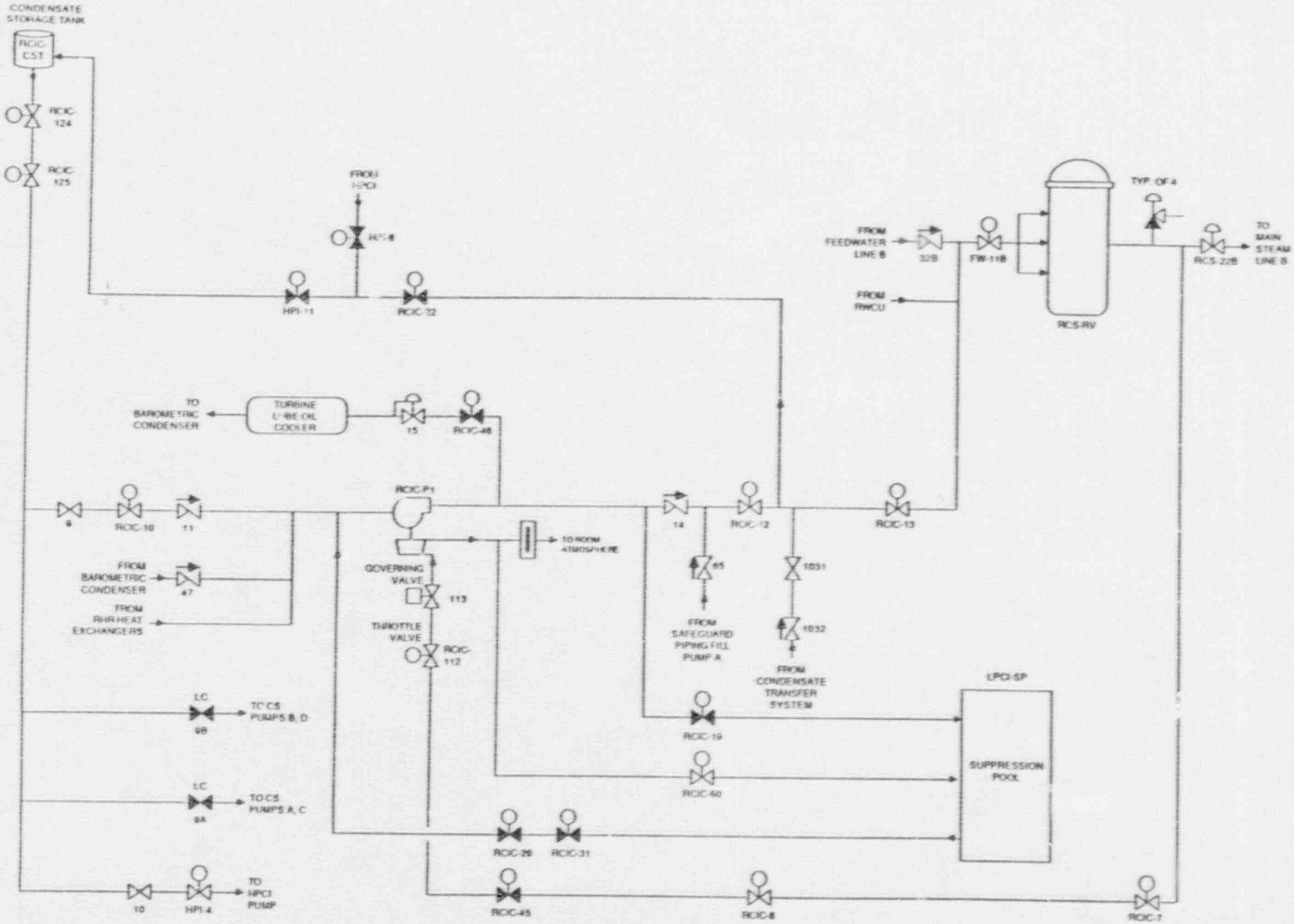


Figure 3.2-1. Limerick 1 Reactor Core Isolation Cooling System

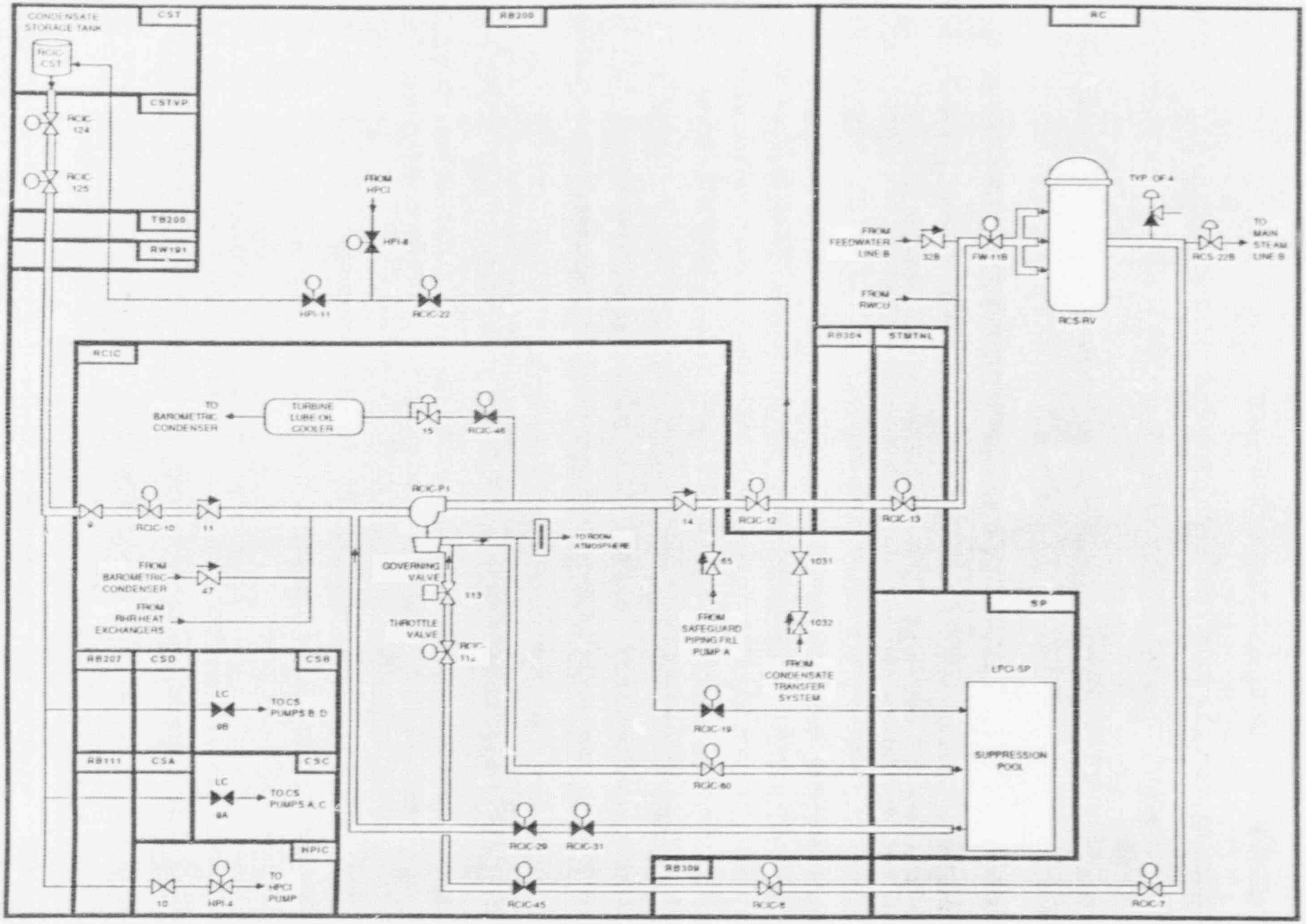


Figure 3.2-2. Limerick 1 Reactor Core Isolation Cooling System Showing Component Locations

Table 3.2-1. Limerick 1 Reactor Core Isolation Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
FW-11B	MOV	RC	MCC-134RC	410	RB402	AC/C
RCIC-10	MOV	RCIC	MCC-1DA	125/250	RB304	DC/1
RCIC-112	MOV	RCIC	MCC-1DA	125/250	RB304	DC/1
RCIC-12	MOV	RB200	MCC-1DA	125/250	RB304	DC/1
RCIC-124	MOV	CSTVP	MCC-114DG	440	DGA	AC/A
RCIC-125	MOV	CSTVP	MCC-124DG	440	DGB	AC/B
RCIC-13	MOV	STMTNL	MCC-1DA	125/250	RB304	DC/1
RCIC-19	MOV	RCIC	MCC-1DA	125/250	RB304	DC/1
RCIC-22	MOV	RB200	MCC-1DA	125/250	RB304	DC/1
RCIC-29	MOV	RCIC	MCC-1DA	125/250	RB304	DC/1
RCIC-31	MOV	RCIC	MCC-1DA	125/250	RB304	DC/1
RCIC-45	MOV	RCIC	MCC-1DA	125/250	RB304	DC/1
RCIC-46	MOV	RCIC	MCC-1DA	125/250	RB304	DC/1
RCIC-60	MOV	RCIC	MCC-1DA	125/250	RB304	DC/1
RCIC-7	MOV	RC	MCC-134RE	440	RB402	AC/C
RCIC-8	MOV	RB309	UNKNOWN		RB304	
RCIC-CST	TANK	CST				
RCIC-P1	TDP	RCIC				

3.3 EMERGENCY CORE COOLING SYSTEM (ECCS)

3.3.1 System Function

The ECCS 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 ECCS also performs suppression pool cooling and containment spray functions and has a capability for mitigating transients.

3.3.2 System Definition

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

- High Pressure Coolant Injection (HPCI) System
- Automatic Depressurization System (ADS)
- Core Spray (CS) System
- Low Pressure Coolant Injection (LPCI) System

The HPCI system is provided to supply make-up water to the reactor pressure vessel (RPV) in the event of a small break LOCA which does not result in a rapid depressurization of the reactor vessel. The HPCI system consists of a turbine-driven pump, system piping, valves and controls. The HPCI pump can draw suction from either the CST or the suppression pool. Water is injected into the reactor via feedwater line A or via the CS system. The HPCI turbine is driven by steam from main steam line C. The turbine exhausts to the suppression pool.

The automatic depressurization system (ADS) provides automatic RPV depressurization for small breaks and transients so that the low pressure systems (LPCI and CS) can provide makeup to the RCS. The ADS utilizes 5 of the 14 safety/relief valves that discharge the high pressure steam to the suppression pool.

The CS system supplies make-up water to the reactor vessel at low pressure. The system consists of four motor-driven pumps to supply water from the CST or the suppression pool to two spray spargers in the reactor vessel above the core.

The low pressure coolant injection system is an operating mode of the residual heat removal (RHR) system, and provides make-up water to the reactor vessel at low pressure. The LPCI system consists of four loops, designated LPCIA, LPCIB, LPCIC, and LPCID. Each loop consists of a motor driven pump which supplies water from the suppression pool into the reactor vessel. There are two heat exchangers in the system, one for pumps A and C and one for pumps B and D. The RHR system can be manually realigned as needed to perform suppression pool cooling or containment spray as part of the basic emergency core cooling function. The RHR system also can be aligned for steam condensing operation, where steam from the HPCI steam line is condensed in the RHR heat exchangers, then piped to the suction of the RCIC pumps for the return to the reactor. This is not an ECCS function.

Simplified drawings of the HPCI system are shown in Figures 3.3-1 and 3.3-2. The CS system is shown in Figures 3.3-3 and 3.3-4. The LPCI system is shown in Figures 3.3-5 and 3.3-6 (loops A and C), and Figures 3.3-7 and 3.3-8 (loops B and D). Interfaces between these systems and the RCS are shown in Section 3.1. A summary of data on selected ECCS components is presented in Table 3.3-1.

3.3.3 System Operation

All ECCS systems normally are in standby. The manner in which the ECCS operates to protect the reactor core is a function of the rate at which coolant is being lost from the RCS. The HPCI system is normally aligned to take a suction on the Condensate Storage Tank (CST). The HPCI system is automatically started in response to decreasing

RPV water level, and will serve as the primary source of makeup if RCS pressure remains high. Reactor core heat is dumped to the suppression pool via the safety/relief valves, which cycle as needed to limit RCS pressure. Steam to drive the HPCI turbine is routed from main steam line C. If the break is of such a size that the coolant loss exceeds the HPCI system capacity, then the CS and LPCI systems can provide higher capacity makeup to the reactor vessel.

The Automatic Depressurization System will automatically reduce RCS pressure if a break has occurred and RPV water level is not maintained by the HPCI system. Rapid depressurization permits flow from the CS or LPCI systems to enter the vessel. The ADS has two redundant trip systems. Each ADS valve can be actuated by either of two solenoid-operated valves supplying air to the relief valve air piston operators. One solenoid valve is actuated by trip system A (division I DC power) and the other by trip system C (division III DC power).

The CS system consists of two loops, each containing two 50% capacity pumps. Each loop provides makeup to the reactor vessel through separate spray spargers. The source of water is normally the suppression pool, but the pumps in each loop can be aligned to take suction from the CST. This path is normally blocked by a locked closed manual valve.

The LPCI system is an operating mode of the RHR system. In the LPCI mode the four pumps take suction on the suppression pool and inject back into the vessel through four separate vessel nozzles. Flow can also be directed to the reactor recirculation loops. Other operating modes of the RHR system include suppression pool cooling, in which water is recirculated from the suppression pool through two RHR heat exchangers and back to the suppression pool; containment spray, in which water is pumped to fog jet nozzles in the drywell and suppression pool; steam condensing, in which condensate is delivered to the RCIC pump; and shutdown cooling.

3.3.4 System Success Criteria

LOCA mitigation requires that both the emergency coolant injection (ECI) and emergency coolant recirculation (ECR) functions be accomplished. The ECCS success criteria are not clearly defined in the Limerick FSAR but can be inferred from pump capacities that are defined based on certain design basis accidents that are considered in the licensing process based on licensing considerations. The ECI system success criteria for a large LOCA are the following:

- 2 of 4 core spray pumps with a suction on the suppression pool, or
- 1 of the 4 low pressure coolant injection pumps with a suction on the suppression pool.

The ECI system success criteria for a small LOCA are the following:

- The high-pressure coolant injection (HPCI) pump with a suction on the suppression pool or the condensate storage tank, or
- The automatic depressurization system (ADS) and 1 of 4 LPCI pumps with a suction on the suppression pool, or
- The automatic depressurization system and 2 of 4 core spray pumps with a suction on the suppression pool.

The success criterion for the ADS is the use of any 1 of 2 ADS trains. It is possible that the coolant inventory control function for some small LOCAs can be satisfied by low-capacity high-pressure injection systems such as the control rod drive hydraulic system (see Section 3.6). The ECR success criteria for LOCAs are related to the ECI success criteria above. All injection systems essentially are operating in a recirculation mode when drawing water from the suppression pool.

For transients, the success criteria for reactor coolant inventory control involve the following:

- Either the reactor core isolation cooling (RCIC) system (not part of the ECCS, see Section 3.2), or
- Small LOCA mitigating systems

For the suppression pool cooling function to be successful, one of two RHR trains must be aligned for containment heat removal and the associated RHR service water train must be operating to complete the heat transfer path from the RHR heat exchangers to the ultimate heat sink. In a given RHR train, one of two pumps must operate with an open flow path through the RHR heat exchanger.

3.3.5 <u>Component Information</u>

A. Motor-driven HPCI pump P1
   1. Rated flow: 5600 gpm @ unknown head
   2. Rated capacity: 100%
   3. Type: centrifugal

B. Motor-driven CS pumps A, B, C, D
   1. Rated flow: 6350 gpm @ 105 psid (vessel to drywell)
   2. Rated capacity: 50%
   3. Type: centrifugal

C. Motor-driven LPCI pumps A, B, C, D
   1. Rated flow: 10,000 gpm @ 20 psid (vessel to drywell)
   2. Rated capacity: 100%
   3. Type: centrifugal

D. RHR Heat Exchangers 1A and 1B
   1. Heat transfer capability: unknown
   2. Rated capacity: 100%
   3. Type: shell and tube

E. Automatic-depressurization valves (5)
   1. Rated flow: 901,500 lb/hr @ 1130 psig (valve H); 909,000 lb/hr @ 1140 psig (valves E, K, M, S)

F. Pressure Suppression Chamber
   1. Design temperature: 220°F
   2. Maximum operating temperature: 95°F
   3. Minimum water volume: 122,120 ft^3

3.3.6 Support Systems and Interfaces

A. Control signals

1. Automatic

   a. The HPCI pump, CS pumps, and the LPCI pumps, and all their associated valves function upon receipt of low water level in the reactor vessel or high pressure in the drywell.

   b. The HPCI pump is automatically tripped upon turbine overspeed, reactor vessel high water level, HPCI pump low suction pressure, or HPCI turbine exhaust high pressure. If an initiation signal is received after the turbine is shut down, the system restarts automatically, provided no shutdown signal exists.

   c. HPCI pump suction is automatically switched from the CST to the suppression pool upon low CST level or high suppression pool water level.

   d. The ADS system is actuated upon coincident signals of the reactor vessel low water level, drywell high pressure, and any LPCI or CS pump running. If all signals are present the ADS valves will open after the ADS timer runs out. The time delay gives the HPCI system a chance to operate before blowdown occurs.

   e. LPCI initiation automatically causes all RHR components to perform their function under the LPCI mode.

2. Remote manual

   ECCS pumps and valves and the ADS can be actuated by remote manual means from the main control room. RHR loop A valves can also be controlled from the remote shutdown panel.

B. Motive Power

1. The CS and LPCI motor-driven pumps and motor-operated valves are Class 1E AC loads that can be supplied from the emergency diesel generators, as described in Section 3.5.
2. Most of the HPCI motor-operated valves are Class 1E DC loads. The HPCI pump is supplied with steam from main steam line C.

C. Other

1. Lubrication and cooling for the ECCS pumps are assumed to be supplied locally.
2. ECCS pump room ventilation systems are cooled by emergency service water (see Section 3.7). RHR pump seals are also cooled by ESW.
3. The RHR heat exchangers are cooled by the Residual Heat Removal Service Water System (see Section 3.8).

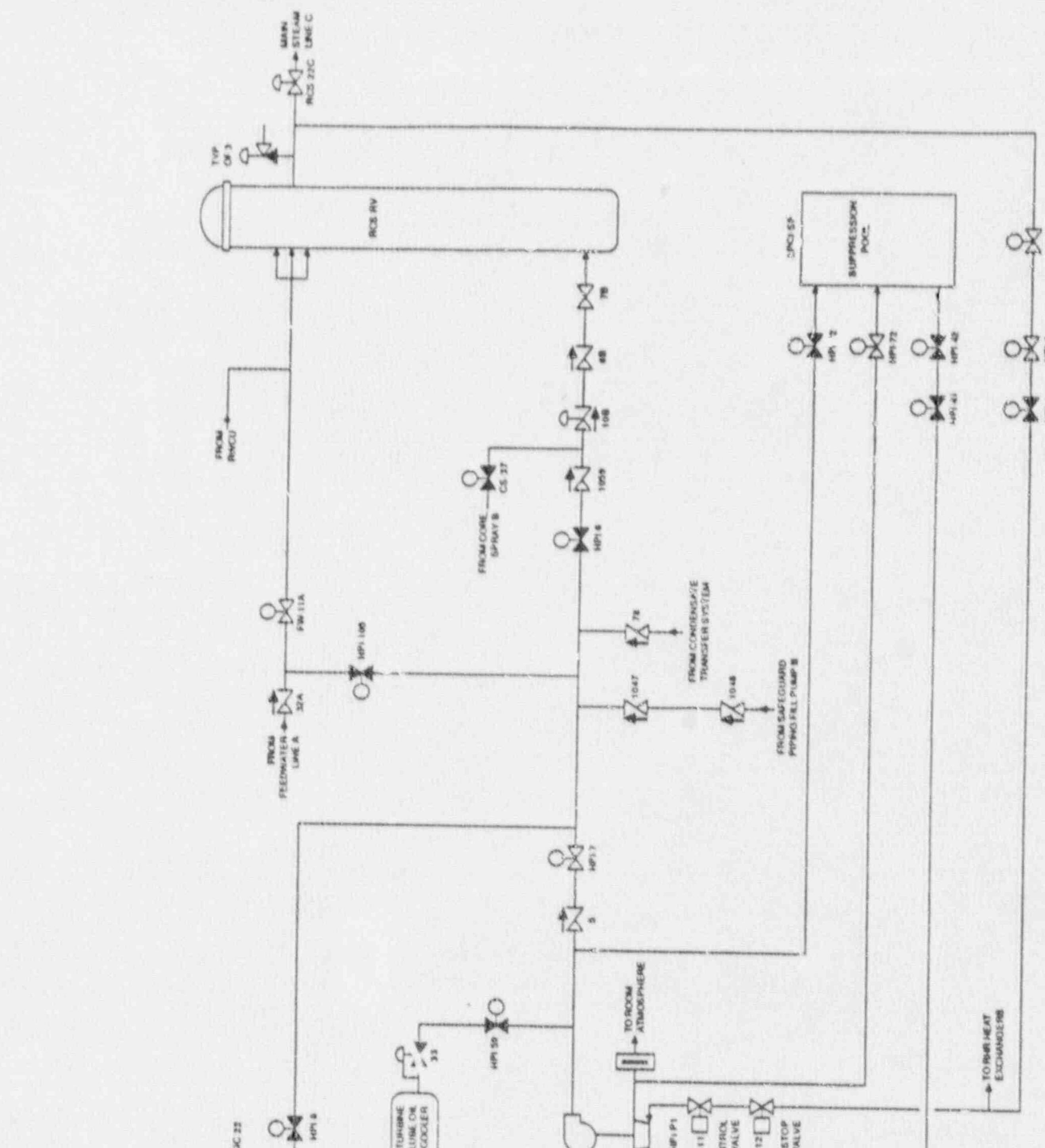


Figure 3.3-1. Limerick 1 High Pressure Coolant Injection System

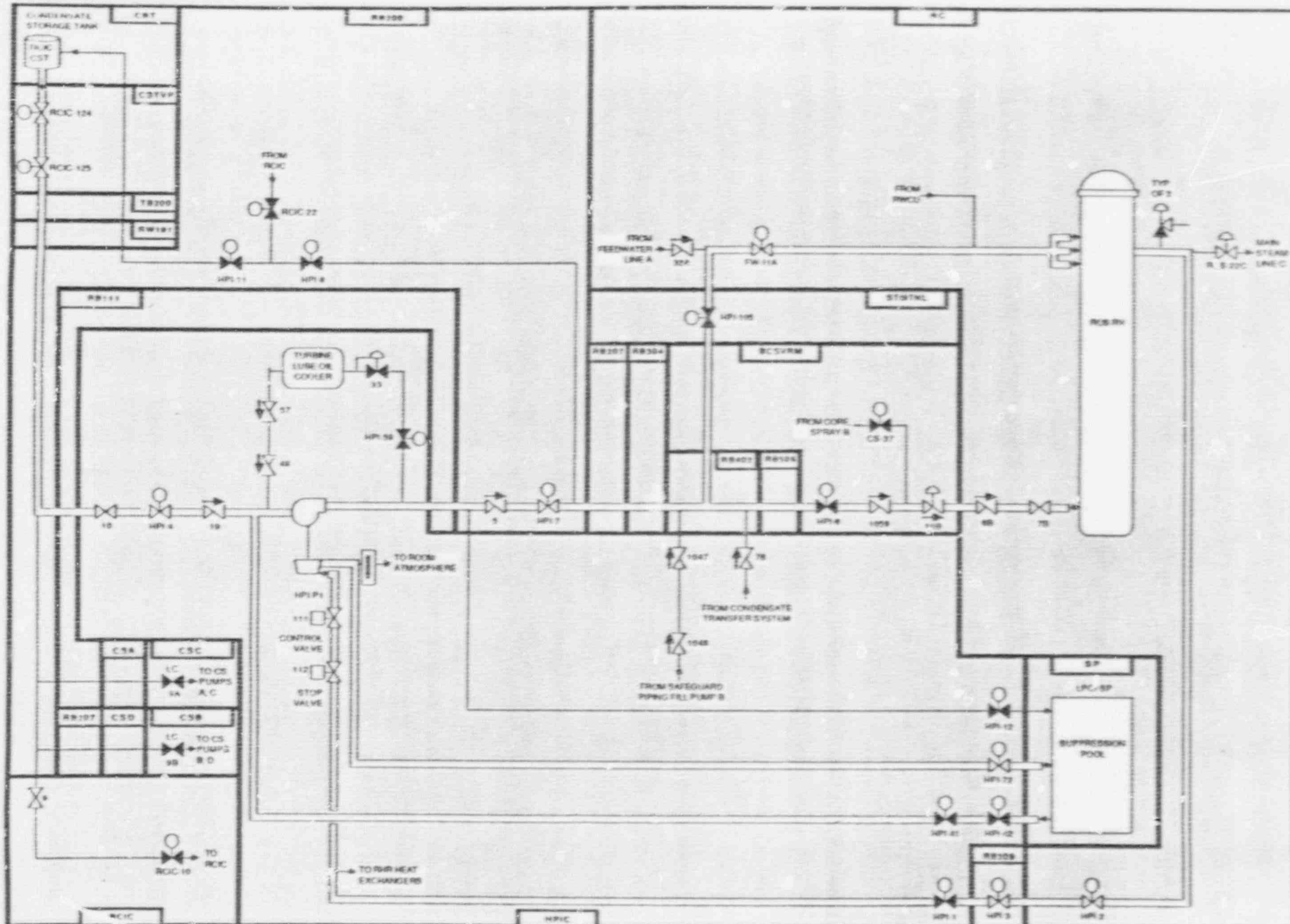


Figure 3.3-2. Limerick 1 High Pressure Coolant Injection System Showing Component Locations

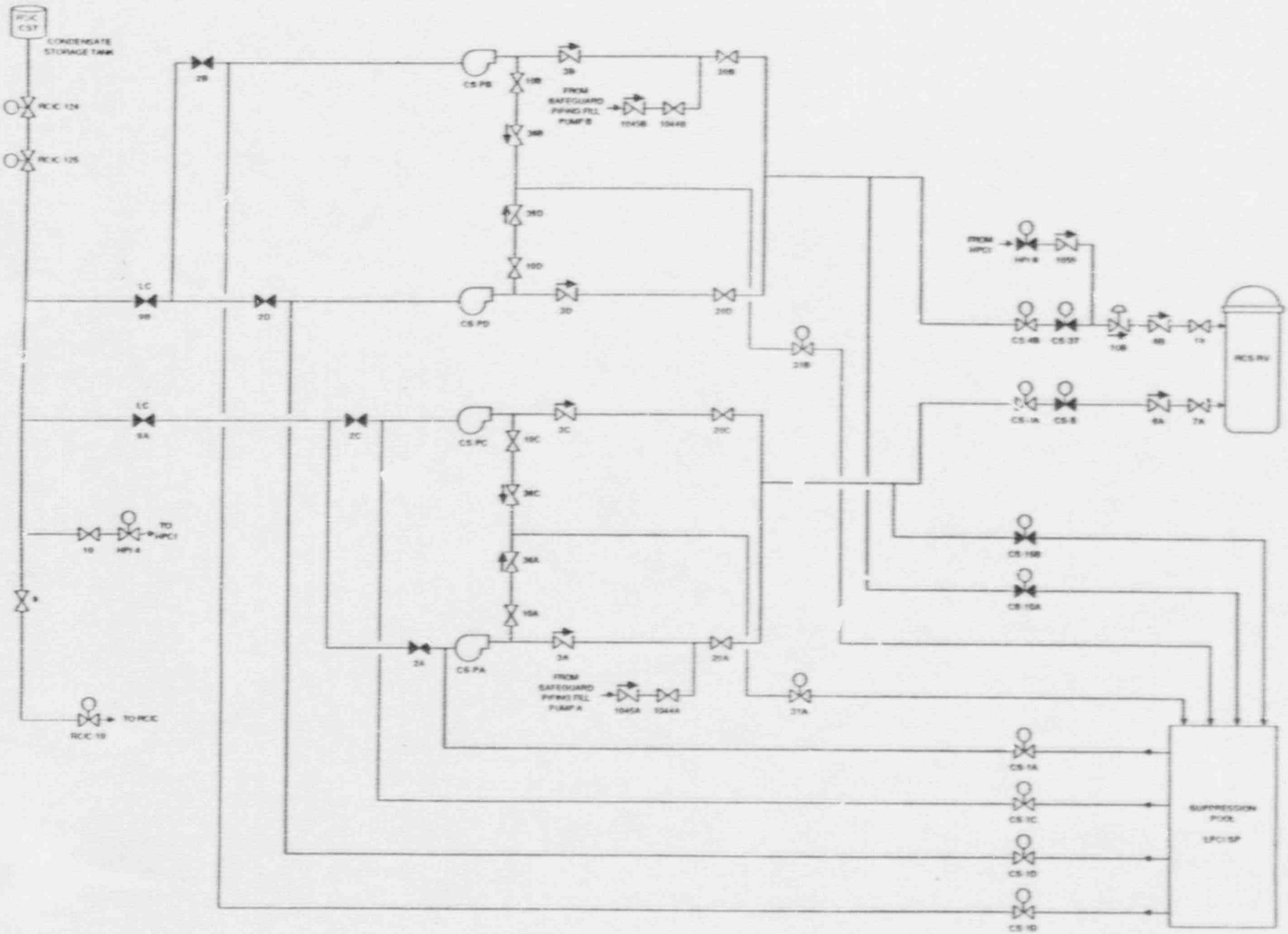


Figure 3.3-3. Limerick 1 Core Spray System

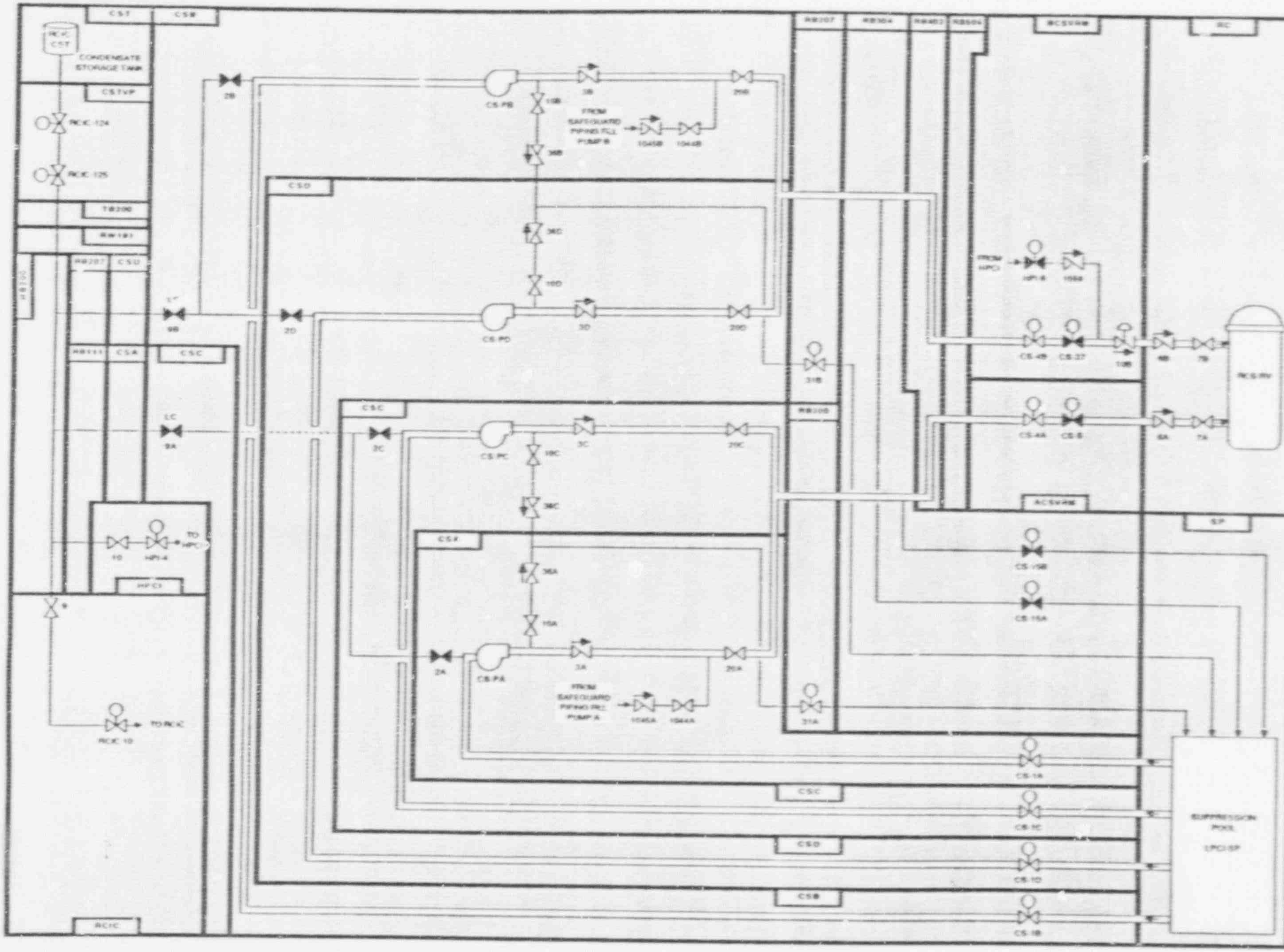


Figure 3.3-4. Limerick 1 Core Spray System Showing Component Locations

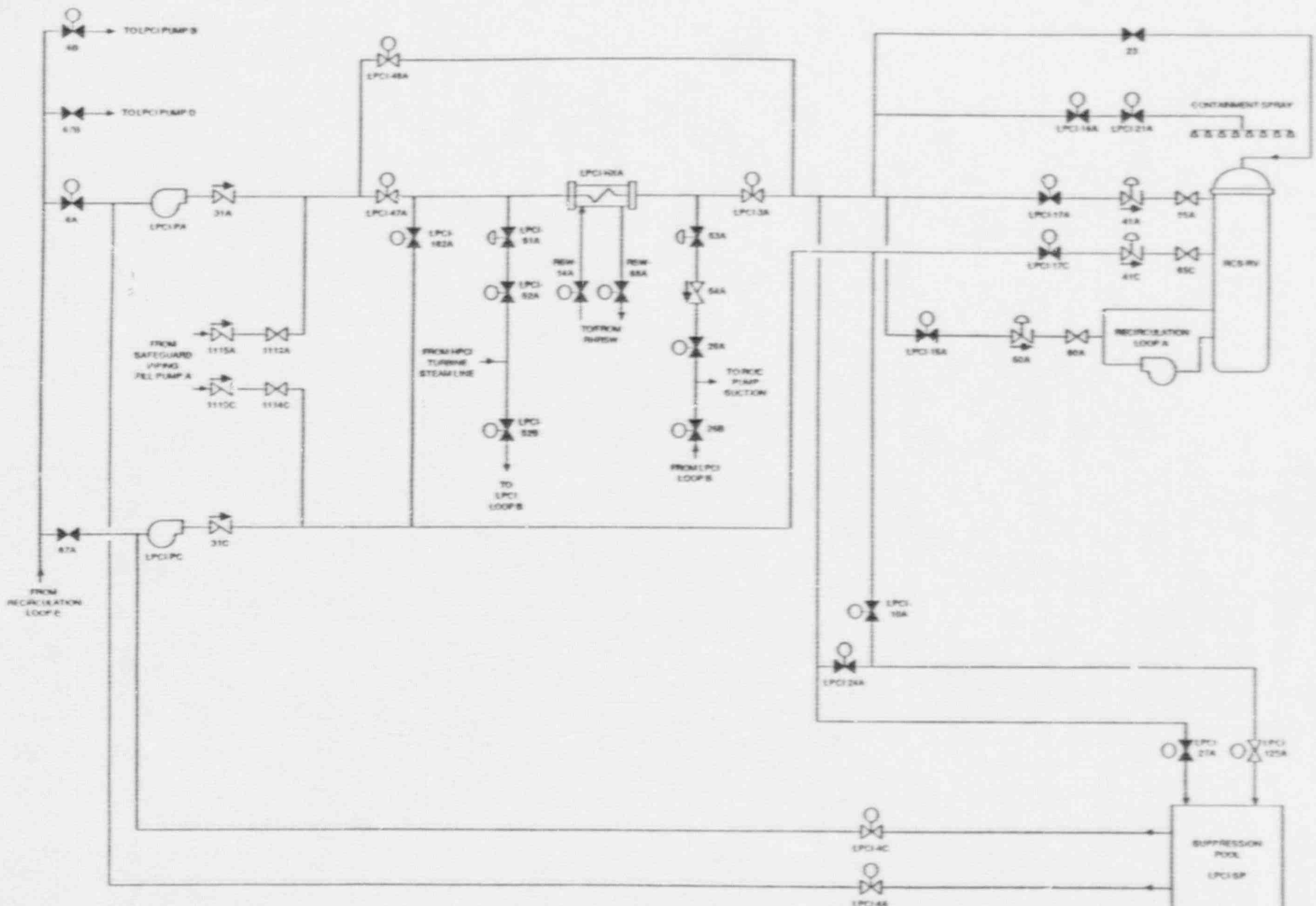
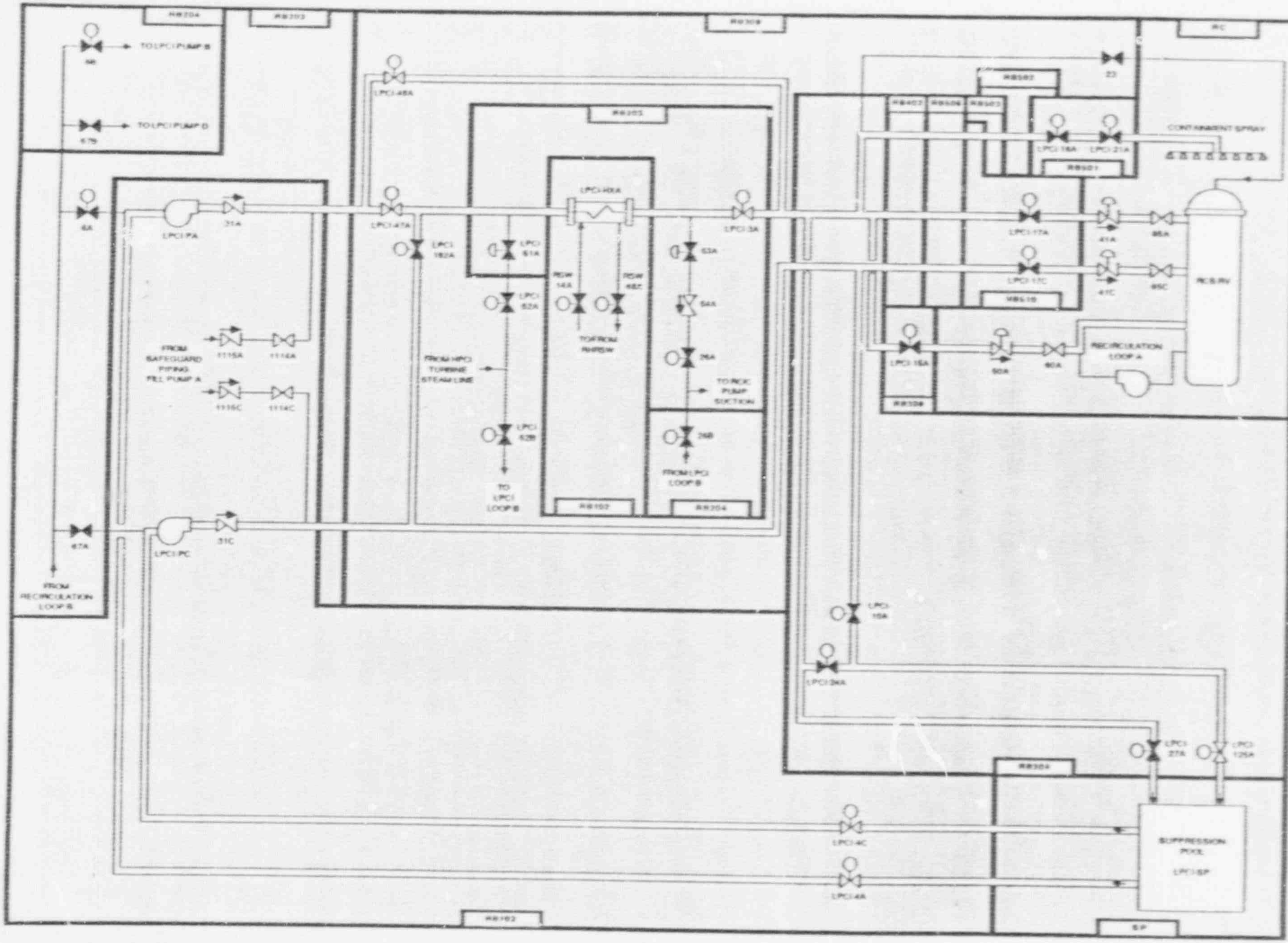


Figure 3.3-5. Limerick 1 Low Pressure Coolant Injection System, Loops A and C



NOTE: LPCI-HXA IS IN ROOMS RB102 AND RB203

Figure 3.3-6. Limerick 1 Low Pressure Coolant Injection System, Loops A and C Showing Component Locations

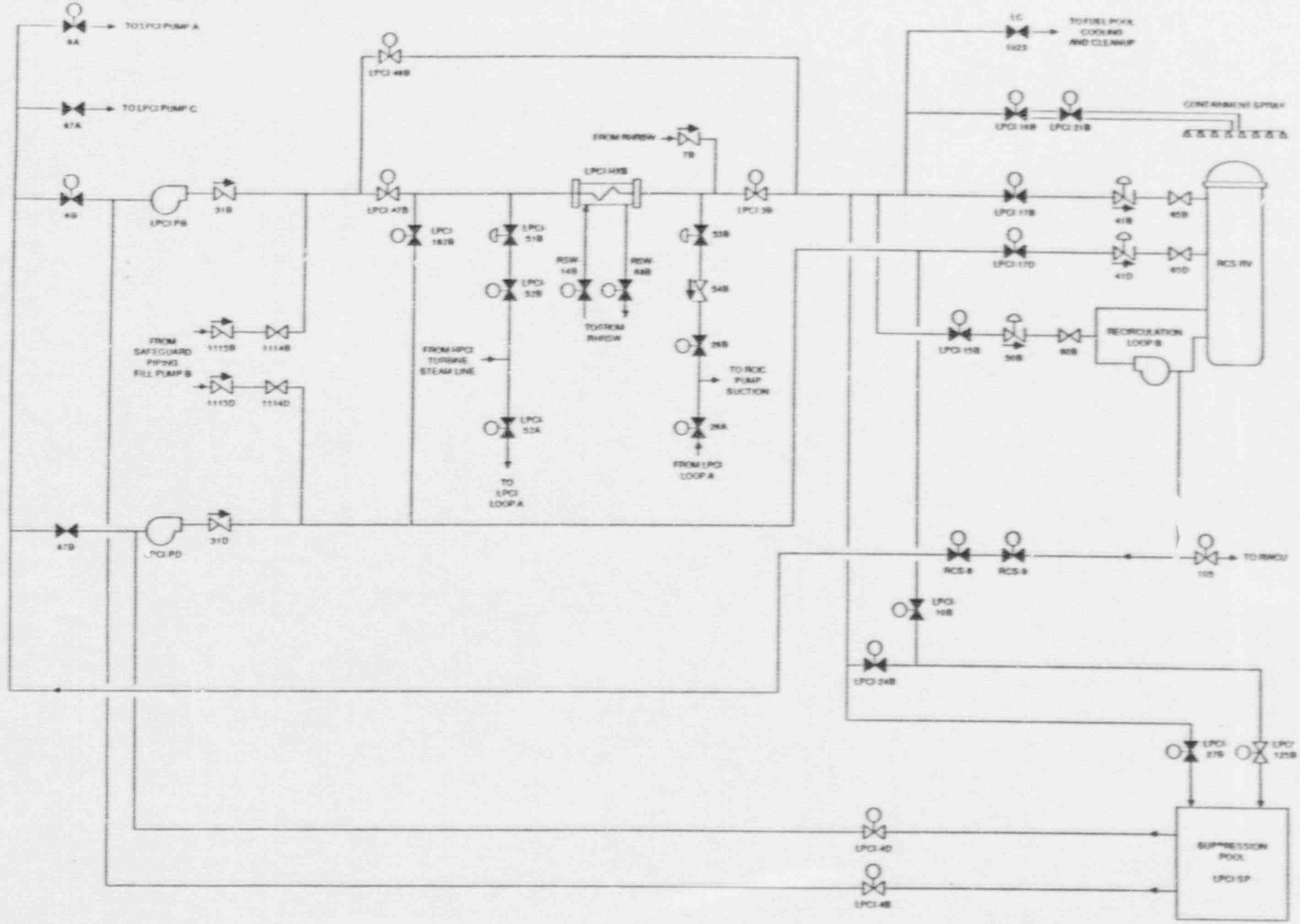


Figure 3.3-7. Limerick 1 Low Pressure Coolant Injection System, Loops B and D

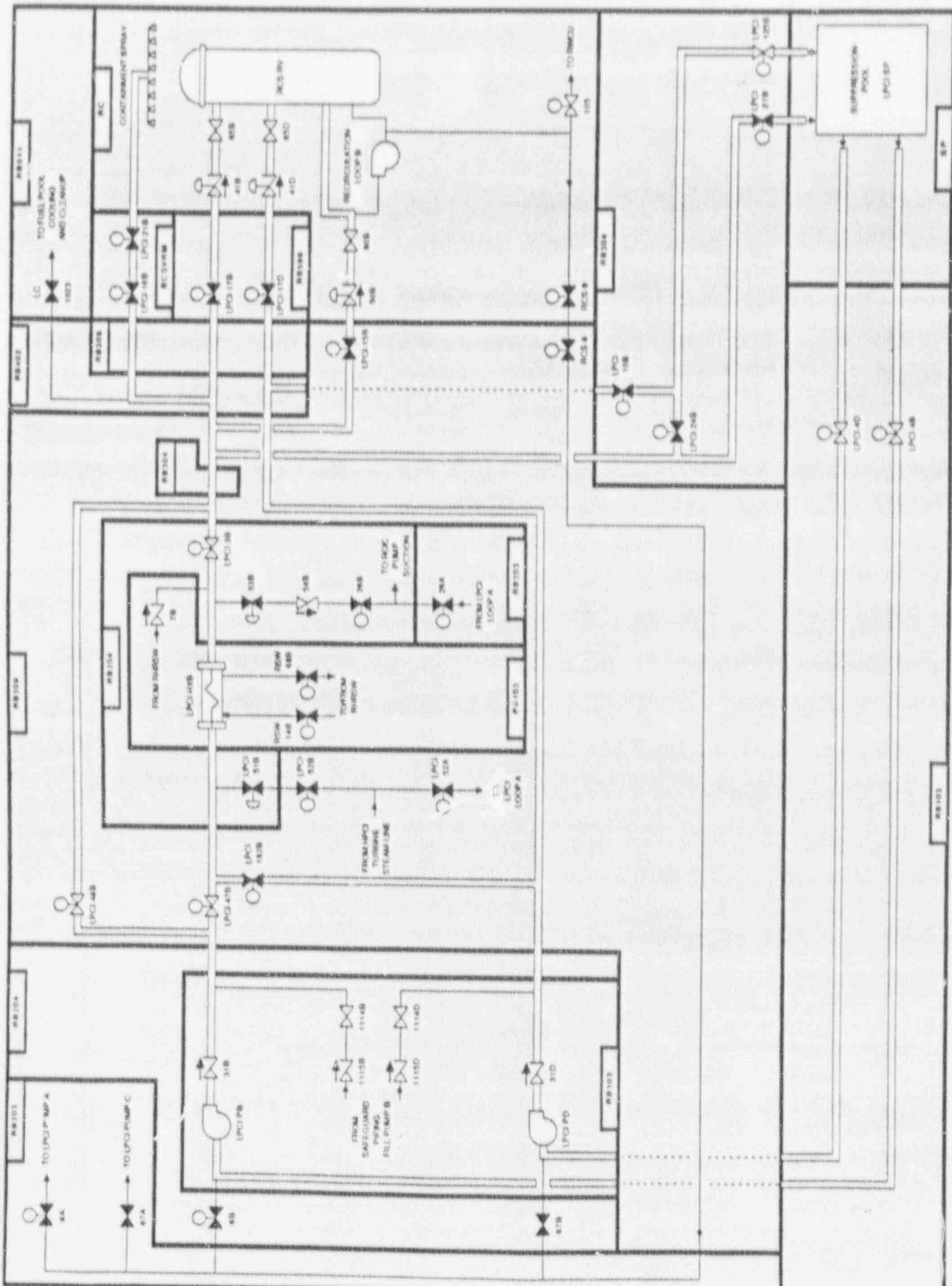


Figure 3.3-8. Limerick 1 Low Pressure Coolant Injection System, Loops B and D Showing Component Locations

Table 3.3-1. Limerick 1 Emergency Core Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CS-15A	MOV	RB304	MCC-114RG	440	RB304	AC/A
CS-15B	MOV	RB304	MCC-124RG	440	RB304	AC/B
CS-1A	MOV	CSA	MCC-114RG	440	RB304	AC/A
CS-1B	MOV	CSB	MCC-124RC	440	RB304	AC/B
CS-1C	MOV	CSC	MCC-134RH	440	RB200	AC/C
CS-1D	MOV	CSD	MCC-144RH	440	RB207	AC/D
CS-37	MOV	BCSVRM	MCC-124RC	440	RB506	AC/B
CS-4A	MOV	ACSVRM	MCC-114RC	440	RB506	AC/A
CS-4B	MOV	BCSVRM	MCC-124RC	440	RB506	AC/B
CS-5	MOV	ACSVRM	MCC-114RC	440	RB506	AC/A
CS-PA	MDP	CSA	BUS-D11	4160	4KVD11	AC/A
CS-PB	MDP	CSB	BUS-D12	4160	4KVD12	AC/B
CS-PC	MDP	CSC	BUS-D13	4160	4KVD13	AC/C
CS-PD	MDP	CSD	BUS-D14	4160	4KVD14	AC/D
FW-11A	MOV	RC	MCC-114RC	440	RB506	AC/A
HPI-1	MOV	HPIC	MCC-1DB-1	125/250	RB304	DC/2
HPI-105	MOV	STMTNL	MCC-1DB-1	125/250	RB304	DC/2
HPI-11	MOV	RB200	MCC-1DB-2	125/250	RB304	DC/2
HPI-12	MOV	HPIC	MCC-1DB-1	125/250	RB304	DC/2
HPI-2	MOV	RC	MCC-144RE	440	RB402	AC/D
HPI-3	MOV	RB309	UNKNOWN		RB304	
HPI-4	MOV	HPIC	MCC-1DB-1	125/250	RB304	DC/2
HPI-41	MOV	HPIC	MCC-1DB-1	125/250	RB304	DC/2
HPI-42	MOV	HPIC	MCC-1DB-1	125/250	RB304	DC/2
HPI-59	MOV	HPIC	MCC-1DB-1	125/250	RB304	DC/2
HPI-6	MOV	BCSVRM	MCC-1DB-2	125/250	RB304	DC/2
HPI-7	MOV	RB200	MCC-1DB-2	125/250	RB304	DC/2

Table 3.3-1. Limerick 1 Emergency Core Cooling System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
HPI-72	MOV	HPIC	MCC-1DB-1	125/250	RB304	DC/2
HPI-8	MOV	RB200	MCC-1DB-2	125/250	RB304	DC/2
HPI-P1	TDP	HPIC				
LPCI-10A	MOV	RB304	MCC-134RH	440	RB200	AC/C
LPCI-10B	MOV	RB304	MCC-144RH	440	RB207	AC/D
LPCI-125A	MOV	RB304	MCC-114RG	440	RB304	AC/A
LPCI-125A	MOV	RB304	MCC-114RG	440	RB304	AC/A
LPCI-125B	MOV	RB304	MCC-124RG	440	RB304	AC/B
LPCI-125B	MOV	RB304	MCC-124RG	440	RB304	AC/B
LPCI-15A	MOV	RB309	MCC-124RG	440	RB304	AC/B
LPCI-15B	MOV	RB309	MCC-124RG	440	RB304	AC/B
LPCI-16A	MOV	RB501	MCC-114RC	440	RB506	AC/A
LPCI-16A	MOV	RB501	MCC-114RC	440	RB506	AC/A
LPCI-16B	MOV	BCSVRM	MCC-124RC	440	RB506	AC/B
LPCI-16B	MOV	BCSVRM	MCC-124RC	440	RB506	AC/B
LPCI-17A	MOV	RB510	MCC-114RC	440	RB506	AC/A
LPCI-17B	MOV	RB599	MCC-124RC	440	RB506	AC/B
LPCI-17C	MOV	RB510	MCC-134RE	440	RB402	AC/C
LPCI-17C	MOV	RB510	MCC-134RE	440	RB402	AC/C
LPCI-17D	MOV	RB599	MCC-144RE	440	RB402	AC/D
LPCI-17D	MOV	RB599	MCC-144RE	440	RB402	AC/D
LPCI-182A	MOV	RB309	MCC-114RG	440	RB304	AC/A
LPCI-182B	MOV	RB309	MCC-124RG	440	RB304	AC/B
LPCI-21A	MOV	RB501	MCC-114RC	440	RB506	AC/A
LPCI-21A	MOV	RB501	MCC-114RC	440	RB506	AC/A
LPCI-21B	MOV	BCSVRM	MCC-124RC	440	RB506	AC/B
LPCI-21B	MOV	BCSVRM	MCC-124RC	440	RB506	AC/B

Table 3.3-1. Limerick 1 Emergency Core Cooling System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
LPCI-24A	MOV	RB304	MCC-114RG	440	RB304	AC/A
LPCI-24A	MOV	RB304	MCC-114RG	440	RB304	AC/A
LPCI-24B	MOV	RB304	MCC-124RG	440	RB304	AC/B
LPCI-24B	MOV	RB304	MCC-124RG	440	RB304	AC/B
LPCI-27A	MOV	RB304	MCC-114RG	440	RB304	AC/A
LPCI-27A	MOV	RB304	MCC-114RG	440	RB304	AC/A
LPCI-27B	MOV	RB304	MCC-124RG	440	RB304	AC/B
LPCI-27B	MOV	RB304	MCC-124RG	440	RB304	AC/B
LPCI-3A	MOV	RB203	MCC-114RG	440	RB304	AC/A
LPCI-3B	MOV	RB204	MCC-124RG	440	RB304	AC/B
LPCI-47A	MOV	RB309	MCC-114RG	440	RB304	AC/A
LPCI-47A	MOV	RB309	MCC-114RG	440	RB304	AC/A
LPCI-47B	MOV	RB309	MCC-124RG	440	RB304	AC/B
LPCI-47B	MOV	RB309	MCC-124RG	440	RB304	AC/A
LPCI-48A	MOV	RB309	MCC-114RG	440	RB304	AC/A
LPCI-48A	MOV	RB309	MCC-114RG	440	RB304	AC/A
LPCI-48B	MOV	RB309	MCC-124RG	440	RB304	AC/B
LPCI-48B	MOV	RB309	MCC-124RG	440	RB304	AC/B
LPCI-4A	MOV	RB102	MCC-114RG	440	RB304	AC/A
LPCI-4B	MOV	RB103	MCC-124RG	440	RB304	AC/B
LPCI-4C	MOV	RB102	MCC-134RH	440	RB200	AC/C
LPCI-4D	MOV	RB103	MCC-144RH	440	RB207	AC/D
LPCI-51A	NV	RB203				
LPCI-51B	NV	RB204				
LPCI-52A	MOV	RB309	MCC-114RG	440	RB304	AC/A
LPCI-52B	MOV	RB309	MCC-124RG	440	RB304	AC/B
LPCI-HXA	HX	RB203				

Table 3.3-1. Limerick 1 Emergency Core Cooling System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
LPCI-HXA	HX	RB102				
LPCI-HXB	HX	RB204				
LPCI-HXB	HX	RB103				
LPCI-PA	MDP	RB102	BUS-D11	4160	4KVD11	AC/A
LPCI-PB	MDP	RB103	BUS-D12	4160	4KVD12	AC/B
LPCI-PC	MDP	RB102	BUS-D13	4160	4KVD13	AC/C
LPCI-PD	MDP	RB103	BUS-D14	4160	4KVD14	AC/D
LPCI-SP	TANK	SP				
RCIC-124	MOV	CSTVP	MCC-114DG	440	DGA	AC/A
RCIC-125	MOV	CSTVP	MCC-124DG	440	DGB	AC/B
RCS-13E	SRV	RC	PANEL-A1	125/250	4KVD11	DC/1
RCS-13E	SRV	RC	PANEL-C1	125	4KVD13	DC/3
RCS-13H	SRV	RC	PANEL-A1	125/250	4KVD11	DC/1
RCS-13H	SRV	RC	PANEL-C1	125	4KVD13	DC/3
RCS-13K	SRV	RC	PANEL-A1	125/250	4KVD11	DC/1
RCS-13K	SRV	RC	PANEL-C1	125	4KVD13	DC/3
RCS-13M	SRV	RC	PANEL-A1	125/250	4KVD11	DC/1
RCS-13M	SRV	RC	PANEL-C1	125	4KVD13	DC/3
RCS-13S	SRV	RC	PANEL-A1	125/250	4KVD11	DC/1
RCS-13S	SRV	RC	PANEL-C1	125	4KVD13	DC/3

3.4 INSTRUMENTATION AND CONTROL (I&C) SYSTEMS

3.4.1 System Function

The instrumentation and control systems consist of the Reactor Protection System (RPS), actuation logic and controls for various Engineered Safety Features (ESF) systems, and systems for the display of plant information to the operators. The RPS and ESF actuation systems 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 shut down the reactor when plant conditions exceed one or more specified limits. The ESF actuation systems 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 plant can be placed in a safe condition in the event that the control room must be evacuated.

3.4.2 System Definition

The RPS includes sensor and transmitter units, logic units, and output trip relays that interface with the control circuits for components in the Control Rod Drive Hydraulic System (see Section 3.6). The ESF actuation systems include independent sensor and transmitter units, logic units, and relays that interface with the control circuits for the many different components that can be actuated. Operator instrumentation display systems consist of display panels that are powered by 125 VDC or 120 VAC power. The remote shutdown capability is provided by the remote shutdown panel.

3.4.3 System Operation

A. RPS

The RPS has four input instrument channels and two output actuation trains. The RPS monitors and automatically initiates a scram based on the following variables:

- Neutron monitoring system
- Reactor vessel high pressure
- Reactor vessel low water level
- Turbine stop valve closure
- Turbine control valve fast closure
- Main steam line isolation valve closure (RUN mode only)
- Scram discharge volume high water level
- Drywell high pressure
- Main steam line high radiation
- Mode switch in SHUTDOWN

In addition, the operator can manually initiate a scram.

Both output channels must be de-energized to initiate a scram. The failure of a single component or power supply does not prevent a desired scram or cause an unwanted scram.

B. ESF Actuation Systems

ESF actuation systems have up to four input instrument channels for each sensed parameter, and two output trains. In general, each train controls equipment powered from different Class 1E electrical buses. The ESF systems that can be automatically actuated include the following (not a complete listing):

- RCIC System
- Emergency Core Cooling System
  - HPCI
  - CS
  - LPCI/RHR
  - ADS
- Standby power systems
- Emergency service water system
- Various room cooling systems
  - ECCS equipment room HVAC system
  - Essential switchgear heat removal HVAC system
  - Diesel generator HVAC system
  - Main control room HVAC system

Details regarding ESF actuation logic are included in the system description for the actuated system.

C. Remote Shutdown

The plant contains a remote shutdown panel from which the systems required for safe shutdown can be monitored and controlled. Components of the RCIC system, LPCI (RHR) loop A, RHR service water loop A, and emergency service water loop A can be controlled from the remote shutdown panel. The functions required for remote shutdown control are provided with manual transfer devices that override controls from the control room and transfer them to the remote panel. Remote shutdown control is not possible without actuation of the transfer devices (Ref. 1, Section 7.4.1.4). Operation of the transfer devices causes an alarm in the control room. The transfer control panel is located outside the control room, and access is administratively and procedurally controlled. Controls available at the remote shutdown panel are listed in Table 3.4-1.

3.4.4 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 is implemented by the scram pilot valves in the control rod drive hydraulic system (see Section 3.6). Details of the RPS for Limerick have not been determined.

B. ESF Actuation Systems

A single component usually receives a signal from only one ESF output train. Trains A and B must be available in order to automatically actuate their respective components. ESF actuation systems typically use 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 ESF output channels to send an actuation signal. Note that there may be some ESF 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 ESF actuation systems for Limerick 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 other actuation 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.

3.4.5 Support Systems and Interfaces

A. Control Power
1. RPS
The RPS is powered from the 120 VAC RPS system. Backup scram valves are powered from the 125 VDC system.
2. Other actuation and control systems
The various ESF actuation systems are assumed to be powered from the 125 VDC and 120 VAC systems. Specific power sources have not been identified.
3. Operator Instrumentation
Operator instrumentation displays are powered from the 120 VAC system.

3.4.6 Section 3.4 References

1. Limerick Generating Station Final Safety Analysis Report, Philadelphia Electric Co., Philadelphia, PA.

Table 3.4-1. Controls Available on the Limerick Remote Shutdown Panel

System	Selectors	Transfer Switches	Valves	Pumps
RCIC System	-	191, 192, 193, 195	1, 2, 7, 8, 10, 12, 13 19, 22, 29, 31, 45, 46, 60, 76, 80, 84, 112	219, 220
Nuclear Boiler System	-	191	13A, 13C, 13N	-
RHR System	-	191 to 198	3A, 4A, 6A, 6B, 7A, 8, 8A, 9, 11A, 15A, 16A, 17A, 22, 23, 23A, 24A, 26A, 27A, 47A, 49, 52A, 125A,	202
RHR Service Water System	15A-2, 15C-2, 16A-2, 16C-2	93, 94	14A, 68A	6
Emergency Service Water System	-	91 to 93	5, 11A, 15A, 17A	548
Standby AC Power Supply	-	115/CS, 116/CS, 117/CS	Circuit breakers: 502/CSR, 505/CSR, 509/CSR, 602/CSR, 605/CSR, 609/CSR, 702/CSR, 705/CSR, 709/CSR	-

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 four independent 4160 and 440 VAC trains, denoted A, B, C, and D. Each AC power division has a standby diesel generator which serves as the AC power source when both the preferred and alternate sources of offsite power are unavailable.

The DC system consists of two 125/250 volt buses, denoted A and B, and two 125 volt buses, denoted C and D. The 125/250 volt buses are supplied by two 125 volt batteries and two battery chargers. The 125 volt buses are supplied by a single battery and charger.

The 120 VAC system consists of four instrument buses, supplied by the 440 VAC system through transformers, and two RPS uninterruptible power supply panels that are supplied by the 125 VDC system through inverters.

Simplified one-line diagrams of the electric power system are shown in Figures 3.5-1 to 3.5-6. 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 presented in Table 3.5-2.

3.5.3 System Operation

Each Class 1E 4160 VAC bus is provided with a preferred and alternate offsite power supply feeder and one standby diesel generator. The preferred power source for buses D11 and D13 is safeguard bus 101, fed from the 220 kV substation, with safeguard bus 201 as the alternate. The preferred power source for buses D12 and D14 is safeguard bus 201, fed from the 500 kV substation, with safeguard bus 101 as the alternate. Details of the station electric power system are shown in Figures 3.5-1 and 3.5-2.

The four standby diesel generators are started upon any of the following conditions: (a) total loss of offsite power at the 4 kV bus, (b) low reactor water level, (c) high drywell pressure coincident with low reactor pressure, or (d) manual actuation, either locally or in the control room. Diesel generators 11, 12, 13, and 14 are connected to the 4160 VAC safeguard buses D11, D12, D13, and D14, respectively. Each diesel is connected to only one bus. In turn, each 4160 VAC safeguard bus supplies power to a 440 VAC load center bus through a transformer. Details of the 4160 and 440 VAC systems are shown in Figures 3.5-3 and 3.5-4.

Instrument power is provided by four independent Class 1E 208/120 VAC buses. The instrument buses receive power from 440 VAC motor control centers (MCCs) through transformers. The 120 VAC system also consists of two RPS uninterruptible power supply panels that are supplied by the 125 VDC system through inverters.

The Class 1E DC system consists of four independent channels, two 125/250 VDC divisions (I and II), and two 125 VDC divisions (III and IV). Each 125/250 VDC system is comprised of a set of two 125 V batteries, each with its own charger, and three power distribution panels. Each 125 VDC system is comprised of one 125 V battery with its own charger and three power distribution panels. Each battery has sufficient capacity without its charger to supply its required loads for 4 hours (Ref. 1, Section 8.3). Motor control center 1DA, in division I, supplies power to RCIC system valves and 120 VAC

RPS panel A through inverter A. Motor control centers 1DB-1 and 1DB-2, in division II, supply power to HPCI system valves, and MCC 1DB-2 also supplies 120 VAC RPS panel B through inverter B. Details of the 125 VDC and 120 VAC systems are shown in Figures 3.5-5 and 3.5-6.

Control power for the 4160 VAC switchgear is provided by the associated 125 VDC channel. Control power for the 440 VAC load centers and MCCs is provided by the 120 VAC system.

Redundant safeguards equipment such as motor driven pumps and motor operated valves are supplied by different buses or MCCs. For the purpose of discussion, this equipment has been grouped into "load groups". Load group "AC/A" contains components receiving electric power either directly of indirectly from 4160 bus D11. Load group "AC/B" contains components powered either directly or indirectly from 4160 bus D12. Load group "AC/C" contains components powered either directly or indirectly from 4160 bus D13. Load group "AC/D" contains components powered either directly or indirectly from 4160 bus D14. Components receiving DC power are assigned to load groups "DC/1" to "DC/4", based on the battery source.

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 11, 12, 13, 14
   1. Continuous power rating: 2850 kW
   2. 2-hour rating: 3135 kW
   3. Rated voltage: 4160 VAC
   4. Manufacturer: Colt-Pielstick

B. Station batteries A and B
   1. Type: 120 lead-calcium cells
   2. Rated voltage: 250 VDC
   3. Rated capacity: 4 hours with design loads

C. Station batteries C and D
   1. Type: 60 lead-calcium cells
   2. Rated voltage: 125 VDC
   3. Rated capacity: 4 hours with design loads

3.5.6 Support Systems and Interfaces

A. Control Signals

1. Automatic

   The standby diesel generators are automatically started upon loss of voltage on their associated bus, low reactor water level, or high drywell pressure coincident with low reactor pressure.

2. Remote manual

   The diesel generators can be started, and many distribution circuit breakers can be operated from the main control room.

3. Local manual

   The diesel generators can be started locally.

B. Diesel Generator Auxiliary Systems

The following auxiliaries are provided for each emergency diesel generator:

- Cooling

  The emergency service water system (see Section 3.7) provides for diesel cooling.

- Fueling

  An independent day tank is provided for each diesel. Long-term fuel tanks are located underground near the diesel generator rooms.

- Lubrication

  Each diesel generator has a self-contained lubrication system.

- Starting

  An independent starting air accumulator is provided for each diesel generator.

- Control power

  Each diesel generator is dependent on 125 VDC power from a station battery for control power.

- Diesel room ventilation fans provide room cooling during diesel operation.

C. Switchgear Room Ventilation

Ventilation capabilities for the essential switchgear rooms could not be determined.

3.5.7 Section 3.5 References

1. Limerick Generating Station Final Safety Analysis Report, Philadelphia Electric Co., Philadelphia, PA.

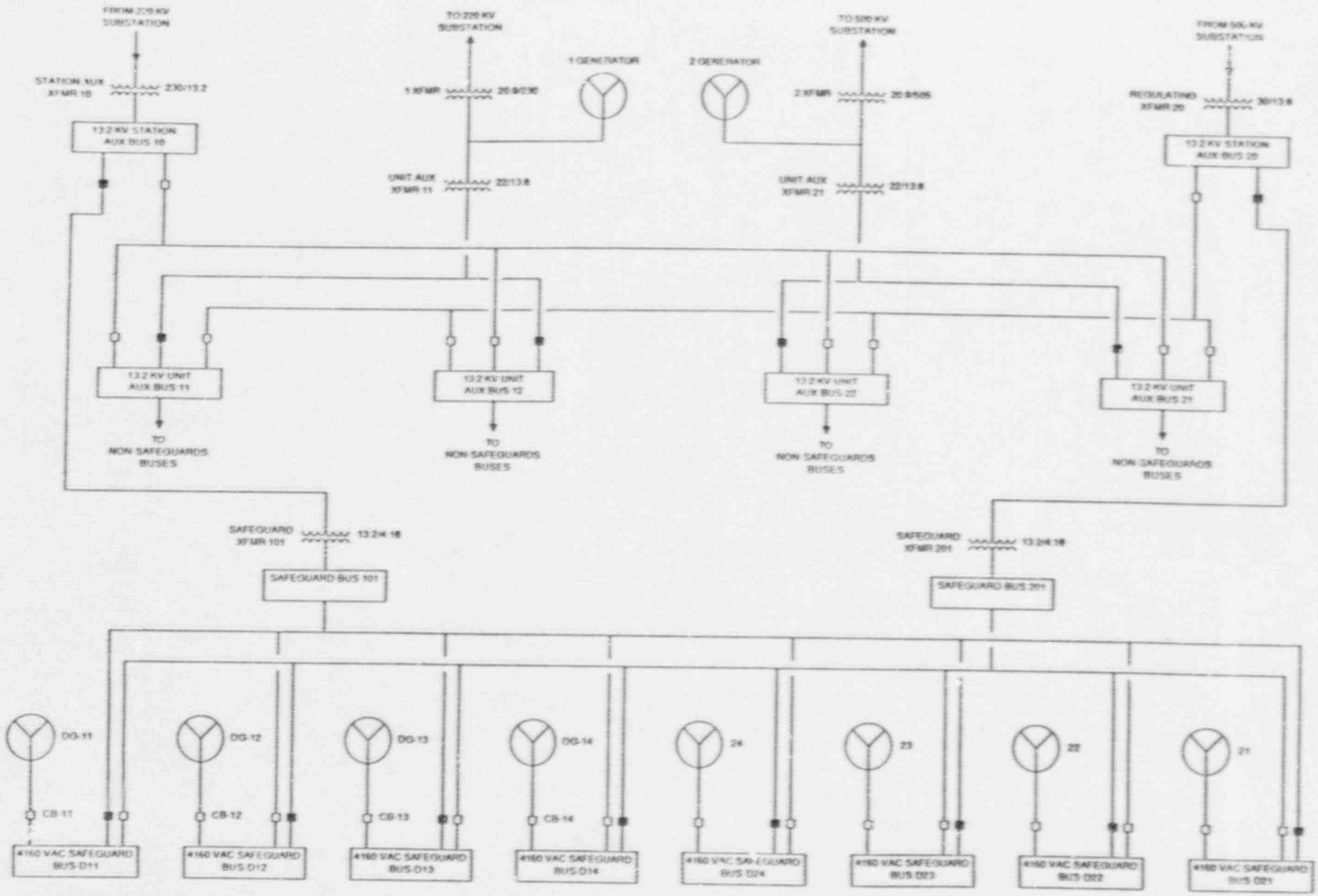


Figure 3.5-1. Limerick 1 & 2 Station Electric Power System

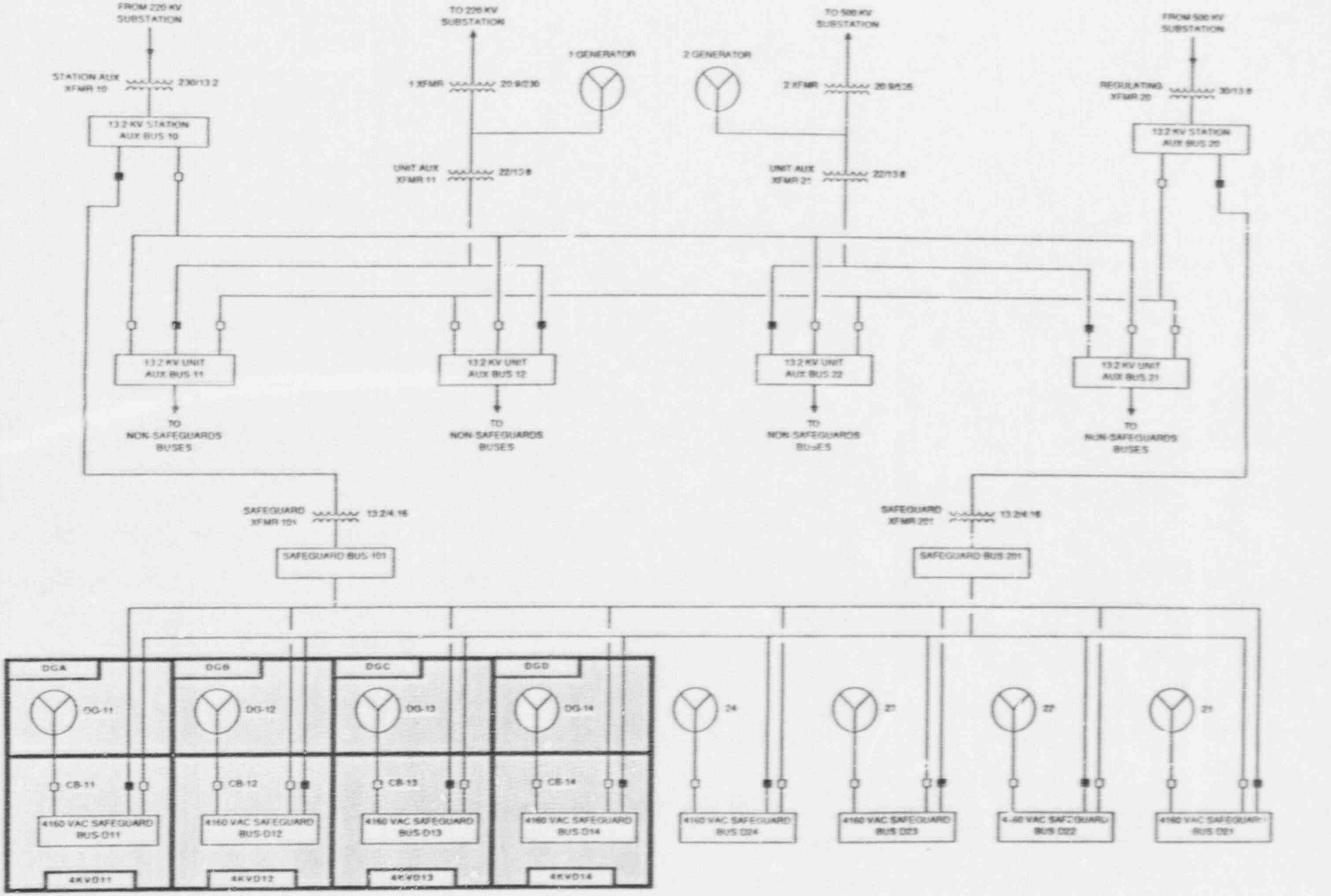


Figure 3.5-2. Limerick 1 & 2 Station Electric Power System Showing Component Locations

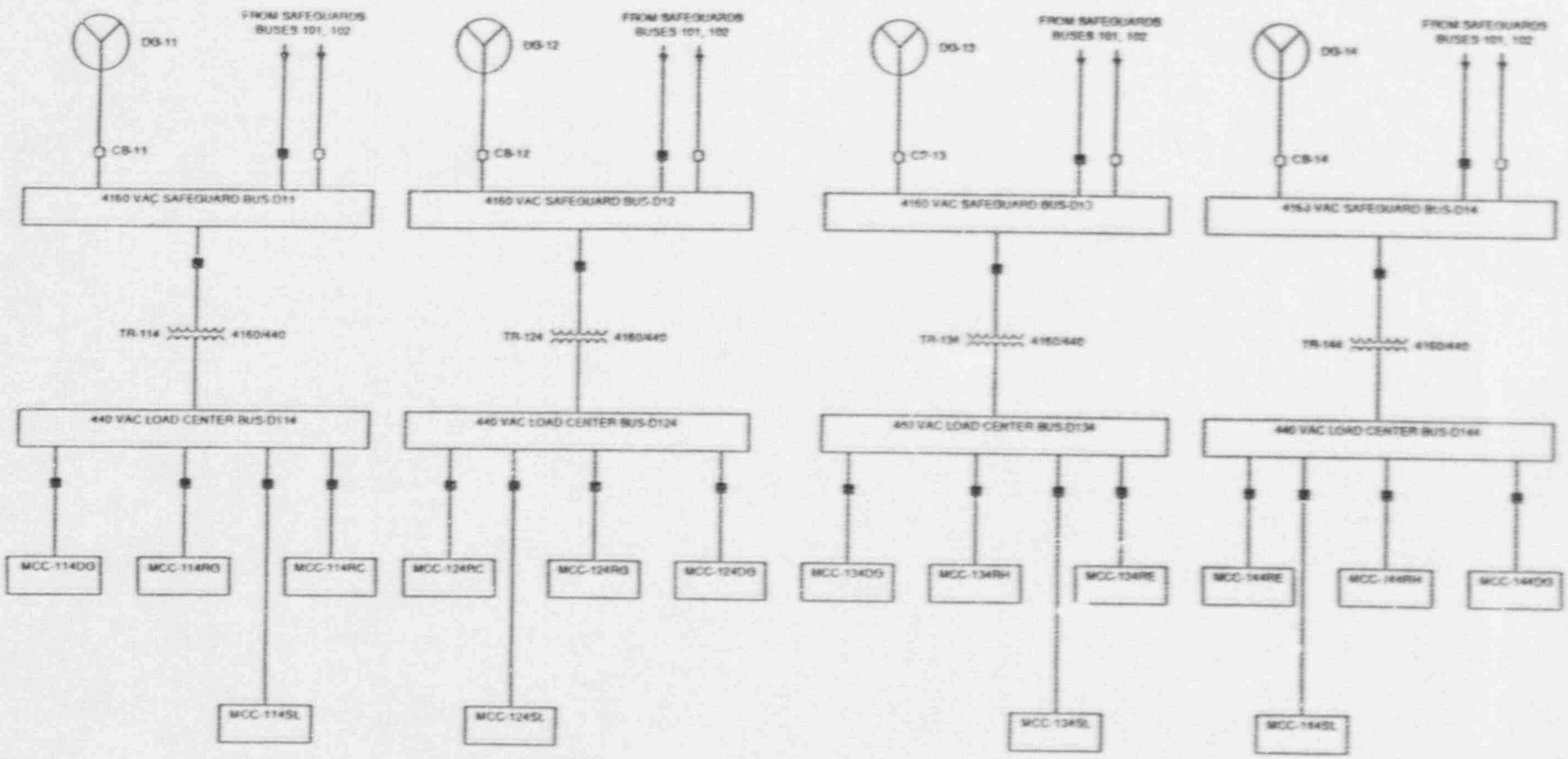
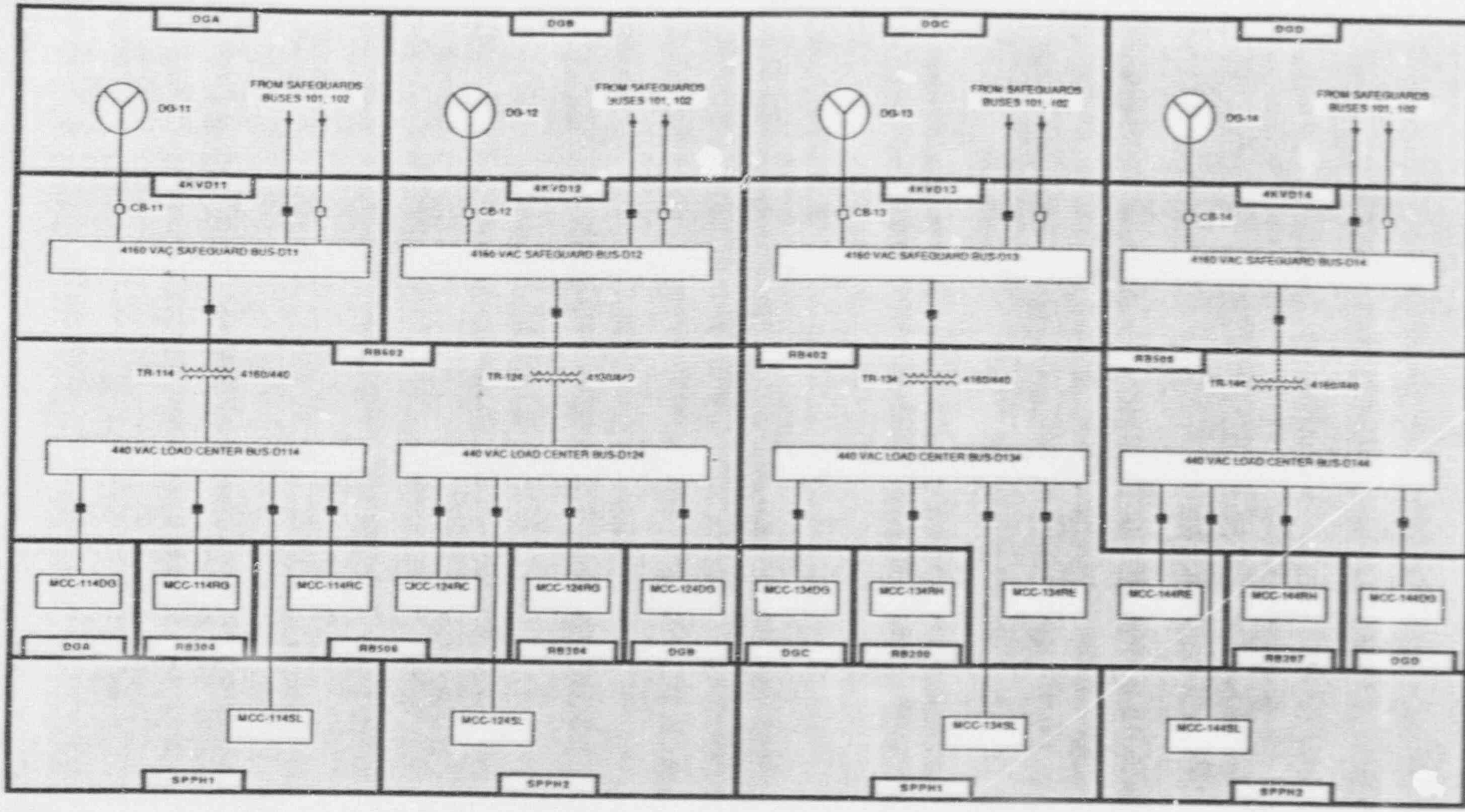


Figure 3.5-3. Limerick 1 4160 and 440 VAC Electric Power System



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-4. Limerick 1 4160 and 440 VAC Electric Power System Showing Component Locations

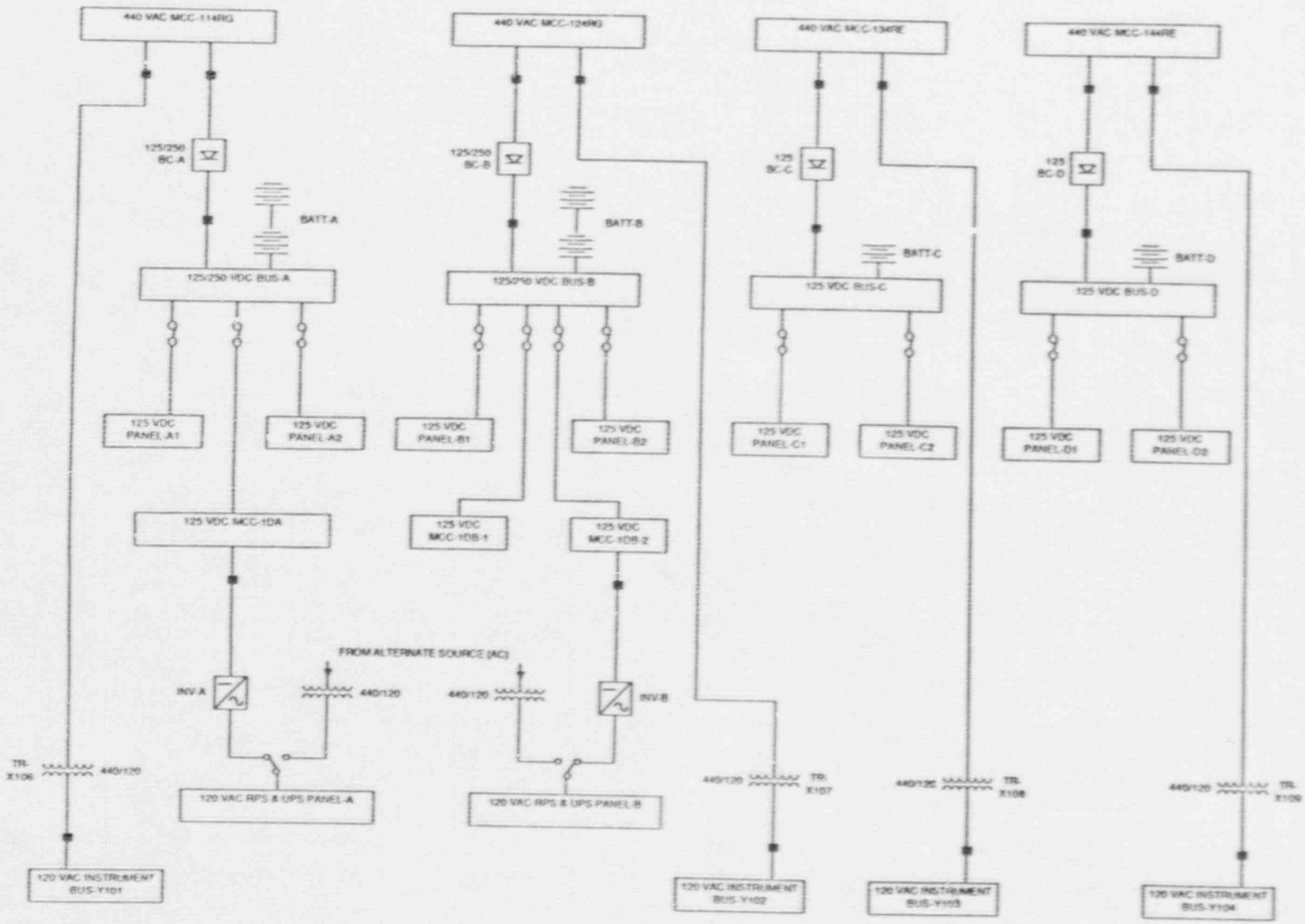


Figure 3.5-5. Limerick 1 125/250 VDC and 120 VAC Electric Power System

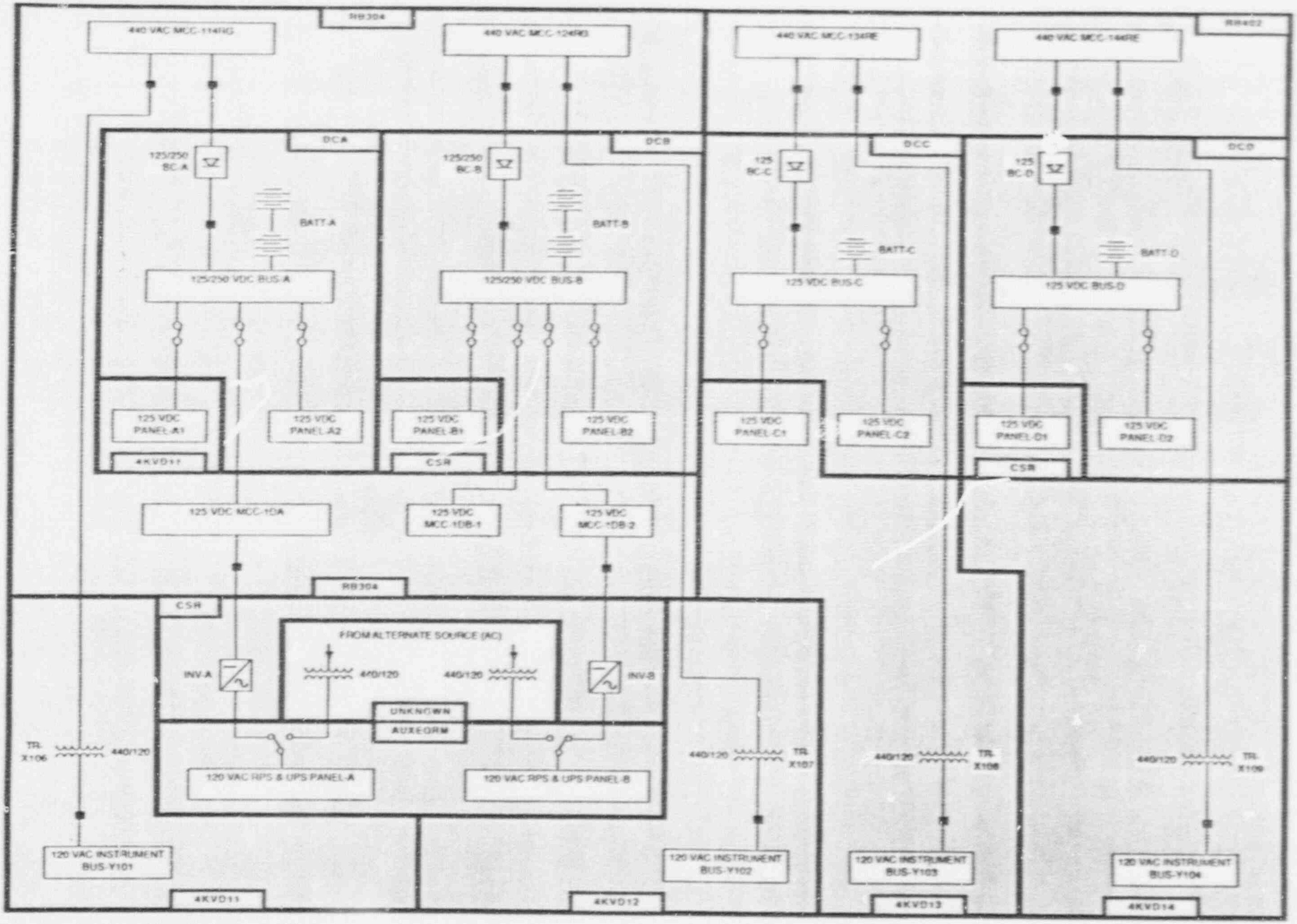


Figure 3.5-6. Limerick 1 125/250 VDC and 120 VAC Electric Power System Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
BATT-A	BATT	DCA		125/250		DC/1
BATT-B	BATT	DCB		125/250		DC/2
BATT-C	BATT	DCC		125		DC/3
BATT-D	BATT	DCD		125		DC/4
BC-A	BC	DCA	MCC-114RG	125/250	RB304	DC/1
BC-B	BC	DCB	MCC-124RG	125/250	RB304	DC/2
BC-C	BC	DCC	MCC-134RE	125	RB402	DC/3
BUS-A	BUS	DCA	BATT-A	125/250	DCA	DC/1
BUS-A	BUS	DCA	BC-A	125/250	DCA	DC/1
BUS-B	BUS	DCB	BATT-B	125/250	DCB	DC/2
BUS-B	BUS	DCB	BC-B	125/250	DCB	DC/2
BUS-C	BUS	DCC	BATT-C	125	DCC	DC/3
BUS-C	BUS	DCC	BC-C	125	DCC	DC/3
BUS-D	BUS	DCD	BATT-D	125	DCD	DC/4
BUS-D	BUS	DCD	BC-D	125	DCD	DC/4
BUS-D11	BUS	4KVD11	DG-11	4160	DGA	AC/A
BUS-D114	BUS	RB602	TR-114	440	RB602	AC/A
BUS-D12	BUS	4KVD12	DG-12	4160	DGB	AC/B
BUS-D124	BUS	RB602	TR-124	440	RB602	AC/B
BUS-D13	BUS	4KVD13	DG-13	4160	DGC	AC/C
BUS-D134	BUS	RB402	TR-134	440	RB402	AC/C
BUS-D14	BUS	4KVD14	DG-14	4160	DGD	AC/D
BUS-D144	BUS	RB506	TR-144	440	RB506	AC/D
BUS-Y101	BUS	4KVD11	TRAN-X106	120	4KVD11	AC/A
BUS-Y102	BUS	4KVD12	TRAN-X107	120	4KVD12	AC/B
BUS-Y103	BUS	4KVD13	TRAN-X108	120	4KVD13	AC/C
BUS-Y104	BUS	4KVD14	TRAN-X109	120	4KVD14	AC/D

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CB-11	CB	4KVD11	DG-11	4160	DGA	AC/A
CB-12	CB	4KVD12	DG-12	4160	DGB	AC/B
CB-13	CB	4KVD13	DG-13	4160	DGC	AC/C
CB-14	CB	4KVD14	DG-14	4160	DGD	AC/D
DG-11	DG	DGA		4160		AC/A
DG-12	DG	DGB		4160		AC/B
DG-13	DG	DGC		4160		AC/C
DG-14	DG	DGD		4160		AC/D
MCC-114DG	MCC	DGA	BUS-D114	440	RB602	AC/A
MCC-114RC	MCC	RB506	BUS-D114	440	RB602	AC/A
MCC-114RG	MCC	RB304	BUS-D114	440	RB602	AC/A
MCC-114SL	MCC	SPPH1	BUS-D114	440	RB602	AC/A
MCC-124DG	MCC	DGB	BUS-D124	440	RB602	AC/B
MCC-124RC	MCC	RB506	BUS-D124	440	RB602	AC/B
MCC-124RG	MCC	RB304	BUS-D124	440	RB602	AC/B
MCC-124SL	MCC	SPPH2	BUS-D124	440	RB602	AC/B
MCC-134DG	MCC	DGC	BUS-D134	440	RB402	AC/C
MCC-134RE	MCC	RB402	BUS-D134	440	RB402	AC/C
MCC-134RH	MCC	RB200	BUS-D134	440	RB402	AC/C
MCC-134SL	MCC	SPPH1	BUS-D134	440	RB402	AC/C
MCC-144DG	MCC	DGD	BUS-D144	440	RB506	AC/D
MCC-144RE	MCC	RB402	BUS-D144	440	RB506	AC/D
MCC-144RH	MCC	RB207	BUS-D144	440	RB506	AC/D
MCC-144SL	MCC	SPPH2	BUS-D144	440	RB506	AC/D
MCC-1DA	MCC	RB304	BUS-A	125/250	DCA	DC/1
MCC-1DB-2	MCC	RB304	BUS-B	125/250	DCB	DC/2
PANEL-A1	PNL	4KVD11	BUS-A	125/250	DCA	DC/1

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
PANEL-B1	PNL	CSR	BUS-B	125/250	DCB	DC/2
PANEL-C1	PNL	4KVD13	BUS-C	125	DCC	DC/3
TR-114	TRAN	RB602	BUS-D11	440	4KVD11	AC/A
TR-124	TRAN	RB602	BUS-D12	440	4KVD12	AC/B
TR-134	TRAN	RB402	BUS-D13	440	4KVD13	AC/C
TR-144	TRAN	RB506	BUS-D14	440	4KVD14	AC/D
TR-X106	TRAN	4KVD11	MCC-114RG	120	RB304	AC/A
TR-X107	TRAN	4KVD12	MCC-124RG	120	RB304	AC/B
TR-X108	TRAN	4KVD13	MCC-134RE	120	RB402	AC/C
TR-X109	TRAN	4KVD14	MCC-144RE	120	RB402	AC/D

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Limerick 1

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BATT-A	125/250	DC/1	DCA	EP	BUS-A	BUS	DCA
BATT-B	125/250	DC/2	DCB	EP	BUS-B	BUS	DCB
BATT-C	125	DC/3	DCC	EP	BUS-C	BUS	DCC
BATT-D	125	DC/4	DCD	EP	BUS-D	BUS	DCD
BC-A	[illegible]5/250	DC/1	DCA	EP	BUS-A	BUS	DCA
BC-B	[illegible]	DC/2	DCB	EP	BUS-B	BUS	DCB
BC-C	125	DC/3	DCC	EP	BUS-C	BUS	DCC
BC-D	125	DC/4	DCD	EP	BUS-D	BUS	DCD
BUS-A	125/250	DC/1	DCA	EP	MCC-1DA	MCC	RB304
BUS-A	125/250	DC/1	DCA	EP	PANEL-A1	PNL	4KVD11
BUS-B	125/250	[illegible]	[illegible]	EP	MCC-1DB	MCC	RB304
BUS-B	125/250	DC/2	D[illegible]	EP	PANEL-B1	PNL	CSR
BUS-C	125	DC/3	DC[illegible]	EP	PANEL-C1	PNL	4KVD13
BUS-D11	4160	AC/A	4KVD11	ECCS	CS-PA	MDP	CSA
BUS-D11	4160	AC/A	4KVD11	ECCS	LPCI-PA	MDP	RB102
BUS-D11	440	AC/A	4KVD11	EP	TR-114	TRAN	RB602
BUS-D11	4160	AC/A	4KVD11	ESW	ESW-PA	MDP	SPPH1
BUS-D11	4160	AC/A	4KVD11	RHRSW	RSW-PA	MDP	SPPH1
BUS-D114	440	AC/A	RB6[illegible]	EP	MCC-114DG	MCC	DGA
BUS-D114	440	AC/A	RB[illegible]02	EP	MCC-114RC	MCC	RB506
BUS-D114	440	AC/A	RB60[illegible]	EP	MCC-114RG	MCC	RB304
BUS-D114	440	AC/A	RB602	EP	MCC-114SL	MCC	SPPH1
BUS-D12	4160	AC/B	4KVD12	ECCS	CS-PB	MDP	CSB
BUS-D12	4160	AC/B	4KVD12	ECCS	LPCI-PB	MDP	RB103
BUS-D12	440	AC/B	4KVD12	EP	TR-124	TRAN	RB602
BUS-D12	4160	AC/B	4KVD12	ESW	ESW-PB	MDP	SPPH2
BUS-D12	4160	AC/B	4KVD12	RHRSW	RSW-PB	MDP	SPPH2
BUS-D124	440	AC/B	RB602	EP	MCC-124DG	MCC	[illegible]
BUS-D124	440	AC/B	RB602	EP	MCC-124RC	MCC	RB50[illegible]
BUS-D124	440	AC/B	RB602	EP	MCC-124RG	MCC	RB304
BUS-D124	440	AC/B	RB602	EP	MCC-124SL	MCC	SPPH2

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Limerick 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS-D13	4160	AC/C	4KVD13	ECCS	CS-PC	MDP	CSC
BUS-D13	4160	AC/C	4KVD13	ECCS	LPCI-PC	MDP	RB102
BUS-D13	440	AC/C	4KVD13	EP	TR-134	TRAN	RB402
BUS-D13	4160	AC/C	4KVD13	ESW	ESW-PC	MDP	SPPH1
BUS-D134	440	AC/C	RB402	EP	MCC-134DG	MCC	DGC
BUS-D134	440	AC/C	RB402	EP	MCC-134RE	MCC	RB402
BUS-D134	440	AC/C	RB402	EP	MCC-134RH	MCC	RB200
BUS-D134	440	AC/C	RB402	EP	MCC-134SL	MCC	SPPH1
BUS-D14	4160	AC/D	4KVD14	ECCS	CS-PD	MDP	CSD
BUS-D14	4160	AC/D	4KVD14	ECCS	LPCI-PD	MDP	RB103
BUS-D14	440	AC/D	4KVD14	EP	TR-144	TRAN	RB506
BUS-D14	4160	AC/D	4KVD14	ESW	ESW-PD	MDP	SPPH2
BUS-D144	440	AC/D	RB506	EP	MCC-144DG	MCC	DGD
BUS-D144	440	AC/D	RB506	EP	MCC-144RE	MCC	RB402
BUS-D144	440	AC/D	RB506	EP	MCC-144RH	MCC	RB207
BUS-D144	440	AC/D	RB506	EP	MCC-144SL	MCC	SPPH2
DG-11	4160	AC/A	DGA	EP	BUS-D11	BUS	4KVD11
DG-11	4160	AC/A	DGA	EP	CB-11	CB	4KVD11
DG-12	4160	AC/B	DGB	EP	BUS-D12	BUS	4KVD12
DG-12	4160	AC/B	DGB	EP	CB-12	CB	4KVD12
DG-13	4160	AC/C	DGC	EP	BUS-D13	BUS	4KVD13
DG-13	4160	AC/C	DGC	EP	CB-13	CB	4KVD13
DG-14	4160	AC/D	DGD	EP	BUS-D14	BUS	4KVD14
DG-14	4160	AC/D	DGD	EP	CB-14	CB	4KVD14
MCC-114DG	440	AC/A	DGA	ECCS	RCIC-124	MOV	CSTVP
MCC-114DG	440	AC/A	DGA	ESW	ESW-11A	MOV	RB202
MCC-114DG	440	AC/A	DGA	ESW	ESW-131A	MOV	DGA
MCC-114DG	440	AC/A	DGA	ESW	ESW-132A	MOV	DGA
MCC-114DG	440	AC/A	DGA	ESW	ESW-133A	MOV	DGA
MCC-114DG	440	AC/A	DGA	ESW	ESW-134A	MOV	DGA
MCC-114DG	440	AC/A	DGA	RCIC	RCIC-124	MOV	CSTVP

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Limerick 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-114RC	440	AC/A	RB506	ECCS	CS-4A	MOV	ACSVRM
MCC-114RC	440	AC/A	RB506	ECCS	CS-5	MOV	ACSVRM
MCC-114RC	440	AC/A	RB506	ECCS	FW-11A	MOV	RC
MCC-114RC	440	AC/A	RB506	ECCS	LPCI-16A	MOV	RB501
MCC-114RC	440	AC/A	RB506	ECCS	LPCI-16A	MOV	RB501
MCC-114RC	440	AC/A	RB506	ECCS	LPCI-17A	MOV	RB510
MCC-114RC	440	AC/A	RB506	ECCS	LPCI-21A	MOV	RB501
MCC-114RC	440	AC/A	RB506	ECCS	LPCI-21A	MOV	RB501
MCC-114RG	440	AC/A	RB304	ECCS	CS-15A	MOV	RB304
MCC-114RG	440	AC/A	RB304	ECCS	CS-1A	MOV	CSA
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-125A	MOV	RB304
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-125A	MOV	RB304
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-182A	MOV	RB309
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-24A	MOV	RB304
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-24A	MOV	RB304
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-27A	MOV	RB304
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-27A	MOV	RB304
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-3A	MOV	RB203
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-47A	MOV	RB309
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-47A	MOV	RB309
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-48A	MOV	RB309
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-48A	MOV	RB309
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-4A	MOV	RB102
MCC-114RG	440	AC/A	RB304	ECCS	LPCI-52A	MOV	RB309
MCC-114RG	125/250	DC/1	RB304	EP	BC-A	BC	DCA
MCC-114RG	120	AC/A	RB304	EP	TR-X106	TRAN	4KVD11
MCC-114RG	440	AC/A	RB304	RCS	RCS-1	MOV	RC
MCC-114RG	440	AC/A	RB304	RCS	RCS-16	MOV	RC
MCC-114RG	440	AC/A	RB304	RCS	RCS-9	MOV	RC
MCC-114RG	40	AC/A	RB304	RHRSW	RSW-14A	MOV	RB102
MCC-114SL	440	AC/A	SPPH1	ESW	RSW-31A	MOV	SPPH1

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Limerick 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-114SL	440	AC/A	SPPH1	ESW	RSW-32A	MOV	SPPH1
MCC-114SL	440	AC/A	SPPH1	RHRSW	RSW-31A	MOV	SPPH1
MCC-114SL	440	AC/A	SPPH1	RHRSW	RSW-32[illegible]	MOV	SPPH1
MCC-124DG	440	AC/B	DGB	ECCS	RCIC-125	MOV	CSTVP
MCC-124DG	440	AC/B	DGB	ESW	ESW-11B	MOV	RB202
MCC-124DG	440	AC/B	DGB	ESW	ESW-131B	MO[illegible]	DGB
MCC-124DG	440	AC/B	DGB	ESW	ESW-132B	MOV	DGB
MCC-124DG	440	AC/B	DGB	ESW	ESW-133B	MOV	DGB
MCC-124DG	440	AC/B	DGB	ESW	ESW-134B	MOV	DGB
MCC-124DG	440	AC/B	DGB	RCIC	RCIC-125	MOV	CSTVP
MCC-124RC	440	AC/B	RB506	ECCS	CS-37	MOV	BCSVRM
MCC-124RC	440	AC/B	RB506	ECCS	CS-4B	MOV	BCSVRM
MCC-124RC	440	AC/B	RB506	ECCS	LPCI-16B	MOV	BCSVRM
MCC-124RC	440	AC/B	RB5[illegible]6	ECCS	LPCI-16B	MOV	BCSVRM
MCC-124RC	440	AC/B	RB506	ECCS	LPCI-17B	MOV	RB599
MCC-124RC	440	AC/B	RB506	ECCS	LPCI-21B	MOV	BCSVRM
MCC-124RC	440	AC/B	RB506	ECCS	LPCI-21B	MOV	BCS[illegible]M
MCC-124RG	440	AC/B	RB304	ECCS	CS-15B	MOV	RB304
MCC-124RG	440	AC/B	RB304	ECCS	CS-1B	MOV	CSB
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-125B	MOV	RB304
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-125B	MOV	RB304
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-15A	MOV	RB309
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-15B	MOV	RB309
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-182B	MOV	RB309
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-24B	MOV	RB304
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-24B	MOV	RB304
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-27B	MOV	RB304
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-27B	MOV	RB304
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-3B	MOV	RB204
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-4[illegible]B	MOV	RB309
MCC-124RG	440	AC/A	RB304	ECCS	LPCI-47B	MOV	RB309

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Limerick 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-48B	MOV	RB309
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-48B	MOV	RB309
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-4B	MOV	RB103
MCC-124RG	440	AC/B	RB304	ECCS	LPCI-52B	MOV	RB309
MCC-124RG	125/250	DC/2	RB304	EP	BC-B	BC	DCB
MCC-124RG	120	AC/B	RB304	EP	TR-X107	TRAN	4KVD12
MCC-124RG	440	AC/B	RB304	RCS	RCS-4	MOV	RB522
MCC-124RG	440	AC/B	RB304	RHRSW	RSW-14B	MOV	RB103
MCC-124SL	440	AC/B	SPPH2	ESW	RSW-31B	MOV	SPPH2
MCC-124SL	440	AC/B	SPPH2	ESW	RSW-32B	MOV	SPPH2
MCC-124SL	440	AC/B	SPPH2	RHRSW	RSW-31B	MOV	SPPH2
MCC-124SL	440	AC/B	SPPH2	RHRSW	RSW-32B	MOV	SPPH2
MCC-134DG	440	AC/C	DGC	ESW	ESW-131C	MOV	DGC
MCC-134DG	440	AC/C	DGC	ESW	ESW-132C	MOV	DGC
MCC-134DG	440	AC/C	DGC	ESW	ESW-133C	MOV	DGC
MCC-134DG	440	AC/C	DGC	ESW	ESW-134C	MOV	DGC
MCC-134DG	440	AC/C	DGC	ESW	ESW-15A	MOV	RB202
MCC-134RC	440	AC/C	RB402	RCIC	FW-11B	MOV	RC
MCC-134RE	440	AC/C	RB402	ECCS	LPCI-17C	MOV	RB510
MCC-134RE	440	AC/C	RB402	ECCS	LPCI-17C	MOV	RB510
MCC-134RE	125	DC/3	RB402	EP	BC-C	BC	DCC
MCC-134RE	120	AC/C	RB402	EP	TR-X108	TRAN	4KVD13
MCC-134RE	440	AC/C	RB402	RCIC	RCIC-7	MOV	RC
MCC-134RE	440	AC/C	RB402	RCS	RCIC-7	MOV	RC
MCC-134RH	440	AC/C	RB200	ECCS	CS-1C	MOV	CSC
MCC-134RH	440	AC/C	RB200	ECCS	LPCI-10A	MOV	RB304
MCC-134RH	440	AC/C	RB200	ECCS	LPCI-4C	MOV	RB102
MCC-134RH	440	AC/C	RB200	RHRSW	RSW-68A	MOV	RB102
MCC-134SL	440	AC/C	SPPH1	ESW	RSW-31C	MOV	SPPH1
MCC-134SL	440	AC/C	SPPH1	ESW	RSW-32C	MOV	SPPH1
MCC-134SL	440	AC/C	SPPH1	RHRSW	RSW-31C	MOV	SPPH1

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Limerick 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-134SL	440	AC/C	SPPH1	RHRSW	RSW-32C	MOV	SPPH1
MCC-144DG	440	AC/D	DGD	ESW	ESW-131D	MOV	DGD
MCC-144DG	440	AC/D	DGD	ESW	ESW-132D	MOV	DGD
MCC-144DG	440	AC/D	DGD	ESW	ESW-133D	MOV	DGD
MCC-144DG	440	AC/D	DGD	ESW	ESW-134D	MOV	DGD
MCC-144DG	440	AC/D	DGD	ESW	ESW-15B	MOV	RB202
MCC-144RE	440	AC/D	RB402	ECCS	HPI-2	MOV	RC
MCC-144RE	440	AC/D	RB402	ECCS	LPCI-17D	MOV	RB599
MCC-144RE	440	AC/D	RB402	ECCS	LPCI-17D	MOV	RB599
MCC-144RE	120	AC/D	RB402	EP	TR-X109	TRAN	4KVD14
MCC-144RE	440	AC/D	RB402	RCS	HPI-2	MOV	RC
MCC-144RH	440	AC/D	RB207	ECCS	CS-1D	MOV	CSD
MCC-144RH	440	AC/D	RB207	ECCS	LPCI-10B	MOV	RB304
MCC-144RH	440	AC/D	RB207	ECCS	LPCI-4D	MOV	RB103
MCC-144RH	440	AC/D	RB207	RHRSW	RSW-68B	MOV	RB103
MCC-144SL	440	AC/D	SPPH2	ESW	RSW-31D	MOV	SPPH2
MCC-144SL	440	AC/D	SPPH2	ESW	RSW-32D	MOV	SPPH2
MCC-144SL	440	AC/D	SPPH2	RHRSW	RSW-31D	MOV	SPPH2
MCC-144SL	440	AC/D	SPPH2	RHRSW	RSW-32D	MOV	SPPH2
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-10	MOV	RCIC
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-112	MOV	RCIC
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-12	MOV	RB200
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-13	MOV	STMTNL
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-19	MOV	RCIC
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-22	MOV	RB200
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-29	MOV	RCIC
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-31	MOV	RCIC
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-45	MOV	RCIC
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-46	MOV	RCIC
MCC-1DA	125/250	DC/1	RB304	RCIC	RCIC-60	MOV	RCIC
MCC-1DB-1	125/250	DC/2	RB304	ECCS	HPI-1	MOV	HPIC

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Limerick 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-1DB-1	125/250	DC/2	RB304	ECCS	HPI-105	MOV	STMTNL
MCC-1DB-1	125/250	DC/2	RB304	ECCS	HPI-12	MOV	HPIC
MCC-1DB-1	125/250	DC/2	RB304	ECCS	HPI-4	MOV	HPIC
MCC-1DB-1	125/250	DC/2	RB304	ECCS	HPI-41	MOV	HPIC
MCC-1DB-1	125/250	DC/2	RB304	ECCS	HPI-42	MOV	HPIC
MCC-1DB-1	125/250	DC/2	RB304	ECCS	HPI-59	MOV	HPIC
MCC-1DB-1	125/250	DC/2	RB304	ECCS	HPI-72	MOV	HPIC
MCC-1DB-2	125/250	DC/2	RB304	ECCS	HPI-11	MOV	RB200
MCC-1DB-2	125/250	DC/2	RB304	ECCS	HPI-6	MOV	BCSVRM
MCC-1DB-2	125/250	DC/2	RB304	ECCS	HPI-7	MOV	RB200
MCC-1DB-2	125/250	DC/2	RB304	ECCS	HPI-8	MOV	RB200
PANEL-A1	125/250	DC/1	4KVD11	ECCS	RCS-13E	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	ECCS	RCS-13H	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	ECCS	RCS-13K	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	ECCS	RCS-13M	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	ECCS	RCS-13S	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	RCS	RCS-13E	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	RCS	RCS-13H	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	RCS	RCS-13K	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	RCS	RCS-13M	SRV	RC
PANEL-A1	125/250	DC/1	4KVD11	RCS	RCS-13S	SRV	RC
PANEL-C1	125	DC/3	4KVD13	ECCS	RCS-13E	SRV	RC
PANEL-C1	125	DC/3	4KVD13	ECCS	RCS-13H	SRV	RC
PANEL-C1	125	DC/3	4KVD13	ECCS	RCS-13K	SRV	RC
PANEL-C1	125	DC/3	4KVD13	ECCS	RCS-13M	SRV	RC
PANEL-C1	125	DC/3	4KVD13	ECCS	RCS-13S	SRV	RC
PANEL-C1	125	DC/3	4KVD13	RCS	RCS-13E	SRV	RC
PANEL-C1	125	DC/3	4KVD13	RCS	RCS-13H	SRV	RC
PANEL-C1	125	DC/3	4KVD13	RCS	RCS-13K	SRV	RC
PANEL-C1	125	DC/3	4KVD13	RCS	RCS-13M	SRV	RC
PANEL-C1	125	DC/3	4KVD13	RCS	RCS-13S	SRV	RC

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Limerick 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
TR-114	440	AC/A	RB602	EP	BUS-D114	BUS	RB602
TR-124	440	AC/B	RB602	EP	BUS-D124	BUS	RB602
TR-134	440	AC/C	RB402	EP	BUS-D134	BUS	RB402
TR-144	440	AC/D	RB506	EP	BUS-D144	BUS	RB506
TRAN-X106	120	AC/A	4KVD11	EP	BUS-Y101	BUS	4KVD11
TRAN-X107	120	AC/B	4KVD12	EP	BUS-Y102	BUS	4KVD12
TRAN-X108	120	AC/C	4KVD13	EP	BUS-Y103	BUS	4KVD13
TRAN-X109	120	AC/D	4KVD14	EP	BUS-Y104	BUS	4KVD14
UNKNOWN			RB304	ECCS	HPI-3	MOV	RB309
UNKNOWN			RB304	RCIC	RCIC-8	MOV	RB309
UNKNOWN			RB304	RCS	HPI-3	MOV	RB309
UNKNOWN			RB304	RCS	RCIC-8	MOV	RB309
UNKNOWN			RB304	RCS	RCS-19	MOV	STMTNL
UNKNOWN			RB304	RCS	RCS-8	MOV	RB309

3.6 CONTROL ROD DRIVE HYDRAULIC SYSTEM (CRDHS)

3.6.1 System Function

The CRDHS supplies pressurized water to operate and cool the control rod drive mechanisms during normal operation. This system implements a scram command from the reactor protection system (RPS) and drives control rods rapidly into the reactor. The CRDHS also can provide makeup water to the RCS.

3.6.2 System Definition

The CRDHS consists of two high-head, low-flow CRD supply pumps, piping, filters, control valves, one hydraulic control unit for each control rod drive mechanism, and instrumentation. Water is supplied from the condensate treatment system or the condensate storage tanks. The CRDHS also includes scram valves, scram accumulators, and a scram discharge volume.

Details of the scram portion of a typical BWR CRDHS is shown in Figure 3.6-1.

3.6.3 System Operation

During normal operation the CRDHS pumps provide a constant flow for drive mechanism cooling and system pressure stabilization. Excess water not used for cooling is discharged to the RCS. Control rods are driven in or out by the coordinated operation of the direction control valves. Insertion speed is controlled by flow through the insert speed control valve. Rod motion may be either stepped or continuous.

A reactor scram is implemented by pneumatic scram valves in the CRDHS. An inlet scram valve opens to align the insert side of each control rod drive mechanism (CRDM) to the scram accumulator. An outlet scram valve opens to vent the opposite side of each CRDM to the scram discharge volume. This coordinated action results in rapid insertion of control rods into the reactor.

The control rod drive accumulators are necessary to scram the control rods within the required time. It should be noted that each drive has an internal ball check valve which allows reactor pressure to be admitted under the drive piston. If reactor pressure exceeds the supply pressure at the drive, the ball check valve ensures rod insertion in the event that the scram accumulator is not charged or the inlet scram valve fails to open. The insertion time, however, will be slower than the scram time with a properly functioning scram system.

Although not intended as a makeup system, the CRDHS can provide a source of cooling water to the RCS during vessel isolation. In BWR/4 plants, RCS makeup at high pressure is performed by the RCIC (see Section 3.2) and HPCI (see Section 3.3) systems. The maximum RCS makeup rate of the CRDHS is about 200 gpm with both pumps operating (Ref. 1).

3.6.4 System Success Criteria

For the scram function to be accomplished, the following actions must occur in the CRDHS:

- A scram signal must be transmitted by the RPS to the actuated devices (i.e., pilot valves) in the CRDHS.
- The pneumatic inlet scram valve and outlet scram valve must open in the hydraulic control units (HCUs) for the individual control rod drives. This is accomplished by venting the instrument air supply to each valve as follows:
  - Both scram pilot valves in each HCU must be deenergized, or
  - Either backup scram pilot valve must be energized.

- A high-pressure water source must be available from the scram accumulator in each HCU.
- A hydraulic vent path to the scram discharge volume must be available and sufficient collection volume must exist in the scram discharge volume.
- A specified number of control rods must responds and insert into the reactor core (specific number needed is not known).

3.6.5 Component Information

A. Control rod drive pumps (2)
  1. Rated capacity: 100% (for control rod drive function)
  2. Type: centrifugal

B. Condensate Storage Tank
  1. Capacity: 400,000 gal

C. Scram Accumulator
  1. Normal pressure: 1450 to 1510 psig

D. Scram Discharge Volume
  1. Normal pressure: Atmospheric

3.6.6 Support Systems and Interfaces

A. Control Signals
  1. Automatic
     The RPS transmits scram commands to solenoid pilot valves which control the pneumatic scram valves
  2. Remote Manual
     a. A reactor scram can be initiated manually from the control room
     b. The CRDHS can be operated manually from the control room to insert and withdraw rods, or to inject water into the RCS

B. Motive Power
  1. The control rod drive pumps are Class 1E AC loads that can be supplied from the emergency diesel generator as described in Section 3.5.

3.6.7 Section 3.6 References

1. Harrington, R.M., and Ott, L.J., "The Effect of Small-Capacity, High-Pressure Injection Systems on TQUV Sequences at Browns Ferry Unit One," NUREG/CR-3179, Oak Ridge National Laboratory, September 1983.

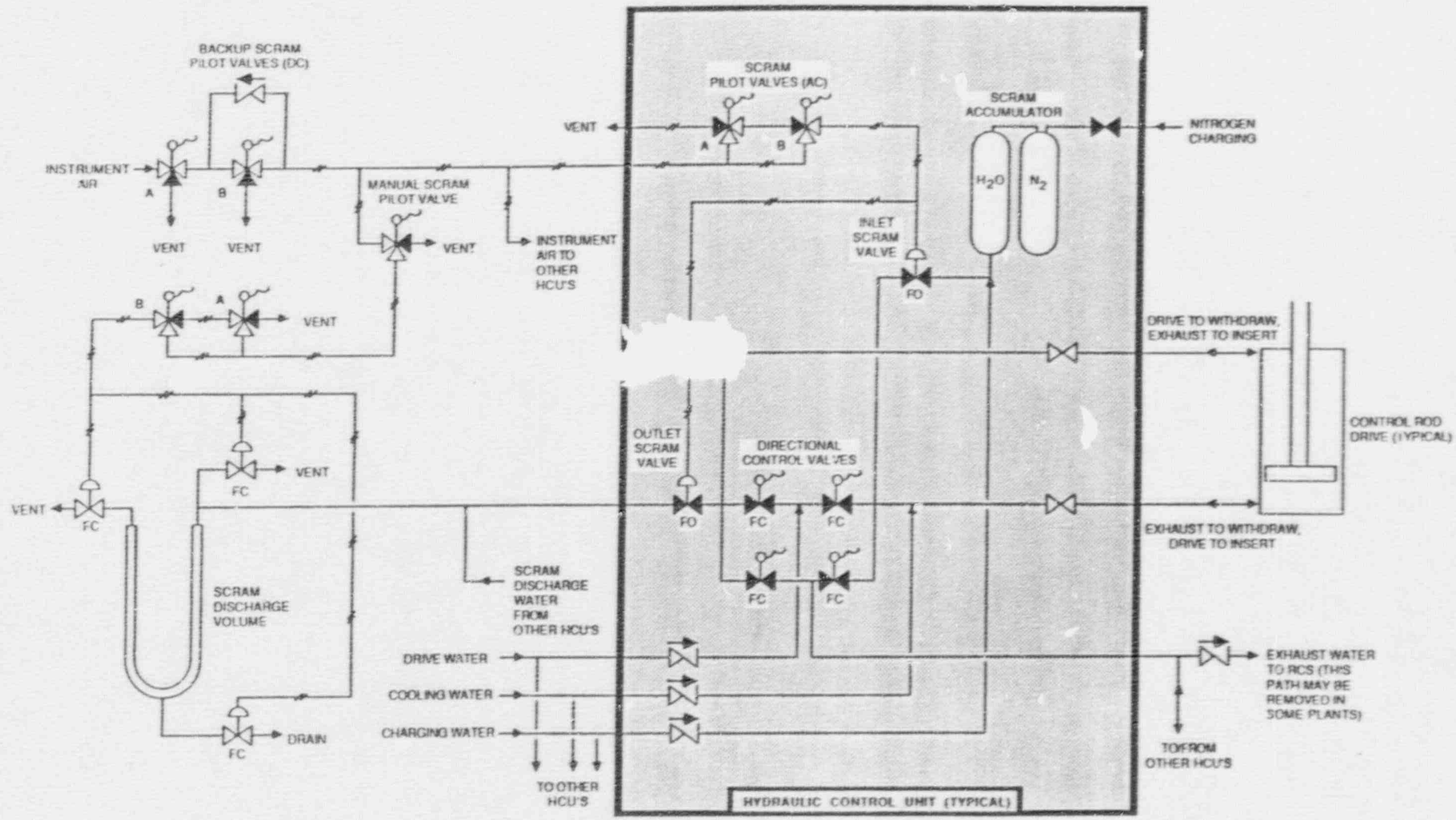


Figure 3.6-1. Simplified Diagram Of Portions Of The Control Rod Drive Hydraulic System That Are Related To The Scram Function

3.7 EMERGENCY SERVICE WATER (ESW) SYSTEM

3.7.1 System Function

The Emergency Service Water System provides cooling water to essential equipment during a loss of offsite power condition or loss of coolant accident. The ESW system cools the diesel generators, the RCIC and ECCS pump room coolers, the RHR pump motor oil and seal coolers, and the control room chillers. It can also provide makeup water to the spent fuel pool.

3.7.2 System Definition

The ESW system consists of two independent loops (A and B), with two 50% capacity pumps per loop. There are no crossties between the two loops, but both loops can cool all four diesel generators. The ESW pumps take suction from the spray pond, and discharge into the RHR service water return header back to the spray pond (see Section 3.8). The system is common to Units 1 and 2.

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

3.7.3 System Operation

During normal operation the ESW pumps are shut down, and its heat loads, except for the diesel generators, are cooled by the normal service water system. The ESW pumps start automatically on diesel generator operation after speed, voltage, and bus breaker conditions are met, and after a load sequencing delay. ESW pump operation causes automatic valve and sluice gate realignments to align the ESW system to perform its equipment cooling function and isolate the normal service water system from these components.

ESW is returned to the spray pond via the RHRSW system. The operator may elect to realign the system to utilize the cooling towers, if they are available.

3.7.4 System Success Criteria

The success criteria for the ESW system is defined on a per-train basis. For each train of the ESW system, both pumps must operate and the flow paths to the various heat loads must be open.

3.7.5 Component Information

A. Emergency Service Water pumps A, B, C, D
   1. Rated flow: 6400 gpm @ 240 ft. head (104 psid)
   2. Rated capacity: 50%
   3. Type: wet pit turbine

3.7.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      Upon diesel generator operation (LOCA or loss of offsite power signal), the associated ESW pump is started and the intertie lines with the normal service water system are automatically closed.
   2. Remote manual
      The ESW pumps can be actuated by remote manual means from the control room. ESW pump A and loop A valves can also be controlled from the remote shutdown panel.

B. Motive Power

The ESW pumps and motor-operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.5.

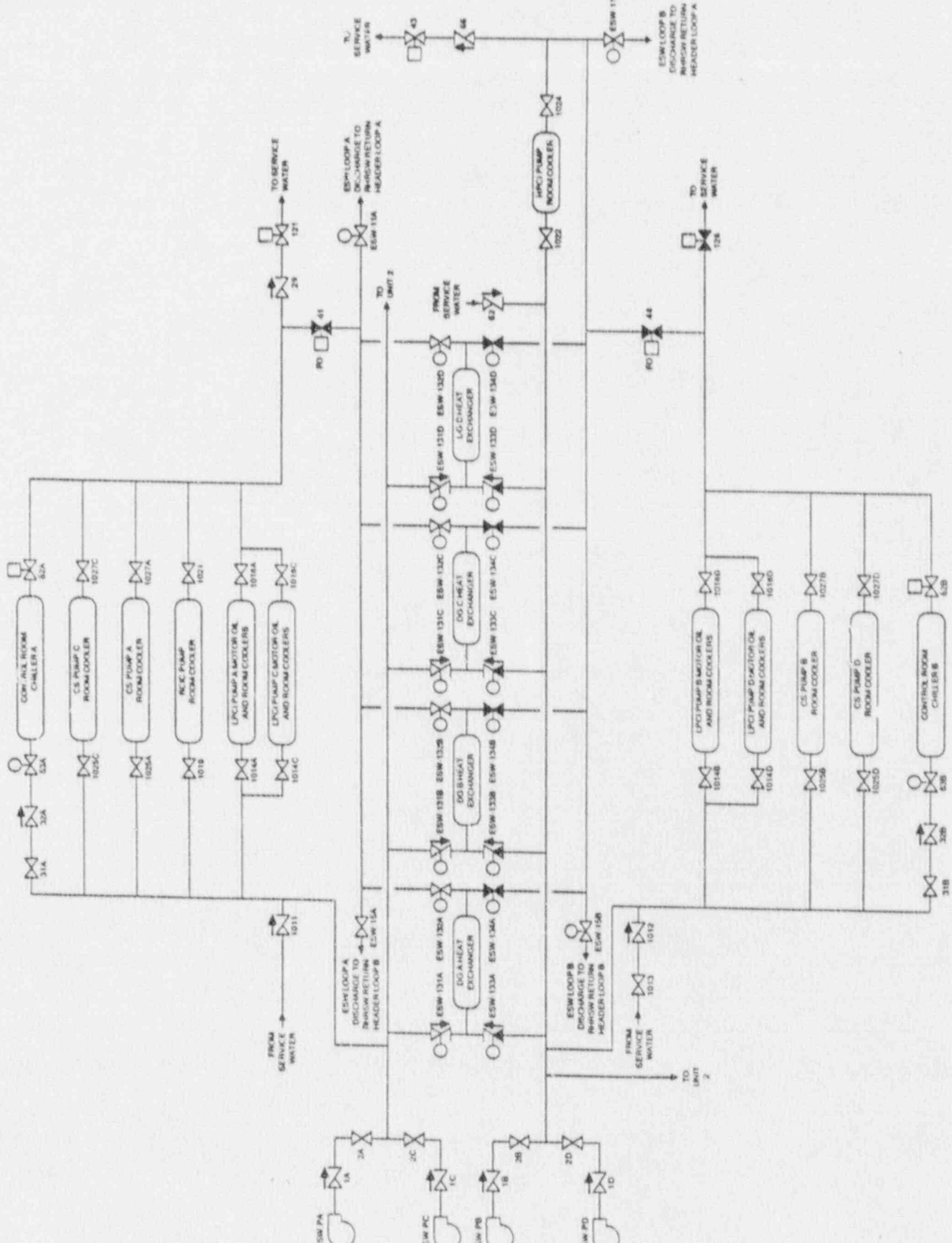


Figure 3.7-1. Limerick 1 Emergency Service Water System

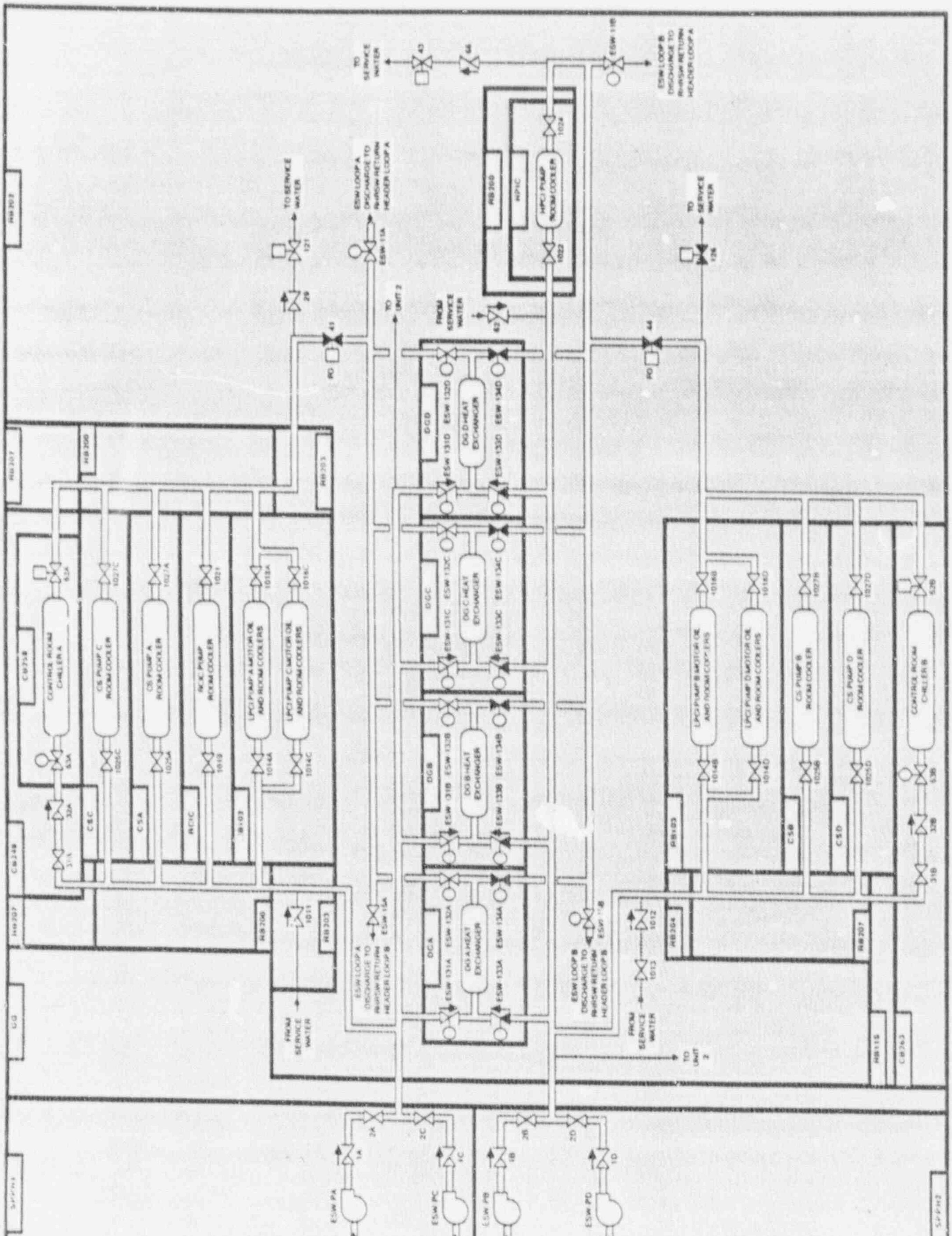


Figure 3.7-2. Limerick 1 Emergency Service Water System Showing Component Locations

Table 3.7-1. Limerick 1 Emergency Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
ESW-11A	MOV	RB202	MCC-114DG	440	DGA	AC/A
ESW-11B	MOV	RB202	MCC-124DG	440	DGB	AC/B
ESW-131A	MOV	DGA	MCC-114DG	440	DGA	AC/A
ESW-131B	MOV	DGB	MCC-124DG	440	DGB	AC/B
ESW-131C	MOV	DGC	MCC-134DG	440	DGC	AC/C
ESW-131D	MOV	DGD	MCC-144DG	440	DGD	AC/D
ESW-132A	MOV	DGA	MCC-114DG	440	DGA	AC/A
ESW-132B	MOV	DGB	MCC-124DG	440	DGB	AC/B
ESW-132C	MOV	DGC	MCC-134DG	440	DGC	AC/C
ESW-132D	MOV	DGD	MCC-144DG	440	DGD	AC/D
ESW-133A	MOV	DGA	MCC-114DG	440	DGA	AC/A
ESW-133B	MOV	DGB	MCC-124DG	440	DGB	AC/B
ESW-133C	MOV	DGC	MCC-134DG	440	DGC	AC/C
ESW-133D	MOV	DGD	MCC-144DG	440	DGD	AC/D
ESW-134A	MOV	DGA	MCC-114DG	440	DGA	AC/A
ESW-134B	MOV	DGB	MCC-124DG	440	DGB	AC/B
ESW-134C	MOV	DGC	MCC-134DG	440	DGC	AC/C
ESW-134D	MOV	DGD	MCC-144DG	440	DGD	AC/D
ESW-15A	MOV	RB202	MCC-134DG	440	DGC	AC/C
ESW-15B	MOV	RB202	MCC-144DG	440	DGD	AC/D
ESW-PA	MDP	SPPH1	BUS-D11	4160	4KVD11	AC/A
ESW-PB	MDP	SPPH2	BUS-D12	4160	4KVD12	AC/B
ESW-PC	MDP	SPPH1	BUS-D13	4160	4KVD13	AC/C
ESW-PD	MDP	SPPH2	BUS-D14	4160	4KVD14	AC/D
RSW-31A	MOV	SPPH1	MCC-114SL	440	SPPH1	AC/A
RSW-31B	MOV	SPPH2	MCC-124SL	440	SPPH2	AC/B
RSW-31C	MOV	SPPH1	MCC-134SL	440	SPPH1	AC/C

Table 3.7-1. Limerick 1 Emergency Service Water System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RSW-31D	MOV	SPPH2	MCC-144SL	440	SPPH2	AC/D
RSW-32A	MOV	SPPH1	MCC-114SL	440	SPPH1	AC/A
RSW-32B	MOV	SPPH2	MCC-124SL	440	SPPH2	AC/B
RSW-32C	MOV	SPPH1	MCC-134SL	440	SPPH1	AC/C
RSW-32D	MOV	SPPH2	MCC-144SL	440	SPPH2	AC/D

3.8 RESIDUAL HEAT REMOVAL SERVICE WATER (RHRSW) SYSTEM

3.8.1 System Function

The Residual Heat Removal Service Water System provides cooling water to the RHR heat exchangers under all operating modes of the RHR system. It thereby completes the decay heat transfer path from the RHR to the ultimate heat sink. Train B of the RHRSW system can also be aligned to supply water to the LPCI system for core flooding or containment spray, if necessary. (Train A provides this capability for Unit 2.)

3.8.2 System Definition

The RHRSW system consists of two independent loops (A and B), with two motor-driven pumps per loop. The system is common to Units 1 and 2, with each RHRSW loop cooling the RHR heat exchangers of the same train in both units. One pump supplies 100% flow to one RHR heat exchanger. During operation of both units, one heat exchanger in both units, and therefore 2 of 4 RHRSW pumps, is required for safe shutdown (Ref. 1, Section 9.2.3).

The RHRSW pumps take suction from the spray pond and discharge back to the spray pond. The return lines of the two loops are cross-connected. The operator may elect to realign the system to utilize the cooling towers, if they are available.

Simplified drawings of the RHRSW system are shown in Figures 3.8-1 and 3.8-2. A summary of data on selected RHRSW components is presented in Table 3.8-1.

3.8.3 System Operation

The RHRSW system is available for normal shutdown or emergencies, and does not operate during normal power operation, except that the system can be used to provide suppression pool cooling in conjunction with the RHR system, if necessary.

The system is common to both units. The A and B pumps receive electric power from Unit 1 buses A and B (D11 and D12), respectively. The C and D pumps receive power from Unit 2 buses A and B (D21 and D22), respectively. During Unit 1 operation/Unit 2 construction the C and D pumps will be available and will be powered from offsite power. The pumps are started manually.

Upon diesel generator start the RHRSW system automatically aligns itself to the spray pond mode, if it is not already in that mode. If the cooling tower mode is available the system can be manually aligned to it. Bypass lines are provided to discharge water directly to the pond, rather than the spray networks, during periods when the pond is frozen. The RHRSW return and the corresponding ESW loop share a common return header to the spray pond.

3.8.4 System Success Criteria

The success criteria for the RHRSW system is defined on a per-train basis. In RHRSW loop A, the A pump must operate, the RHR heat exchanger A inlet and outlet valves must be open, and a path to the spray pond must be open. The success criteria for loop B is similar, with the B pump required to operate.

3.8.5 Component Information

A. RHR Service Water Pumps A, B, C, D
   1. Rated flow: 9000 gpm @ 240 ft head (104 psid)
   2. Rated capacity: 100%
   3. Type: wet pit turbine

3.8.6 Support Systems and Interfaces

A. Control Signals

1. Automatic
   Upon diesel generator start, the RHRSW system automatically aligns itself to the spray pond mode.
2. Remote manual
   The RHRSW pumps require manual actuation, which can be achieved from the control room. The return lines can be manually aligned to the cooling towers.

B. Motive power
The RHRSW pumps and motor-operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.5.

3.8.7 Section 3.8 References

1. Limerick Generating Station Final Safety Analysis Report, Philadelphia Electric Co., Philadelphia, PA.

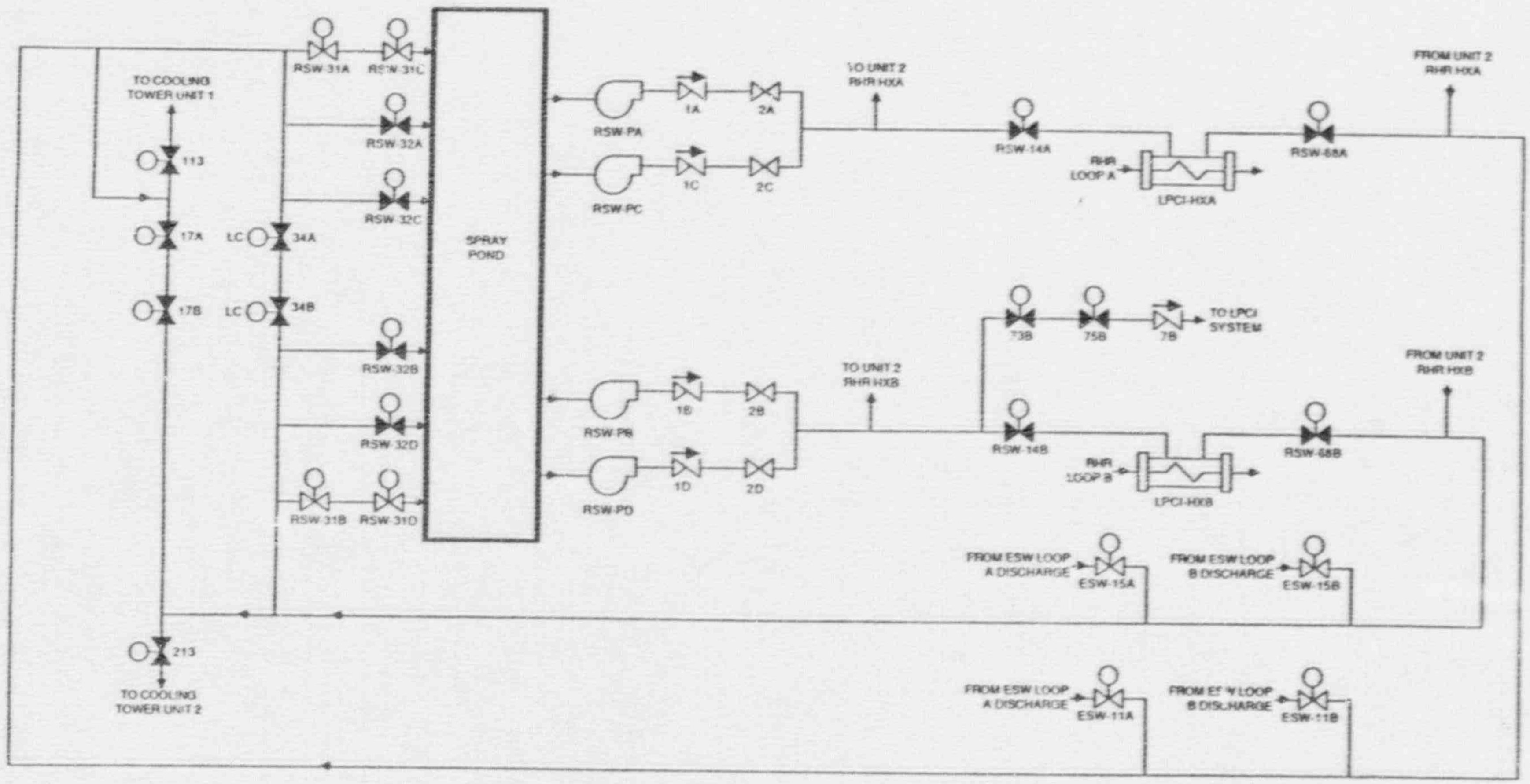
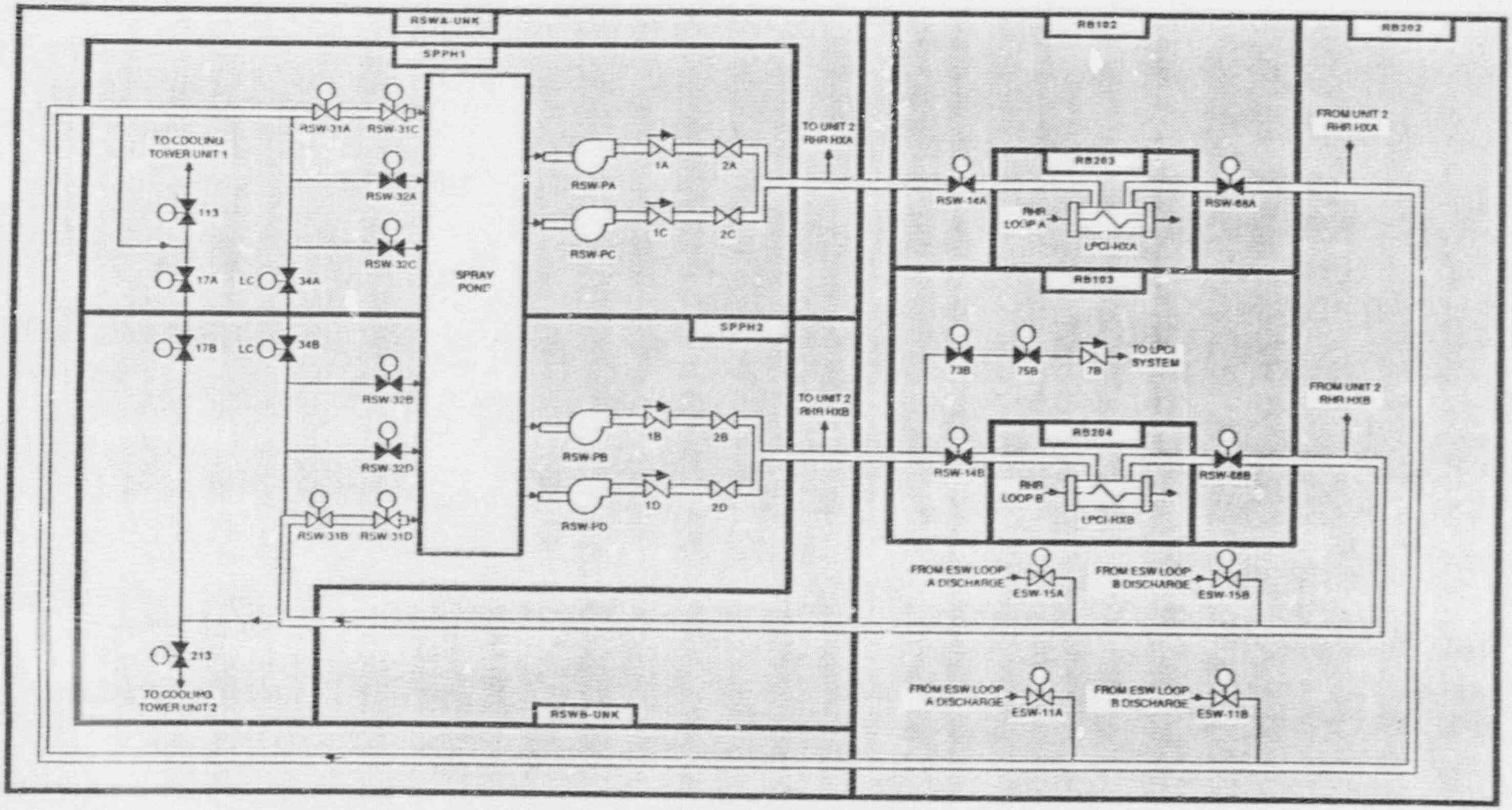


Figure 3.8-1. Limerick 1 Residual Heat Removal Service Water System



NOTE: LPCI-HXA is in rooms RB102 and RB203.
LPCI-HXB is in rooms RB103 and RB204.

Figure 3.8-2. Limerick 1 Residual Heat Removal Service Water System Showing Component Locations

Table 3.8-1. Limerick 1 Residual Heat Removal Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RSW-14A	MOV	RB102	MCC-114RG	40	RB304	AC/A
RSW-14B	MOV	RB103	MCC-124RG	440	RB304	AC/B
RSW-31A	MOV	SPPH1	MCC-114SL	440	SPPH1	AC/A
RSW-31B	MOV	SPPH2	MCC-124SL	440	SPPH2	AC/B
RSW-31C	MOV	SPPH1	MCC-134SL	440	SPPH1	AC/C
RSW-31D	MOV	SPPH2	MCC-144SL	440	SPPH2	AC/D
RSW-32A	MOV	SPPH1	MCC-114SL	440	SPPH1	AC/A
RSW-32B	MOV	SPPH2	MCC-124SL	440	SPPH2	AC/B
RSW-32C	MOV	SPPH1	MCC-134SL	440	SPPH1	AC/C
RSW-32D	MOV	SPPH2	MCC-144SL	440	SPPH2	AC/D
RSW-68A	MOV	RB102	MCC-134RH	440	RB200	AC/C
RSW-68B	MOV	RB103	MCC-144RH	440	RB207	AC/D
RSW-PA	MDP	SPPH1	BUS-D11	4160	4KVD11	AC/A
RSW-PB	MDP	SPPH2	BUS-D12	4160	4KVD12	AC/B

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Limerick Generating Station is located about 1.7 miles southeast of the limits of the Borough of Pottstown in southeastern Pennsylvania. The Schuylkill River passes through the site and separates the western portion which is in Chester County from the eastern portion which is in Montgomery County. The site is about 20.7 miles northwest of the Philadelphia city limits. The station includes two units, Unit 1 which began commercial operation in February 1986 and Unit 2 which is still under construction as of August 1988. Planned completion date of Unit 2 is February 1990. A general view of the site is shown in Figure 4-1 (from Ref. 1) and a more detailed site plan is shown in Figure 4-2.

The two reactor buildings are located adjacent to each other with Unit 1 to the west of Unit 2. Each reactor building contains the primary and secondary containments and the reactor coolant system. The main steam lines exit through a steam tunnel and enter the turbine building to the north. The RCIC, ECCS, and reactor water cleanup systems are located on various elevations of the reactor building. The spent fuel pool is located on the upper levels of the reactor building.

The turbine building for each unit is located north of the reactor building. The turbine building contains the power conversion system, including the main turbines and condensers. Piping from the Unit 1 condensate storage tank to the RCIC and HPCI pumps also passes through the turbine building at the 200 foot elevation.

The control building is part of the turbine buildings. It is located along the south end and in the center of the combined Unit 1/Unit 2 turbine building and is shared by the two units. The control building contains the main control room, the remote shutdown panel, the 4160 VAC buses, and the 125 VDC buses and batteries.

The diesel generator buildings are located south of their respective reactor buildings. Each diesel generator is located in a separate room.

The radwaste building, shared by the two units, is located west of the Unit 1 reactor building. Piping from the Unit 1 condensate storage tank to the RCIC and HPCI pumps passes through the radwaste building at the 191 foot elevation.

The Unit 1 CST is located west of the radwaste building. The Unit 2 CST is located southeast of the Unit 2 diesel generator building.

The spray pond, spray pump structure, and cooling towers are located in the north portion of the site

4.2 FACILITY LAYOUT DRAWINGS

Section views of the Unit 1 reactor and turbine building are shown in Figures 4-3 and 4-4. Simplified layout drawings for Unit 1 are presented in Figures 4-5 to 4-13. A section view of the Unit 2 turbine building is shown in Figure 4-14, and simplified layout drawings of Unit 2 are presented in Figures 4-15 to 4-22. These layout drawings show details of the Unit 2 reactor building only, since the other buildings are shown in Figures 4-5 to 4-13. A simplified drawing of the spray pond structure is shown in Figure 4-23. 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 2, Oak Ridge National Laboratory, Nuclear Safety Information Center, January 1972.

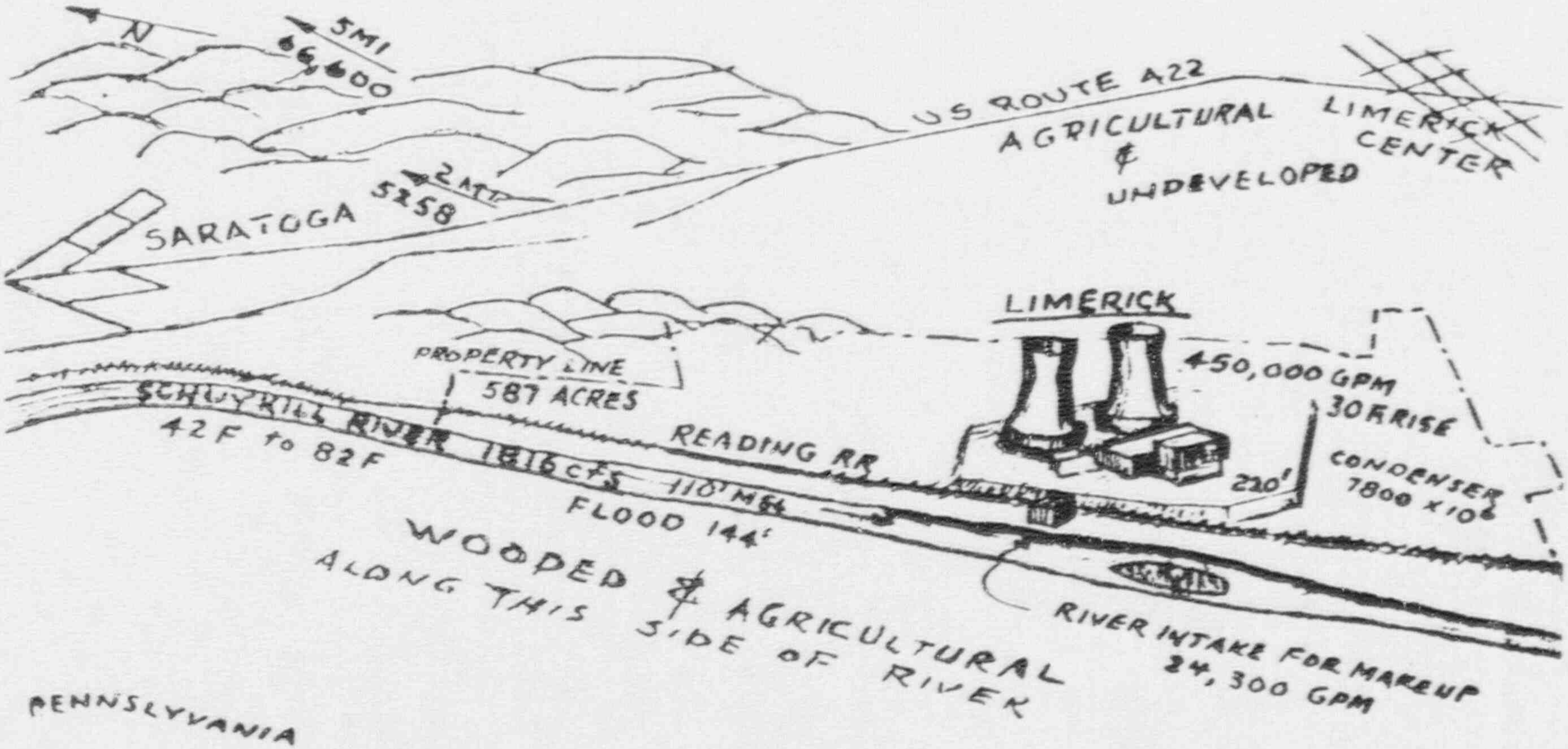


Figure 4-1. General View of Limerick Site and Vicinity

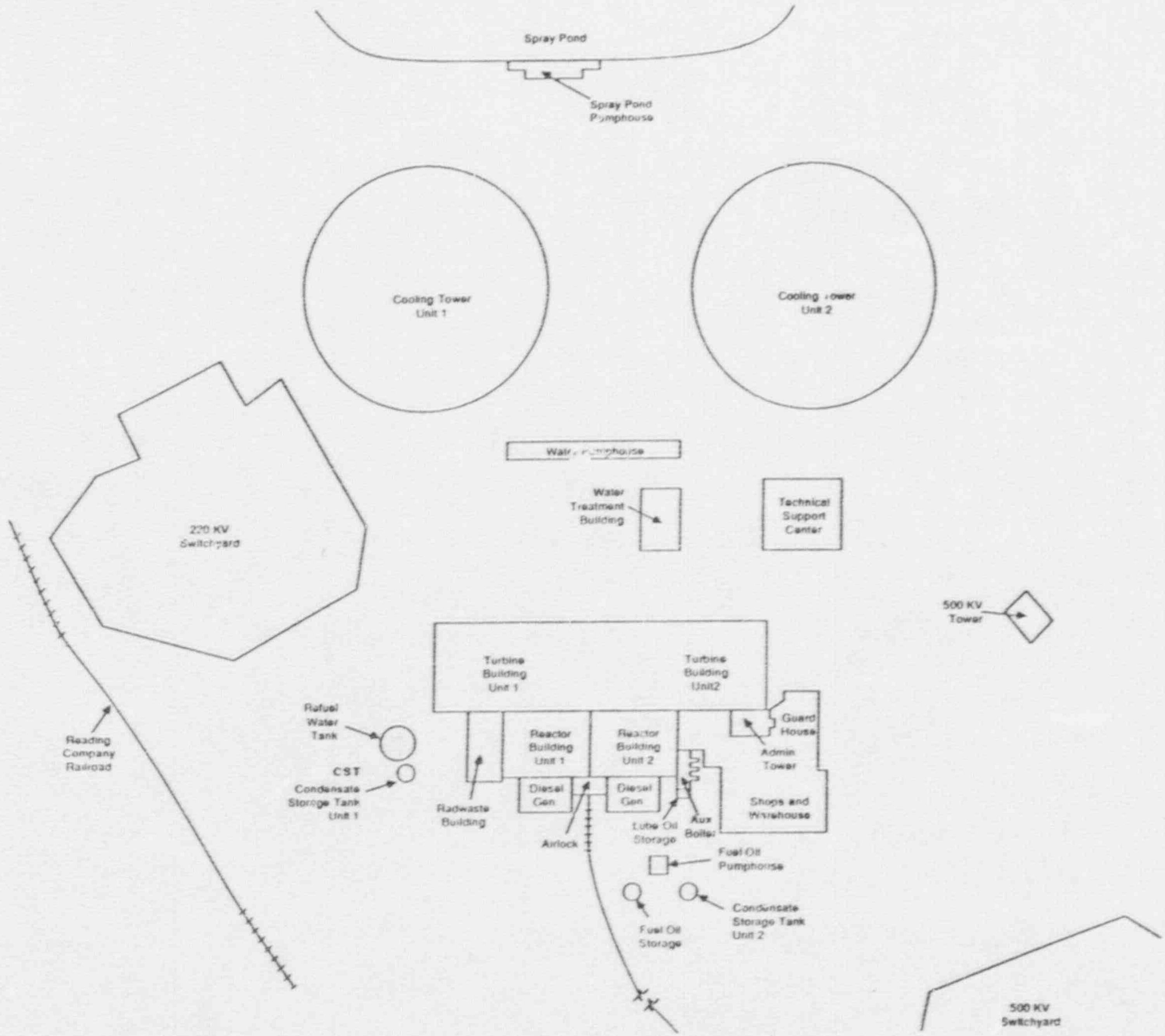


Figure 4-2. Limerick 1 And 2 Plot Plan

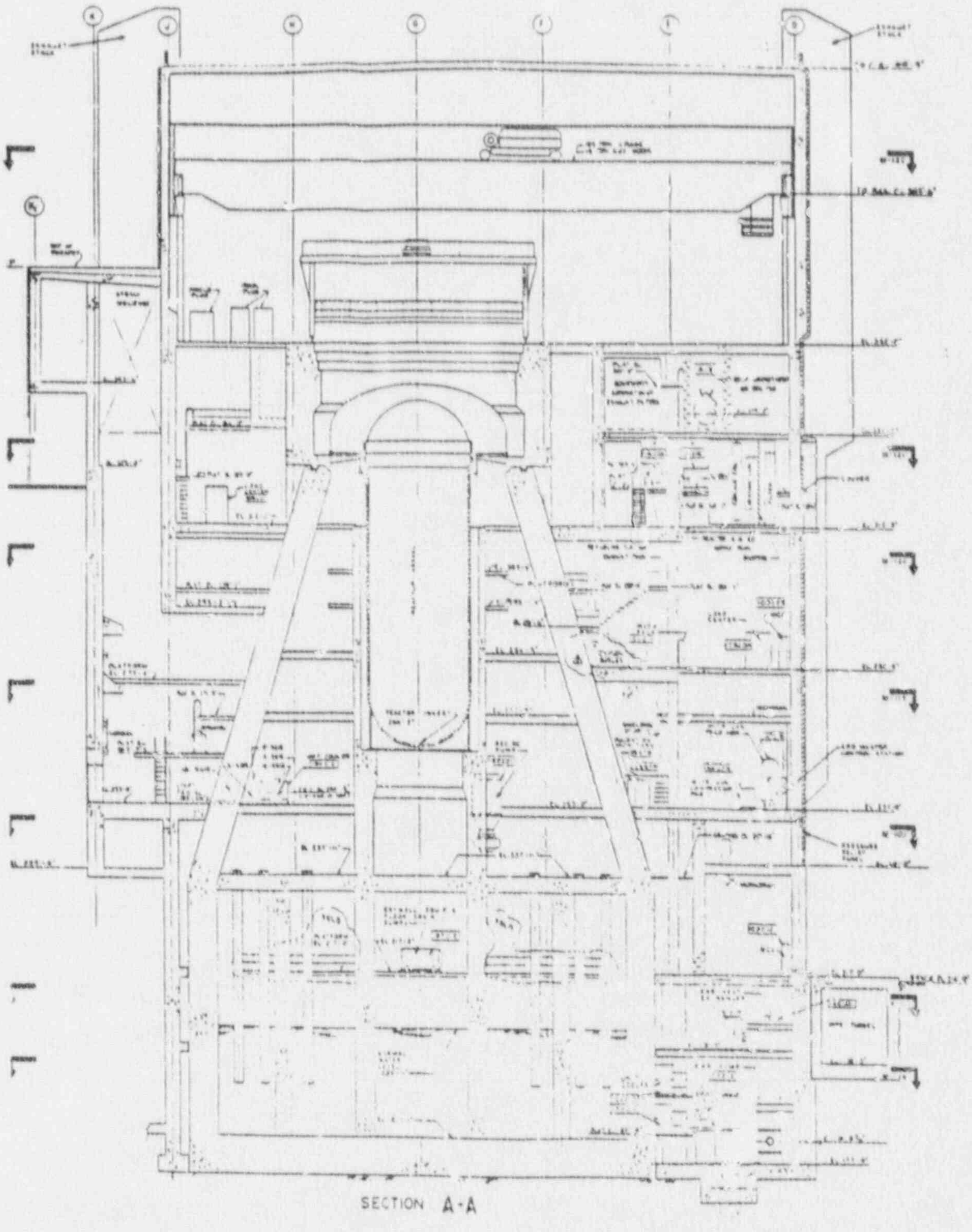


Figure 4-3. Limerick 1 Reactor Building Section

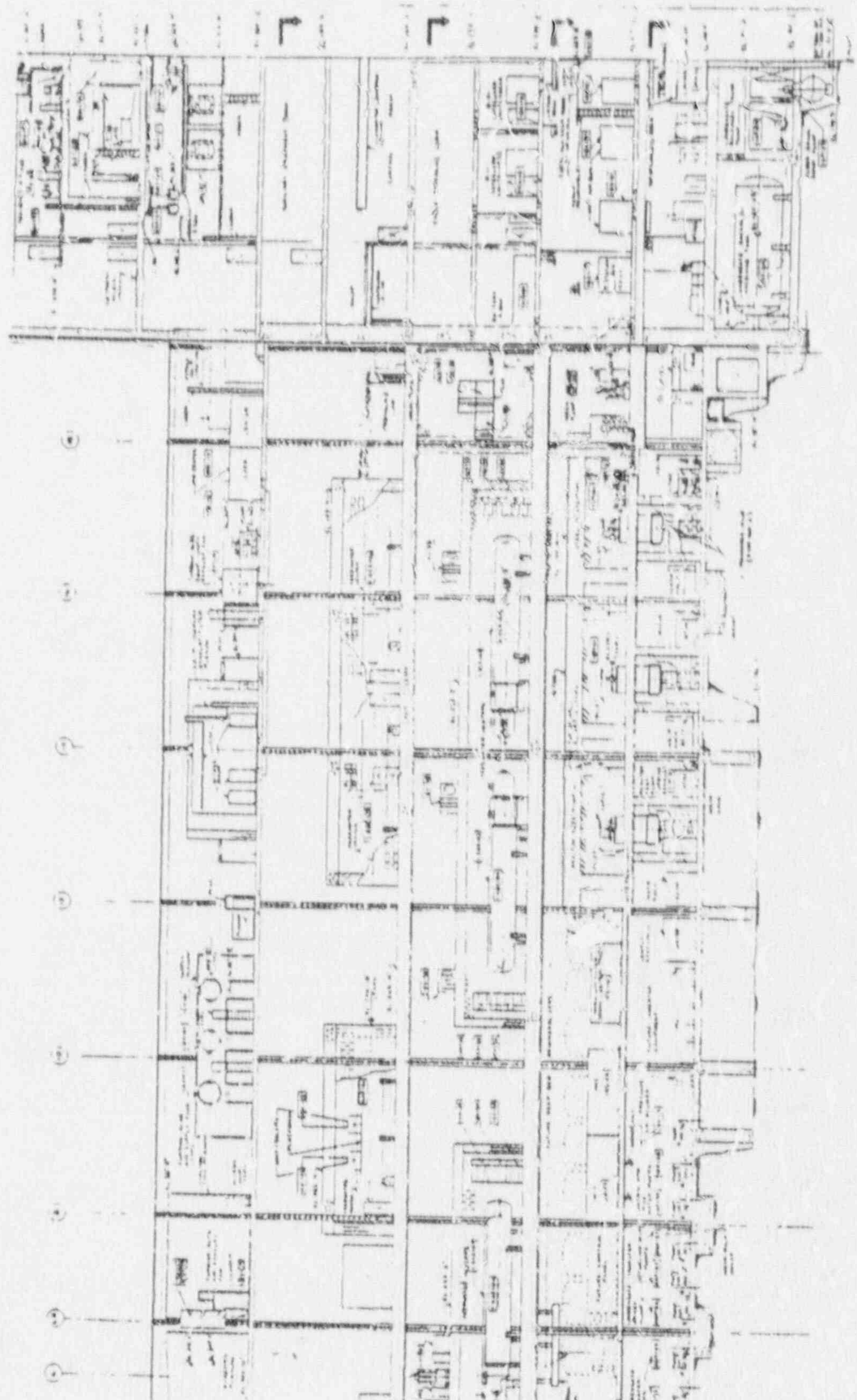


Figure 4-4. Limerick 1 Turbine Building Section

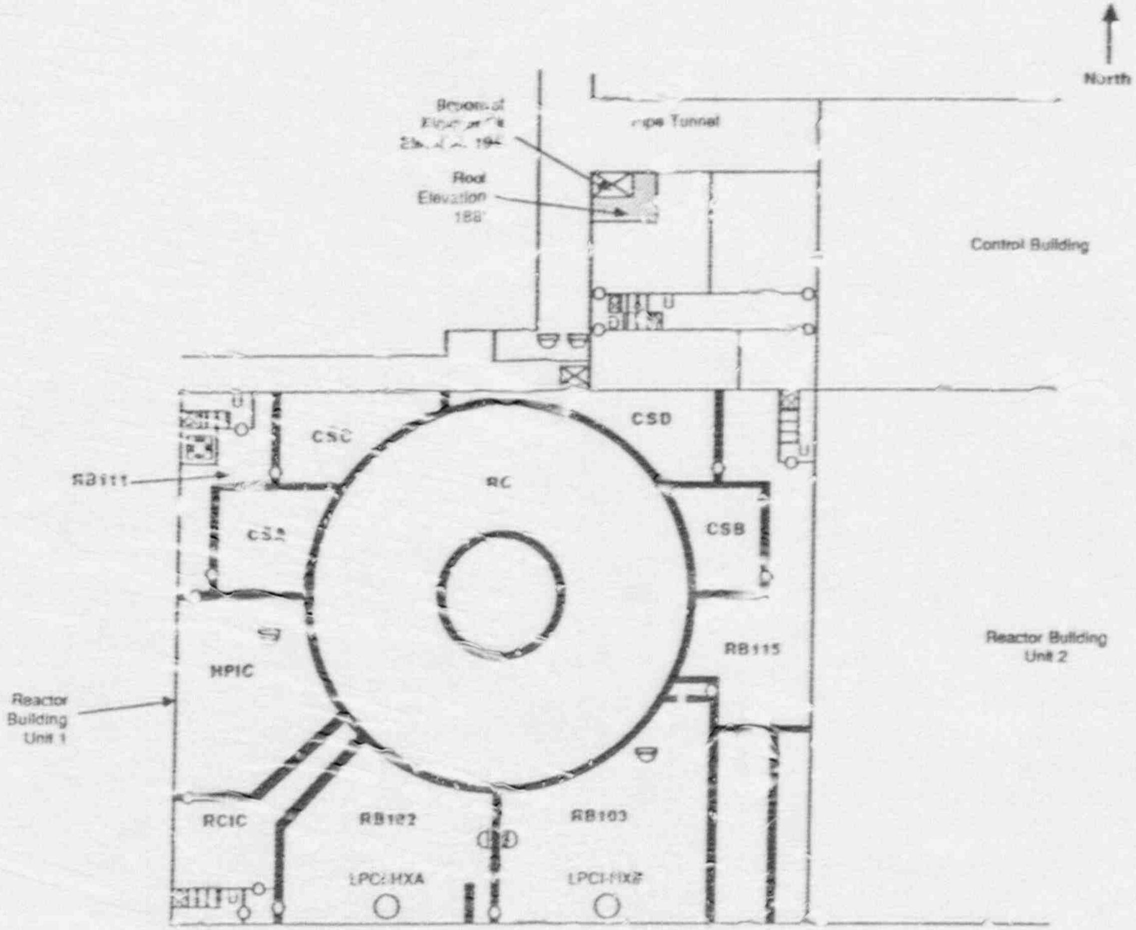


Figure 4-5. Limerick 1 General Arrangement, Elevation 177'

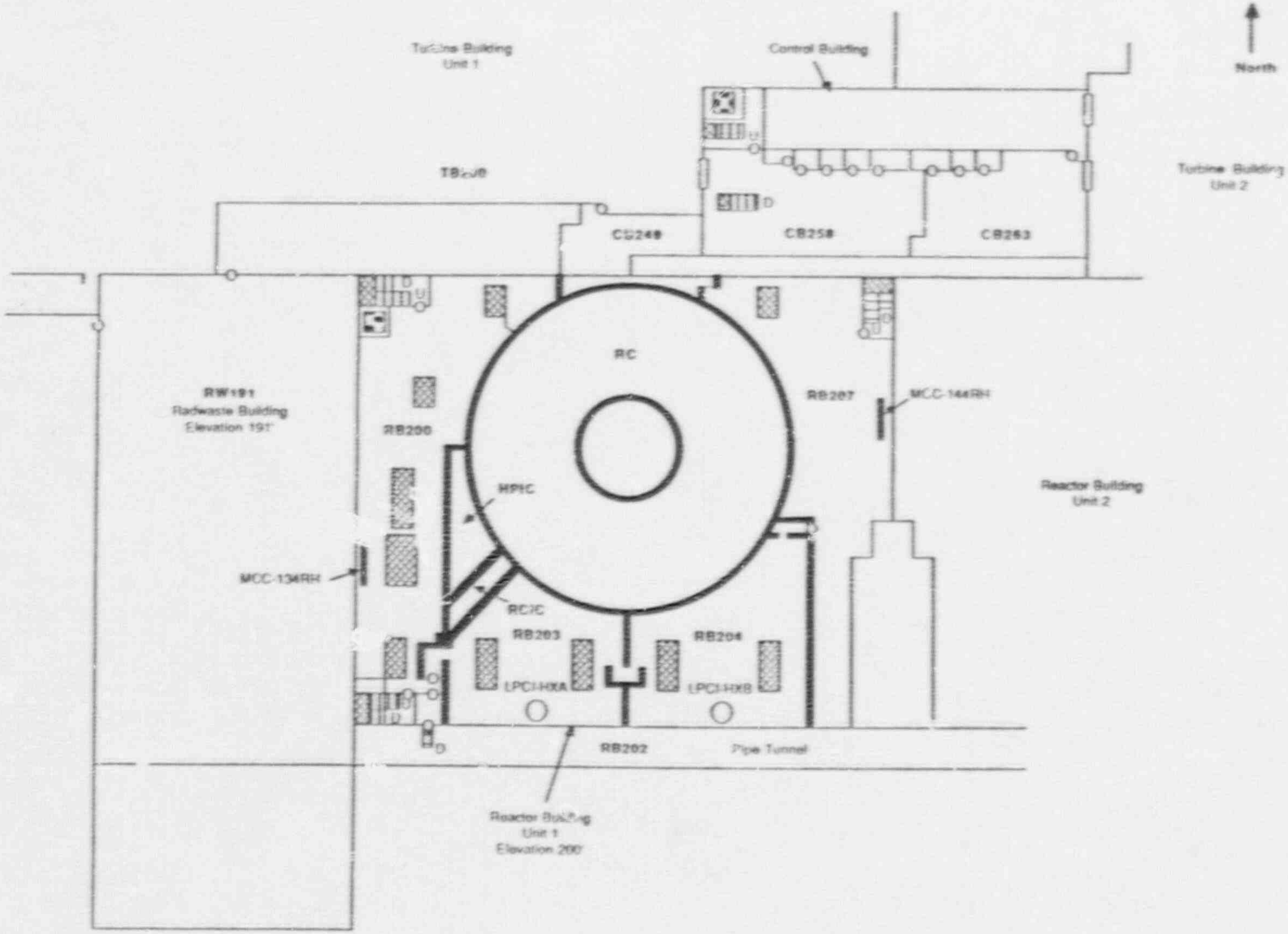


Figure 4-6. Limerick 1 General Arrangement, Elevations 191' and 200'

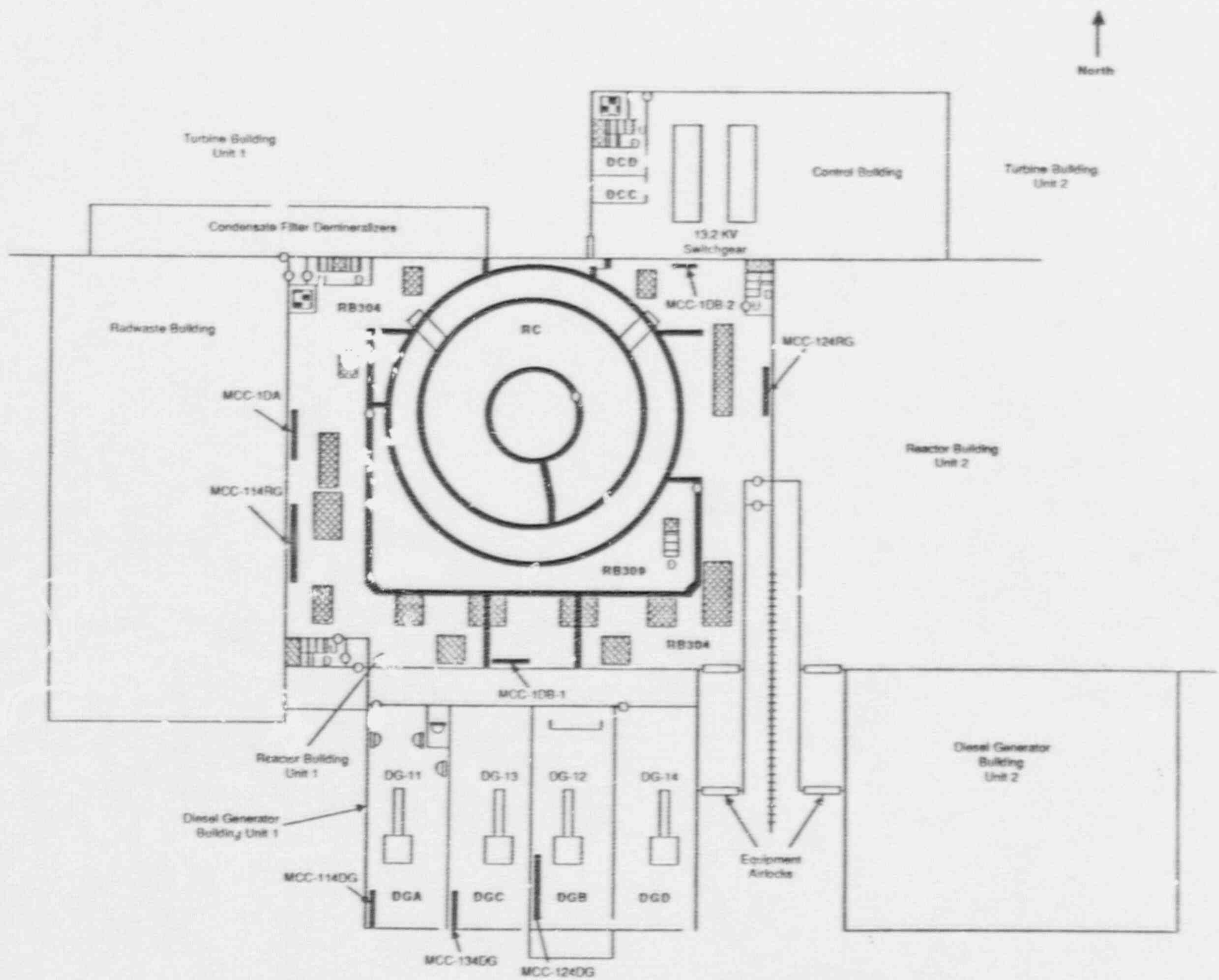


Figure 4-7. Limerick I General Arrangement, Elevation 217'

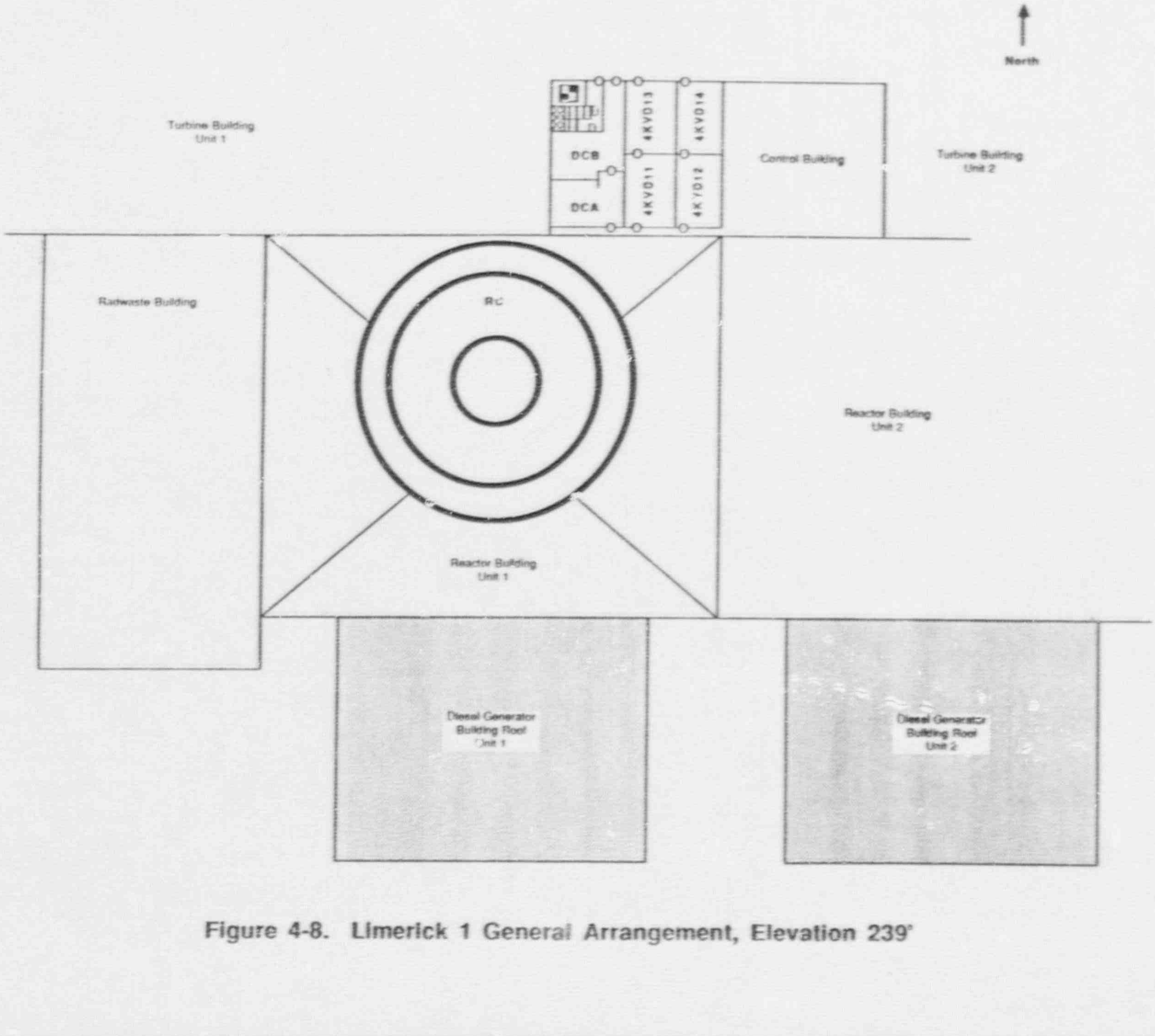


Figure 4-8. Limerick 1 General Arrangement, Elevation 239'

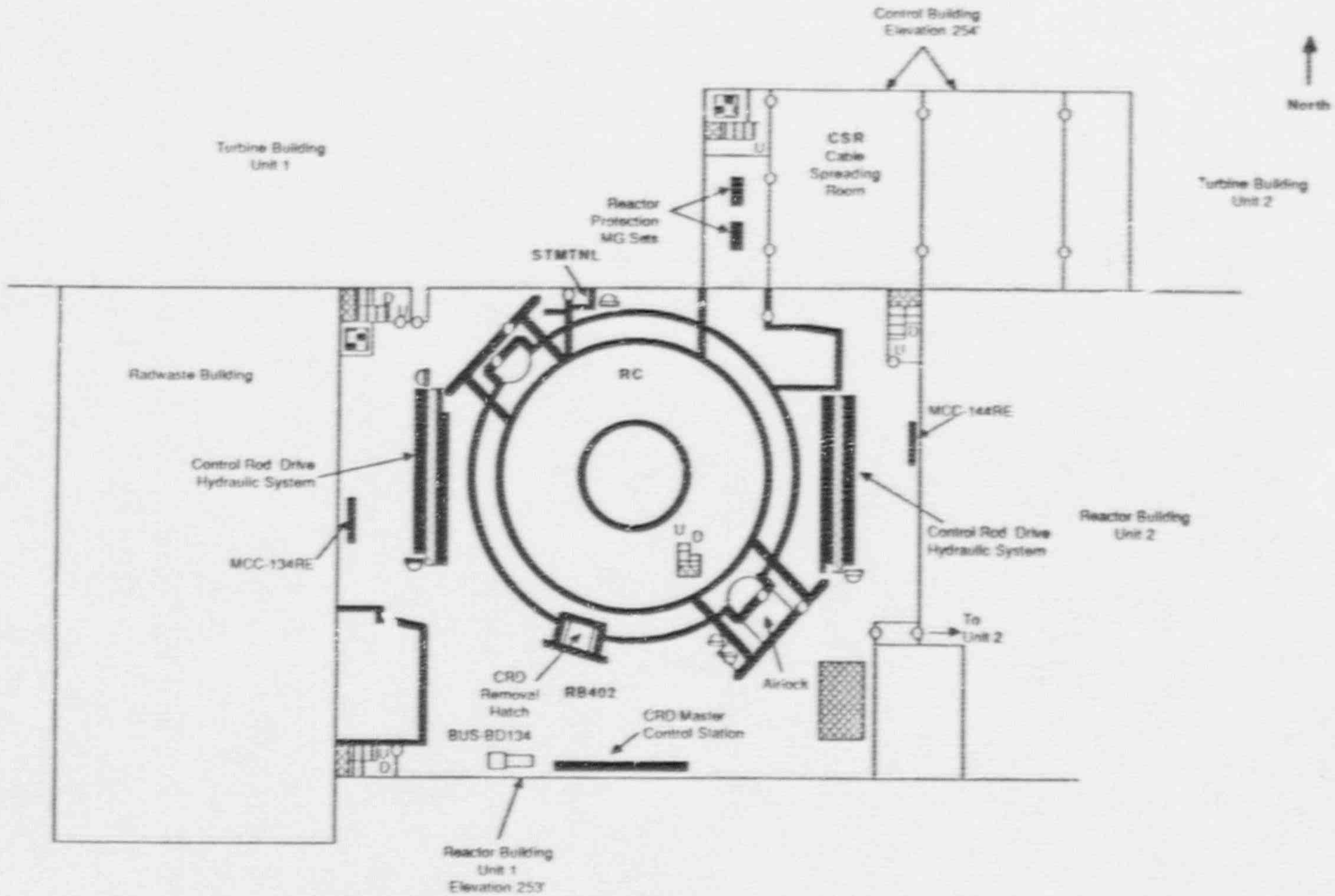


Figure 4-9. Limerick 1 General Arrangement, Elevations 253' and 254'

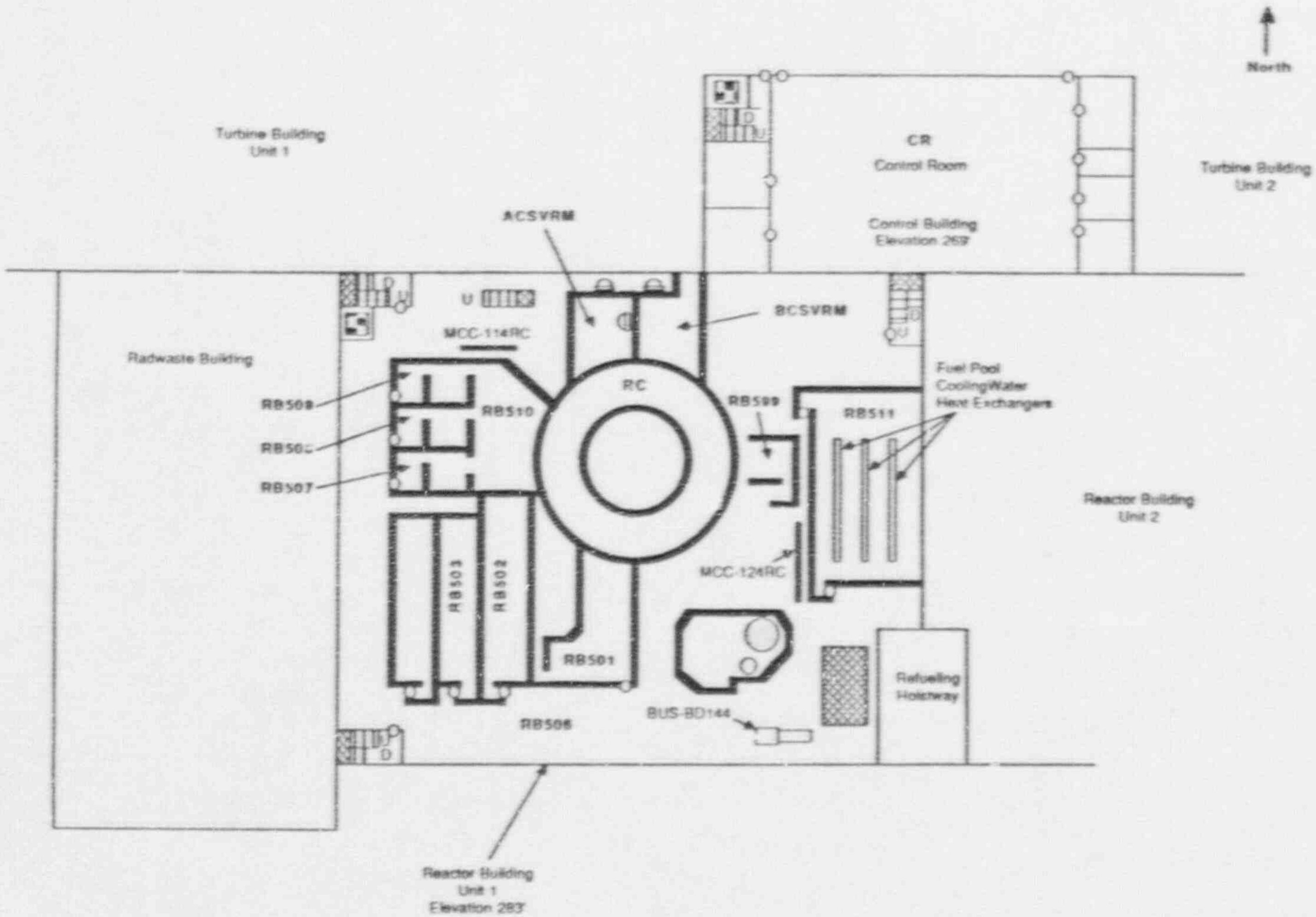


Figure 4-10. Limerick 1 General Arrangement, Elevations 269' and 283'

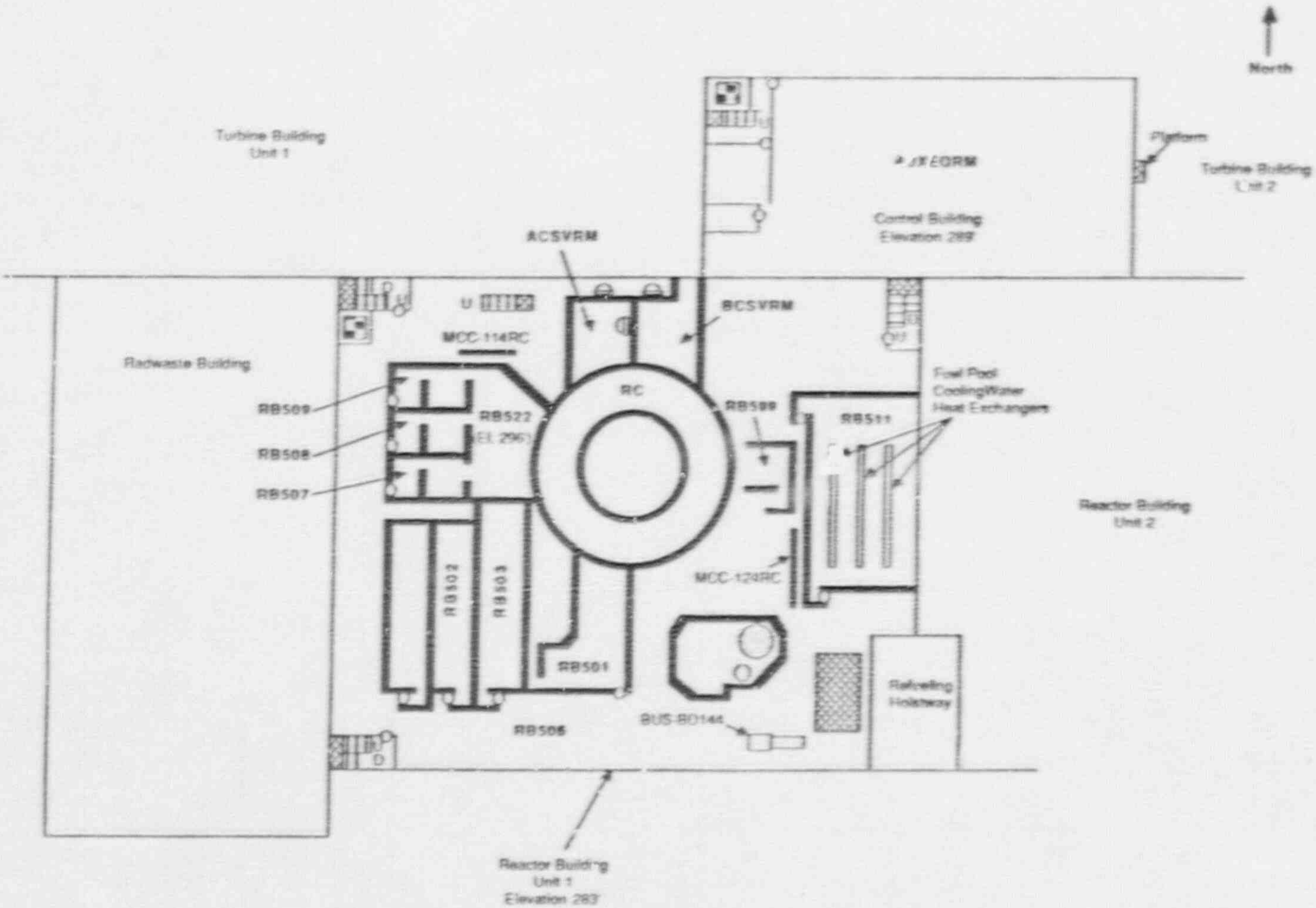


Figure 4-11. Limerick 1 General Arrangement, Elevations 283', 289', and 296'

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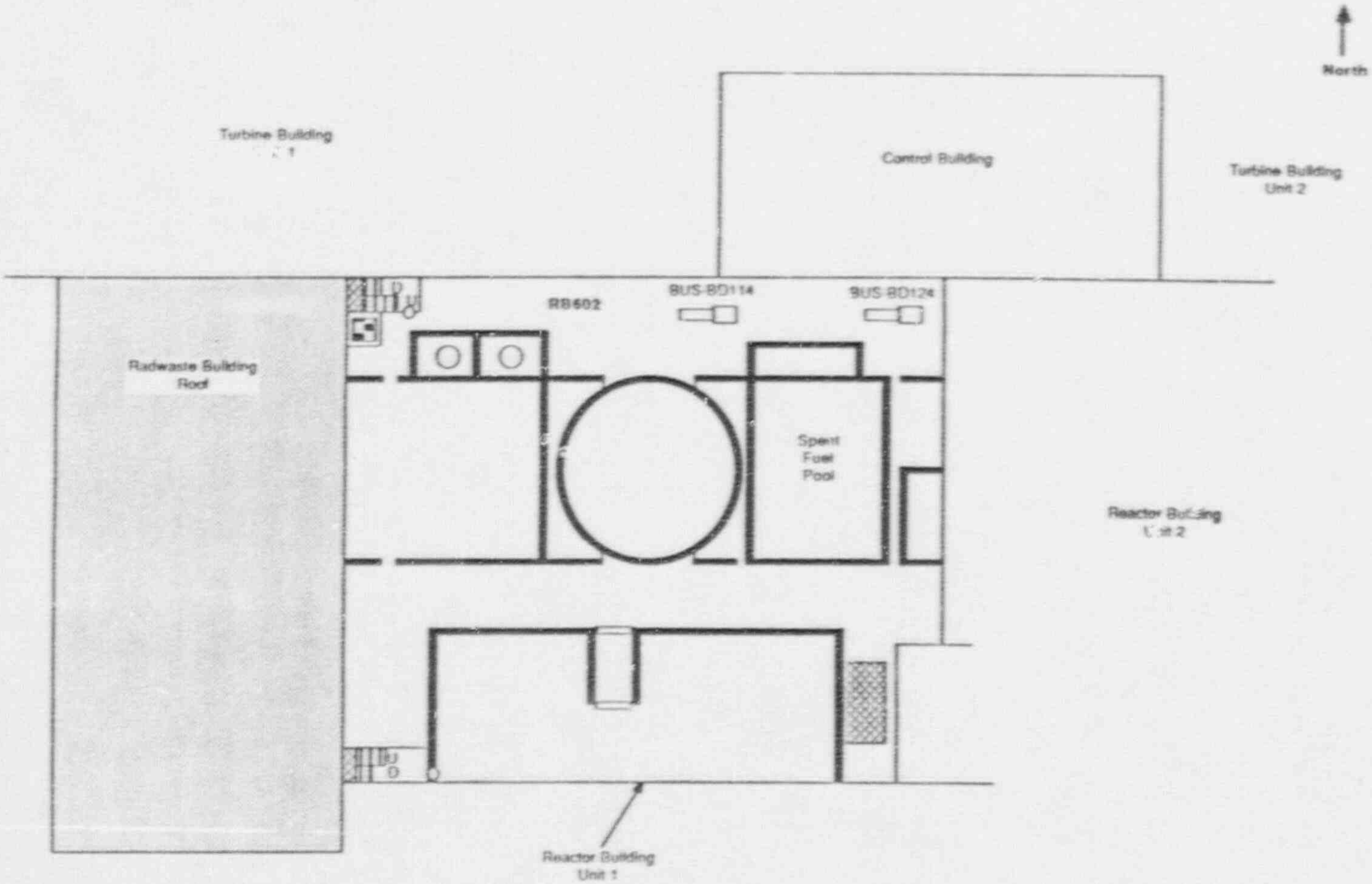

Figure 4-12. Limerick 1 General Arrangement, Elevation 313'

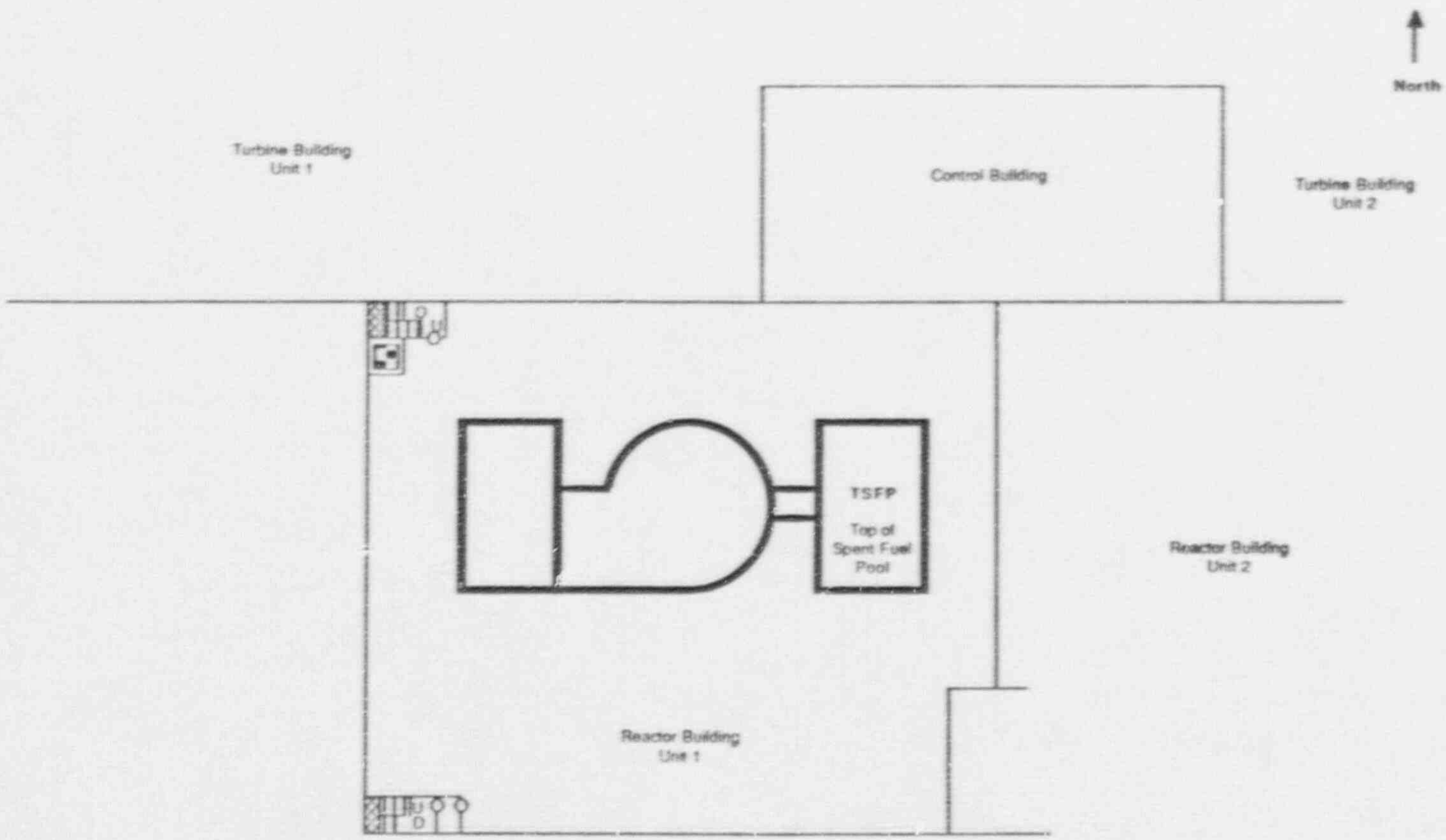

Figure 4-13. Limerick 1 General Arrangment, Elevation 352'

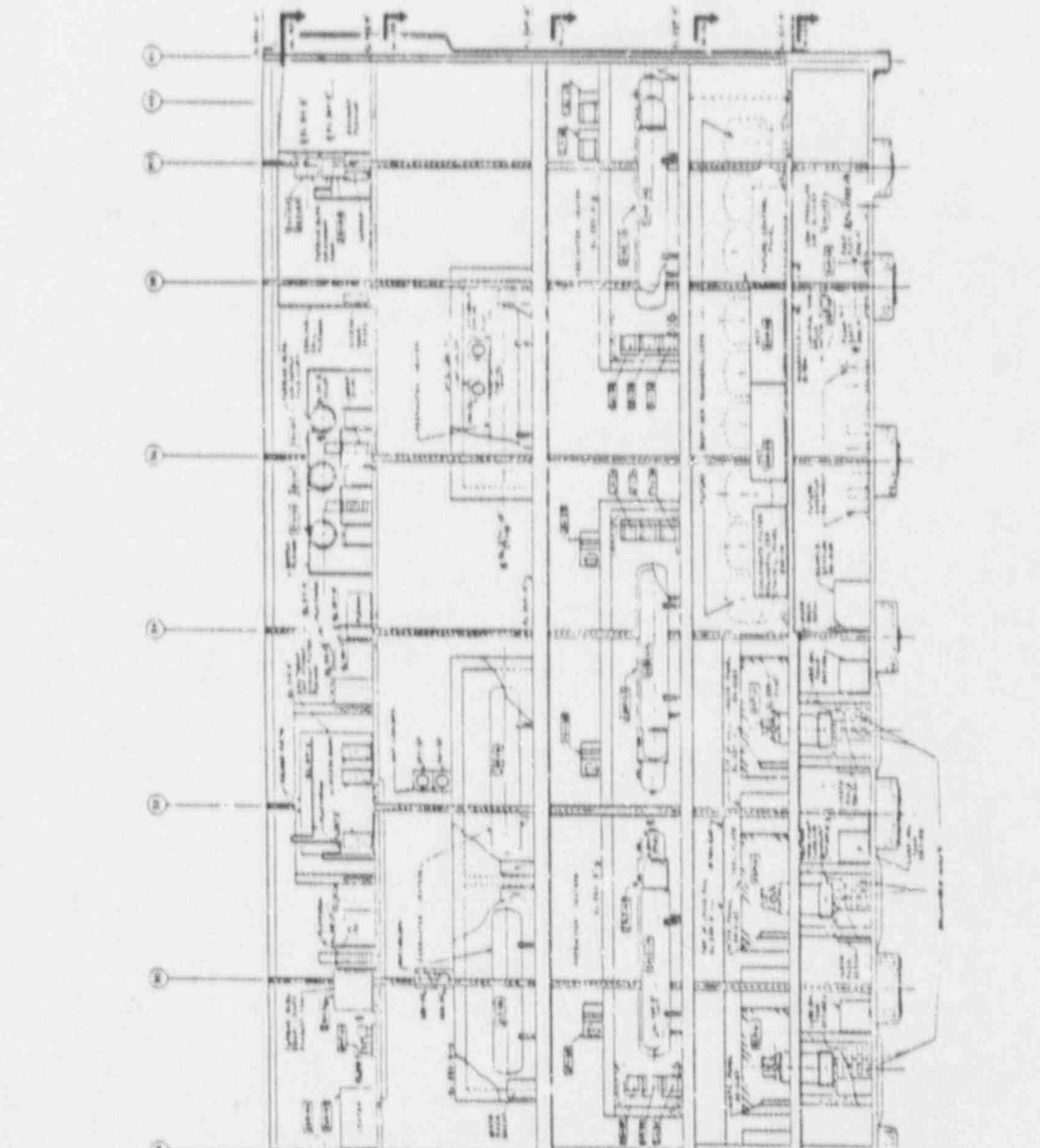

Figure 4-14. Limerick 2 Turbine Building Section

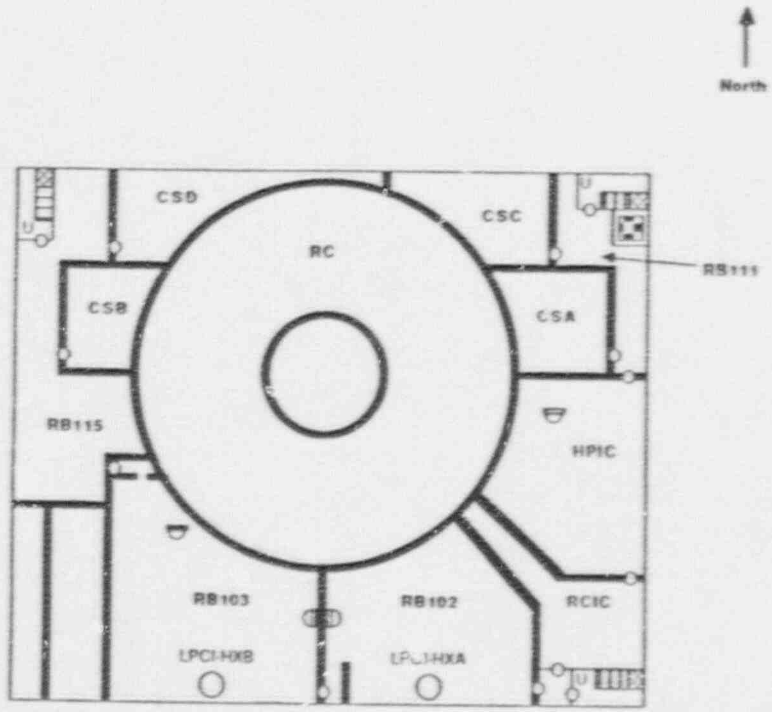

Figure 4-15. Limerick 2 Reactor Building, Elevation 177'

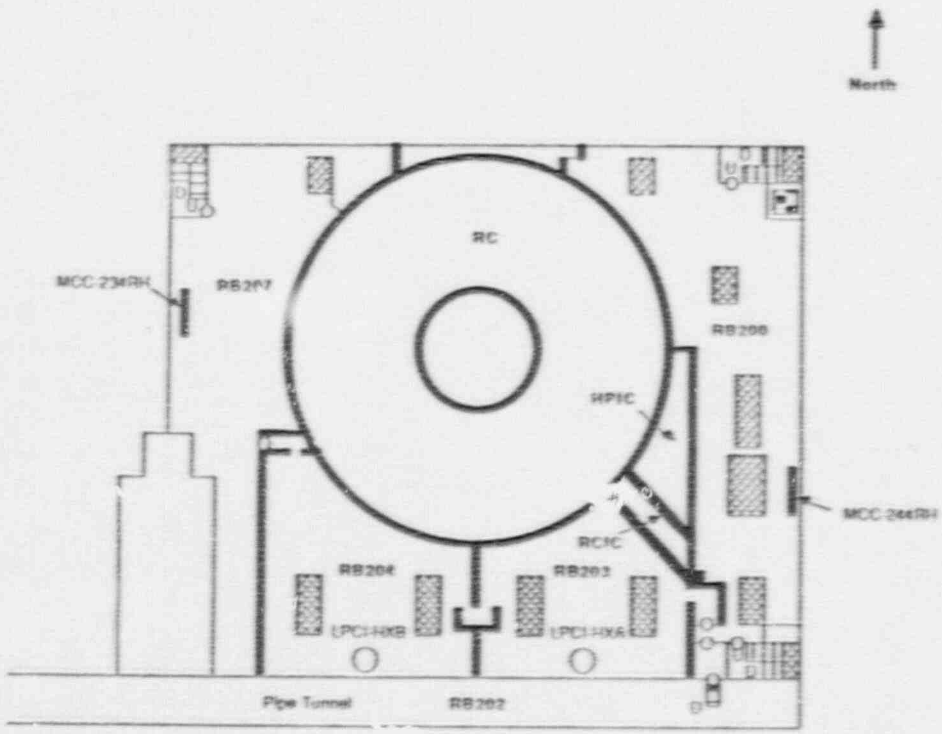

Figure 4-16. Limerick 2 Reactor Building, Elevation 200'

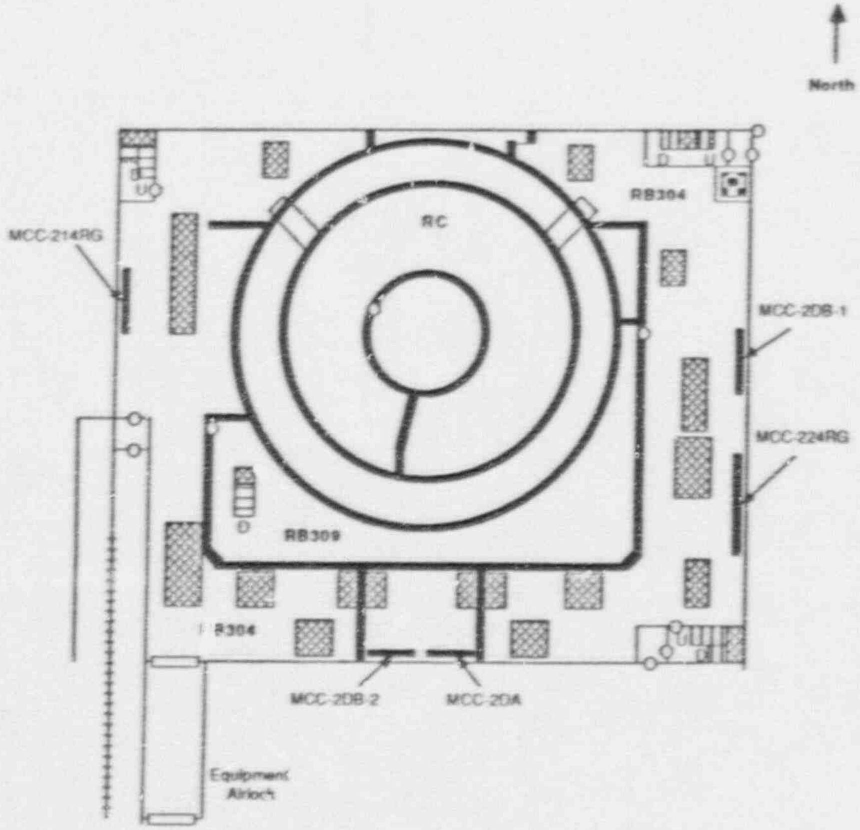

Figure 4-17. Limerick 2 Reactor Building, Elevation 217'

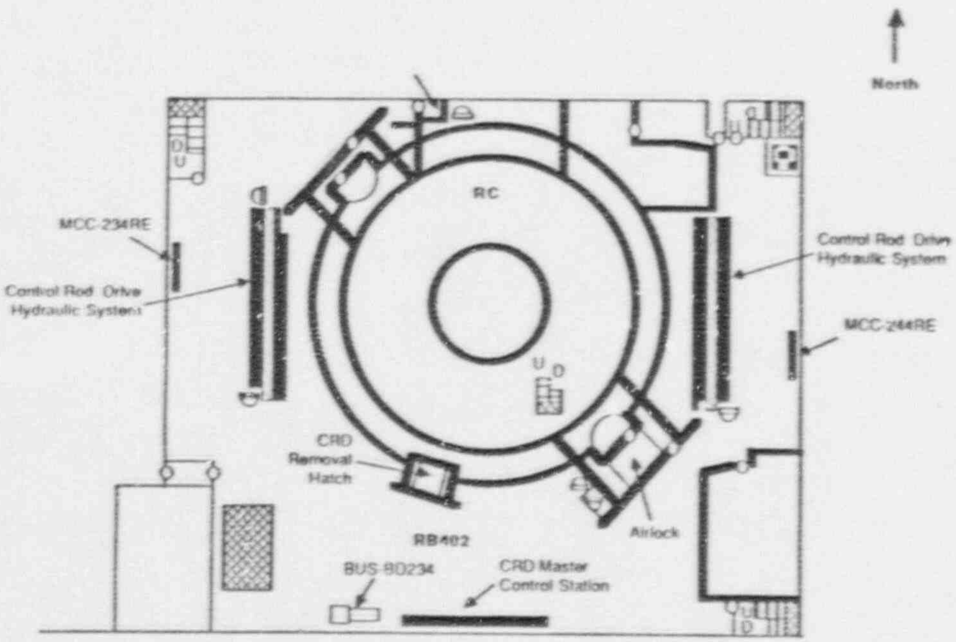

Figure 4-18. Limerick 2 Reactor Building, Elevation 253'

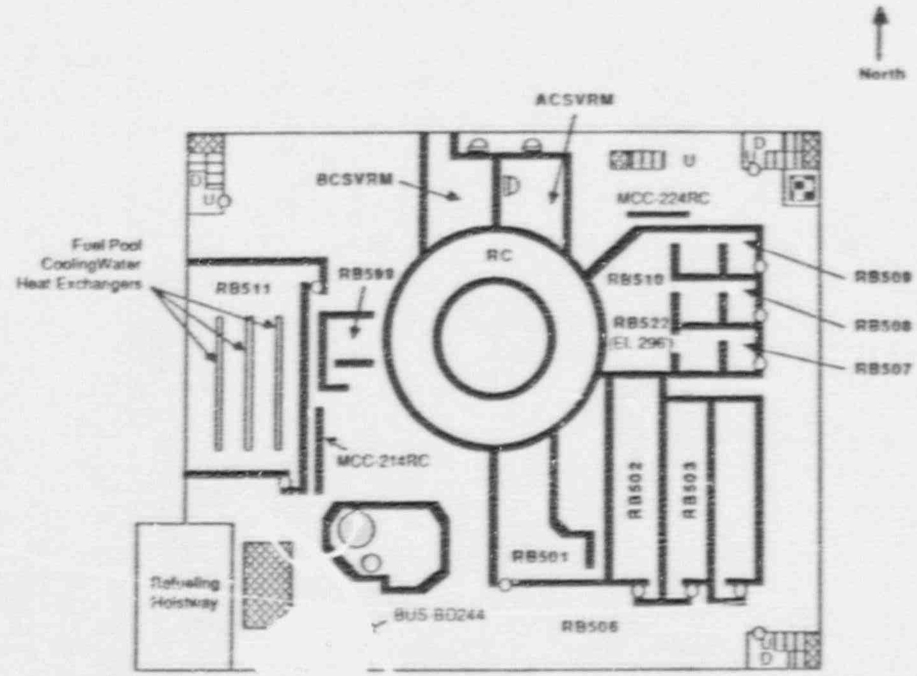

Figure 4-19. Limerick 2 Reactor Building, Elevations 283' and 296'

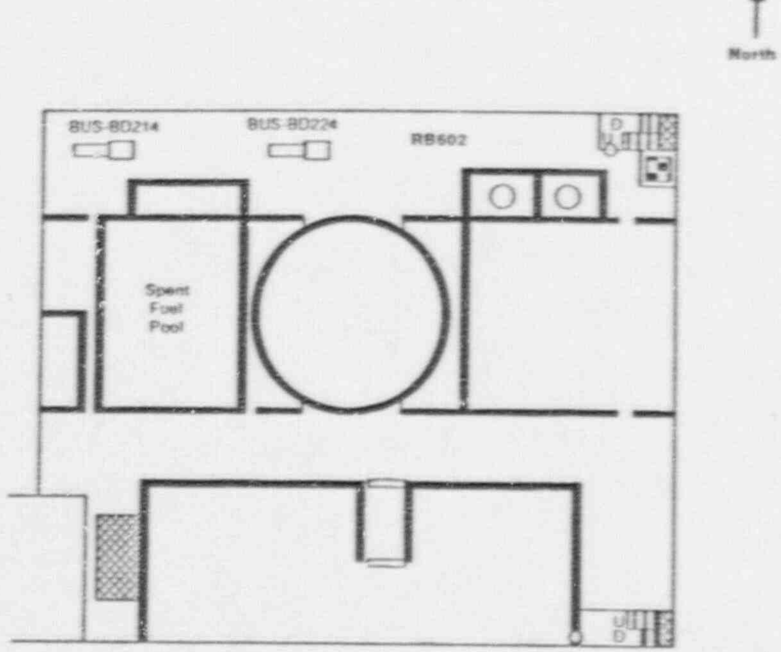

Figure 4-20. Limerick 2 Reactor Building, Elevation 313'

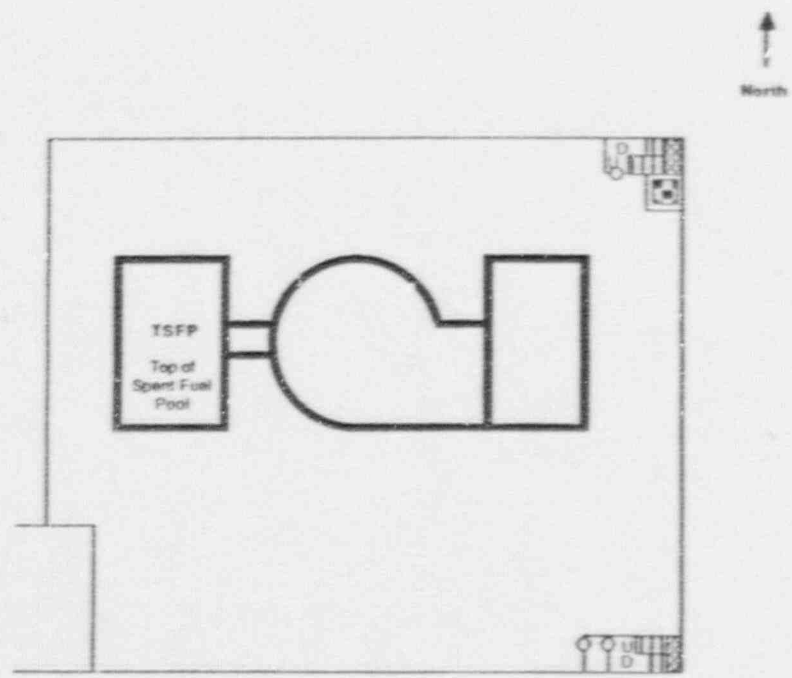

Figure 4-21. Limerick 2 Reactor Building, Elevation 352'

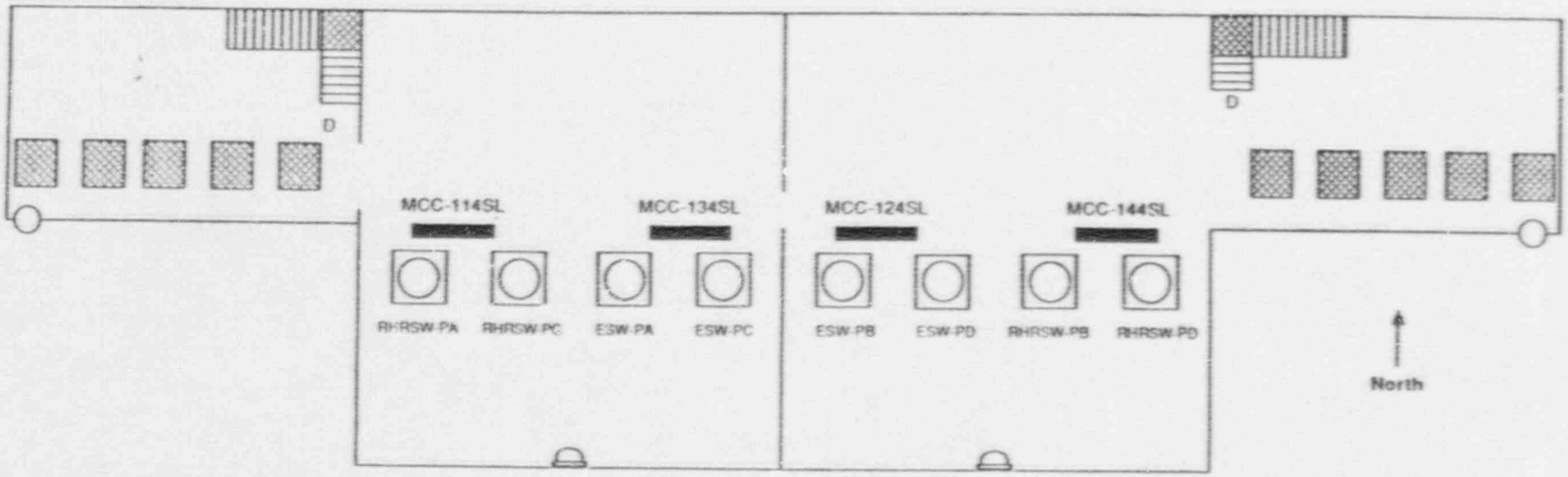

Figure 4-22. Limerick 1 and 2 Spray Pond Pump Structure Elevation 268'

Table 4-1. Definition of Limerick 1 Building and Location Codes

	Codes	Descriptions
1.	4KVD11	4KVD11 Switchgear Room, located on the 239' elevation of the Turbine Building
2.	4KVD12	4KVD12 Switchgear Room, located on the 239' elevation of the Turbine Building
3.	4KVD13	4KVD13 Switchgear Room, located on the 239' elevation of the Turbine Building
4.	4KVD14	4KVD14 Switchgear Room, located on the 239' elevation of the Turbine Building
5.	ACSVRM	A Core Spray Valve Room, located on the 295' elevation of the Reactor Building
6.	AUXEQRM	Auxiliary Equipment Room, located on the 289' elevation of the Control Building
7.	BCSVRM	B Core Spray Valve Room, located on the 295' elevation of the Reactor Building
8.	CB249	Control Building Room 249, located on the 200' elevation
9.	CB258	Control Building Room 258, located on the 200' elevation
10.	CB263	Control Building Room 263, located on the 200' elevation
11.	CR	Control Room , located on the 269'
12.	CSA	Core Spray Pump Room A, located on the 177' elevation of the Reactor Building
13.	CSB	Core Spray Pump Room B, located on the 177' elevation of the Reactor Building
14.	CSC	Core Spray Pump Room C, located on the 177' elevation of the Reactor Building
15.	CSD	Core Spray Pump Room D, located on the 177' elevation of the Reactor Building
16.	CSR	Cable Spreading Room, located on the 217' elevation of the Control Building
17.	CST	Condensate Storage Tank - west of Reactor Building
18.	CSTVP	CST Valve Pit - adjacent to the CST

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

Codes	Descriptions
19. DCA	DCA Switchgear Room, located on the 239' elevation of the Turbine Building
20. DCB	DCB Switchgear Room, located on the 239' elevation of the Turbine Building
21. DCC	DCC Switchgear Room, located on the 217' elevation of the Turbine Building
22. DCD	DCD Switchgear Room, located on the 217' elevation of the Turbine Building
23. DGA	Diesel Generator Room A Diesel, located on the 217' elevation of the Diesel Generator Building
24. DGB	Diesel Generator Room B, located on the 217' elevation of the Diesel Generator Building
25. DGC	Diesel Generator Room C Diesel, located on the 217' elevation of the Diesel Generator Building
26. DGD	Diesel Generator Room D, located on the 217' elevation of the Diesel Generator Building
27. HPCI	HPCI Pump Room, located on the 177' elevation of the Reactor Building
28. MCC134RH	Motor Control Center 134RH, located on the 200' elevation of the Reactor Building
29. MCC144RH	Motor Control Center 144RH, located on the 207' elevation of the Reactor Building
30. RB102	Reactor Building Room 102, located on the 177' elevation
31. RB103	Reactor Building Room 103, located on the 177' elevation
32. RB111	Reactor Building Room 111, located on the 177' elevation
33. RB115	Reactor Building Room 115, located on the 177' elevation
34. RB200	Reactor Building Room 200, located on the 201' elevation
35. RB202	Reactor Building Pipe Tunnel Room 202, located on the 202' elevation of Units 1 and 2
36. RB203	Reactor Building Room 203, located on the 201' elevation

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

Codes	Descriptions
37. RB204	Reactor Building Room 204, located on the 201' elevation
38. RB207	Reactor Building Room 207, located on the 201' elevation
39. RB304	Reactor Building Room 304, located on the 201' elevation
40. RB309	Reactor Building Room 309, located on the 201' elevation
41. RB402	Reactor Building Room 402, located on the 253' elevation
42. RB501	Reactor Building Room 501, located on the 283' elevation
43. RB502	Reactor Building Room 502, located on the 283' elevation
44. RB503	Reactor Building Room 503, located on the 283' elevation
45. RB506	Reactor Building Room 506, located on the 283' elevation
46. RB507	Reactor Building Room 507, located on the 283' elevation - RCUW Pump A
47. RB508	Reactor Building Room 508, located on the 283' elevation - RCUW Pump B
48. RB509	Reactor Building Room 509, located on the 283' elevation - RCUW Pump C
49. RB510	Reactor Building Room 510, located on the 283' elevation
50. RB511	Reactor Building Room 511, located on the 283' elevation
51. RB522	Reactor Building Room 522, located on the 296' elevation
52. RB599	Reactor Building Room 599, located on the 283' elevation
53. RB602	Reactor Building Room 602, located on the 313' elevation
54. RC	Reactor Containment
55. RCIC	RCIC Pump Room, located on the 177' elevation of the Reactor Building
56. RW191	Radwaste Building - 191' elevation
57. SP	Suppression Pool
58. SPPH1	Spray Pond Pump House Unit 1

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

Codes	Descriptions
60. STMTNL	Steam Tunnel Reactor Building
61. TB200	Turbine Building - 200' elevation
62. TSFP	Spent fuel pool operating floor, located on the 352' elevation of the Reactor Building

Table 4-2. Partial Listing of Components by Location at Limerick 1

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
4KVD11	EP	CB-11	CB
4KVD11	EP	BUS-D11	BUS
4KVD11	EP	PANEL-A1	PNL
4KVD11	EP	BUS-Y101	BUS
4KVD11	EP	TR-X106	TRAN
4KVD12	EP	CB-12	CB
4KVD12	EP	BUS-D12	BUS
4KVD12	EP	BUS-Y102	BUS
4KVD12	EP	TR-X107	TRAN
4KVD13	EP	CB-13	CB
4KVD13	EP	BUS-D13	BUS
4KVD13	EP	PANEL-C1	PNL
4KVD13	EP	BUS-Y103	BUS
4KVD13	EP	TR-X108	TRAN
4KVD14	EP	CB-14	CB
4KVD14	EP	BUS-D14	BUS
4KVD14	EP	BUS-Y104	BUS
4KVD14	EP	TR-X109	TRAN
ACSVRM	ECCS	CS-5	MOV
ACSVRM	ECCS	CS-4A	MOV
BCSVRM	ECCS	CS-4B	MOV
BCSVRM	ECCS	CS-37	MOV
BCSVRM	ECCS	HPI-6	MOV
BCSVRM	ECCS	LPCI-16B	MOV
BCSVRM	ECCS	LPCI-21B	MOV
BCSVRM	ECCS	LPCI-16B	MOV
BCSVRM	ECCS	LPCI-21B	MOV
CSA	ECCS	CS-1A	MOV
CSA	ECCS	CS-PA	MDP
CSB	ECCS	CS-1B	MOV

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
CSB	ECCS	CS-PB	MDP
CSC	ECCS	CS-1C	MOV
CSC	ECCS	CS-PC	MDP
CSD	ECCS	CS-1D	MOV
CSD	ECCS	CS-PD	MDP
CSR	EP	PANEL-B1	PNL
CST	ECCS	RCIC-CST	TANK
CST	RCIC	RCIC-CST	TANK
CSTVP	ECCS	RCIC-124	MOV
CSTVP	ECCS	RCIC-125	MOV
CSTVP	RCIC	RCIC-124	MOV
CSTVP	RCIC	RCIC-125	MOV
DCA	EP	BUS-A	BUS
DCA	EP	BATT-A	BATT
DCA	EP	BC-A	BC
DCA	EP	BUS-A	BUS
DCB	EP	BUS-B	BUS
DCB	EP	BATT-B	BATT
DCB	EP	BC-B	BC
DCB	EP	BUS-B	BUS
DCC	EP	BUS-C	BUS
DCC	EP	BATT-C	BATT
DCC	EP	BC-C	BC
DCC	EP	BUS-C	BUS
DCD	EP	BUS-D	BUS
DCD	EP	BATT-D	BATT
DCD	EP	BUS-D	BUS
DGA	EP	DG-11	DG
DGA	EP	MCC-114DG	MCC
DGA	ESW	ESW-134A	MOV

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
DGA	ESW	ESW-133A	MOV
DGA	ESW	ESW-132A	MOV
DGA	ESW	ESW-131A	MOV
DGB	EP	DG-12	DG
DGB	EP	MCC-124DG	MCC
DGB	ESW	ESW-1[illegible]4B	MOV
DGB	ESW	ESW-133B	MOV
DGB	ESW	ESW-132B	MOV
DGB	ESW	ESW-131B	MOV
DGC	EP	DG-13	DG
DGC	EP	MCC-134DG	MCC
DGC	ESW	ESW-134C	MOV
DGC	ESW	ESW-133C	MOV
DGC	ESW	ESW-132C	MOV
DGC	ESW	ESW-131C	MOV
DGD	EP	DG-14	DG
DGD	EP	MCC-144DG	MCC
DGD	ESW	ESW-134D	MOV
DGD	ESW	ESW-133D	MOV
DGD	ESW	ESW-132D	MOV
DGD	ESW	ESW-131D	MOV
HPIC	ECCS	HPI-42	MOV
HPIC	ECCS	HPI-41	MOV
HPIC	ECCS	HPI-1	MOV
HPIC	ECCS	HPI-4	MOV
HPIC	ECCS	HPI-P1	TDP
HPIC	ECCS	HPI-12	MOV
HPIC	ECCS	HPI-72	MOV
HPIC	ECCS	HPI-59	MOV
RB102	ECCS	LPCI-4A	MOV

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RB102	ECCS	LPCI-PA	MDP
RB102	ECCS	LPCI-4C	MOV
RB102	ECCS	LPCI-PC	MDP
RB102	ECCS	LPCI-HXA	HX
RB102	RHRSW	RSW-68A	MOV
RB102	RHRSW	RSW-14A	MOV
RB103	ECCS	LPCI-4B	MOV
RB103	ECCS	LPCI-PB	MDP
RB103	ECCS	LPCI-PD	MDP
RB103	ECCS	LPCI-4D	MOV
RB103	ECCS	LPCI-HXB	HX
RB103	RHRSW	RSW-68B	MOV
RB103	RHRSW	RSW-14B	MOV
RB200	ECCS	HPI-7	MOV
RB200	ECCS	HPI-8	MOV
RB200	ECCS	HPI-11	MOV
RB200	EP	MCC-134RH	MCC
RB200	RCIC	RCIC-22	MOV
RB200	RCIC	RCIC-12	MOV
RB202	ESW	ESW-15A	MOV
RB202	ESW	ESW-11A	MOV
RB202	ESW	ESW-15B	MOV
RB202	ESW	ESW-11B	MOV
RB203	ECCS	LPCI-3A	MOV
RB203	ECCS	LPCI-51A	NV
RB203	ECCS	LPCI-HXA	HX
RB204	ECCS	LPCI-3B	MOV
RB204	ECCS	LPCI-51B	NV
RB204	ECCS	LPCI-HXB	HX
RB207	EP	MCC-144RH	MCC

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RB304	ECCS	CS-15A	MOV
RB304	ECCS	CS-15B	MOV
RB304	ECCS	LPCI-27A	MOV
RB304	ECCS	LPCI-24A	MOV
RB304	ECCS	LPCI-125A	MOV
RB304	ECCS	LPCI-27B	MOV
RB304	ECCS	LPCI-24B	MOV
RB304	ECCS	LPCI-125B	MOV
RB304	ECCS	LPCI-10A	MOV
RB304	ECCS	LPCI-10B	MOV
RB304	ECCS	LPCI-27A	MOV
RB304	ECCS	LPCI-24A	MOV
RB304	ECCS	LPCI-27B	MOV
RB304	ECCS	LPCI-125B	MOV
RB304	ECCS	LPCI-24B	MOV
RB304	ECCS	LPCI-125A	MOV
RB304	EP	MCC-1DB-2	MCC
RB304	EP	MCC-1DA	MCC
RB304	EP	MCC-114RG	MCC
RB304	EP	MCC-124RG	MCC
RB309	ECCS	LPCI-48A	MOV
RB309	ECCS	LPCI-15A	MOV
RB309	ECCS	LPCI-182A	MOV
RB309	ECCS	LPCI-47A	MOV
RB309	ECCS	LPCI-15B	MOV
RB309	ECCS	LPCI-48B	MOV
RB309	ECCS	LPCI-182B	MOV
RB309	ECCS	LPCI-47B	MOV
RB309	ECCS	HPI-3	MOV
RB309	ECCS	LPCI-52A	MOV

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RB309	ECCS	LPCI-52B	MOV
RB309	ECCS	LPCI-48A	MOV
RB309	ECCS	LPCI-48B	MOV
RB309	ECCS	LPCI-47A	MOV
RB309	ECCS	LPCI-47B	MOV
RB309	RCIC	RCIC-8	MOV
RB309	RCS	RCS-8	MOV
RB309	RCS	RCIC-8	MOV
RB309	RCS	HPI-3	MOV
RB402	EP	MCC-134RE	MCC
RB402	EP	TR-134	TRAN
RB402	EP	BUS-D134	BUS
RB402	EP	MCC-144RE	MCC
RB501	ECCS	LPCI-21A	MOV
RB501	ECCS	LPCI-16A	MOV
RB501	ECCS	LPCI-21A	MOV
RB501	ECCS	LPCI-16A	MOV
RB506	EP	TR-144	TRAN
RB506	EP	BUS-D144	BUS
RB506	EP	MCC-114RC	MCC
RB506	EP	MCC-124RC	MCC
RB510	ECCS	LPCI-17A	MOV
RB510	ECCS	LPCI-17C	MOV
RB510	ECCS	LPCI-17C	MOV
RB522	RCS	RCS-4	MOV
RB599	ECCS	LPCI-17B	MOV
RB599	ECCS	LPCI-17D	MOV
RB599	ECCS	LPCI-17D	MOV
RB602	EP	TR-114	TRAN
RB602	EP	BUS-D114	BUS

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RB602	EP	TR-124	TRAN
RB602	EP	BUS-D124	BUS
RC	ECCS	RCS-13E	SRV
RC	ECCS	RCS-RV	RV
RC	ECCS	RCS-RV	RV
RC	ECCS	RCS-RV	RV
RC	ECCS	RCS-RV	RV
RC	ECCS	RCS-RV	RV
RC	ECCS	RCS-RV	RV
RC	ECCS	HPI-2	MOV
RC	ECCS	FW-11A	MOV
RC	ECCS	RCS-RV	RV
RC	ECCS	RCS-13E	SRV
RC	ECCS	RCS-13H	SRV
RC	ECCS	RCS-13H	SRV
RC	ECCS	RCS-13K	SRV
RC	ECCS	RCS-13K	SRV
RC	ECCS	RCS-13M	SRV
RC	ECCS	RCS-13M	SRV
RC	ECCS	RCS-13S	SRV
RC	ECCS	RCS-13S	SRV
RC	RCIC	RCS-RV	RV
RC	RCIC	FW-11B	MOV
RC	RCIC	RCIC-7	MOV
RC	RCS	RCS-22A	NV
RC	RCS	RCS-13E	SRV
RC	RCS	RCS-9	MOV
RC	RCS	RCS-RV	RV
RC	RCS	RCS-16	MOV
RC	RCS	RCIC-7	MOV

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	RCS	RCS-1	MOV
RC	RCS	[illegible]	MOV
RC	RCS	R[illegible]-22B	NV
RC	RCS	RCS-22C	NV
RC	RCS	RCS-22D	NV
RC	RCS	RCS-13E	SRV
RC	RCS	RCS-13H	SRV
RC	RCS	RCS-13H	SRV
RC	RCS	RCS-13K	SRV
RC	RCS	RCS-13K	SRV
RC	RCS	RCS-13M	SRV
RC	[illegible]	RCS-13M	SRV
RC	RCS	RCS-13S	SRV
RC	RCS	RCS-13S	SRV
RCIC	RCIC	RCIC-29	MOV
RCIC	RCIC	RCIC-31	MOV
RCIC	RCIC	RCIC-10	MOV
RCIC	RCIC	RCIC-P1	TDP
RCIC	RCIC	RCIC-112	MOV
RCIC	RCIC	RCIC-45	MOV
RCIC	RCIC	RCIC-19	MOV
RCIC	RCIC	RCIC-60	MOV
RCIC	RCIC	RCIC-46	MOV
SP	ECCS	LPCI-SP	TANK
SP	ECCS	LPCI-SP	TANK
SP	ECCS	LPCI-SP	TANK
SP	ECCS	LPCI-SP	TANK
SP	ECCS	LPCI-SP	TANK
SP	ECCS	LPCI-SP	TANK
SP	ECCS	LPCI-SP	TANK

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
[illegible]	RCIC	LPCI-SP	TANK
SPPH1	EP	MCC-114SL	MCC
SPPH1	EP	MCC-134SL	MCC
SPPH1	ESW	ESW-PA	MDP
SPPH1	ESW	ESW-PC	MDP
SPPH1	ESW	RSW-32A	MOV
SPPH1	ESW	RSW-32C	MOV
SPPH1	ESW	RSW-31A	MOV
SPPH1	ESW	RSW-31C	MOV
SPPH1	RHRSW	RSW-PA	MDP
SPPH1	RHRSW	RSW-31A	MOV
SPPH1	RHRSW	RSW-31C	MOV
SPPH1	RHRSW	RSW-32A	MOV
SPPH1	RHRSW	RSW-32C	MOV
SPPH2	EP	MCC-124SL	MCC
SPPH2	EP	MCC-144SL	MCC
SPPH2	ESW	ESW-PB	MDP
SPPH2	ESW	ESW-PD	MDP
SPPH2	ESW	RSW-32B	MOV
SPPH2	ESW	RSW-32D	MOV
SPPH2	ESW	RSW-31B	MOV
SPPH2	ESW	RSW-31D	MOV
SPPH2	RHRSW	RSW-PB	MDP
SPPH2	RHRSW	RSW-31B	MOV
SPPH2	RHRSW	RSW-31D	MOV
SPPH2	RHRSW	RSW-32B	MOV
SPPH2	RHRSW	RSW-32D	MOV
STMTNL	ECCS	HPI-105	MOV
STMTNL	RCIC	RCIC-13	MOV
STMTNL	RCS	RCS-28A	NV

Table 4-2. Partial Listing of Components by Location at Limerick 1 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
STMTNL	RCS	RCS-19	MOV
STMTNL	RCS	RCS-28B	NV
STMTNL	RCS	RCS-28C	NV
STMTNL	RCS	RCS-28D	NV

5. BIBLIOGRAPHY FOR LIMERICK 1 AND 2

1. NUREG-0974, "Draft Environmental Statement Related to the Operation of Limerick Generating Station. Units 1 and 2," USNRC, June 1983.

2. NUREG-0991, "Safety Evaluation Report Related to the Operation of Limerick Generating Station, Units 1 and 2," USNRC, August 1983.

3. NUREG-1068, "Review Insights on the Probabilistic Risk Assessment for the Limerick Generating Station," USNRC, August 1984.

4. NUREG-1149, "Technical Specification for Limerick Generating Station, Unit No. 1," USNRC.

5. NUREG/CR-3028, "A Review of the Limerick Generating Station Probabilistic Risk Assessment," Brookhaven National Laboratory, February 1983.

6. NUREG/CR-3493, "A Review of the Limerick Generating Station Severe Accident Risk Assessment - Review of Core Melt Frequency," Brookhaven National Laboratory, July 1984.

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 1975 (Vol. 4)

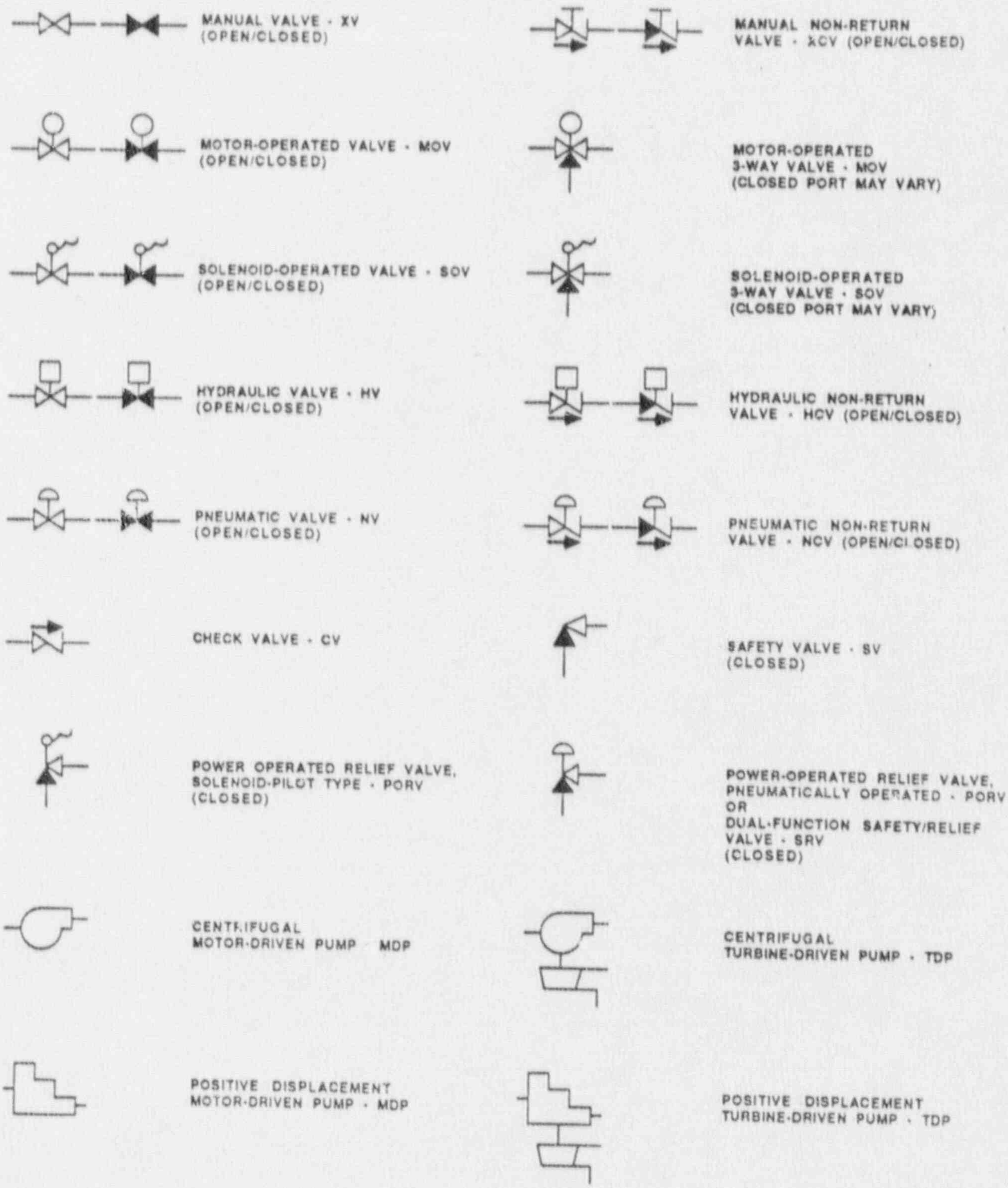

Figure A-1. Key To Symbols In Fluid System Drawings

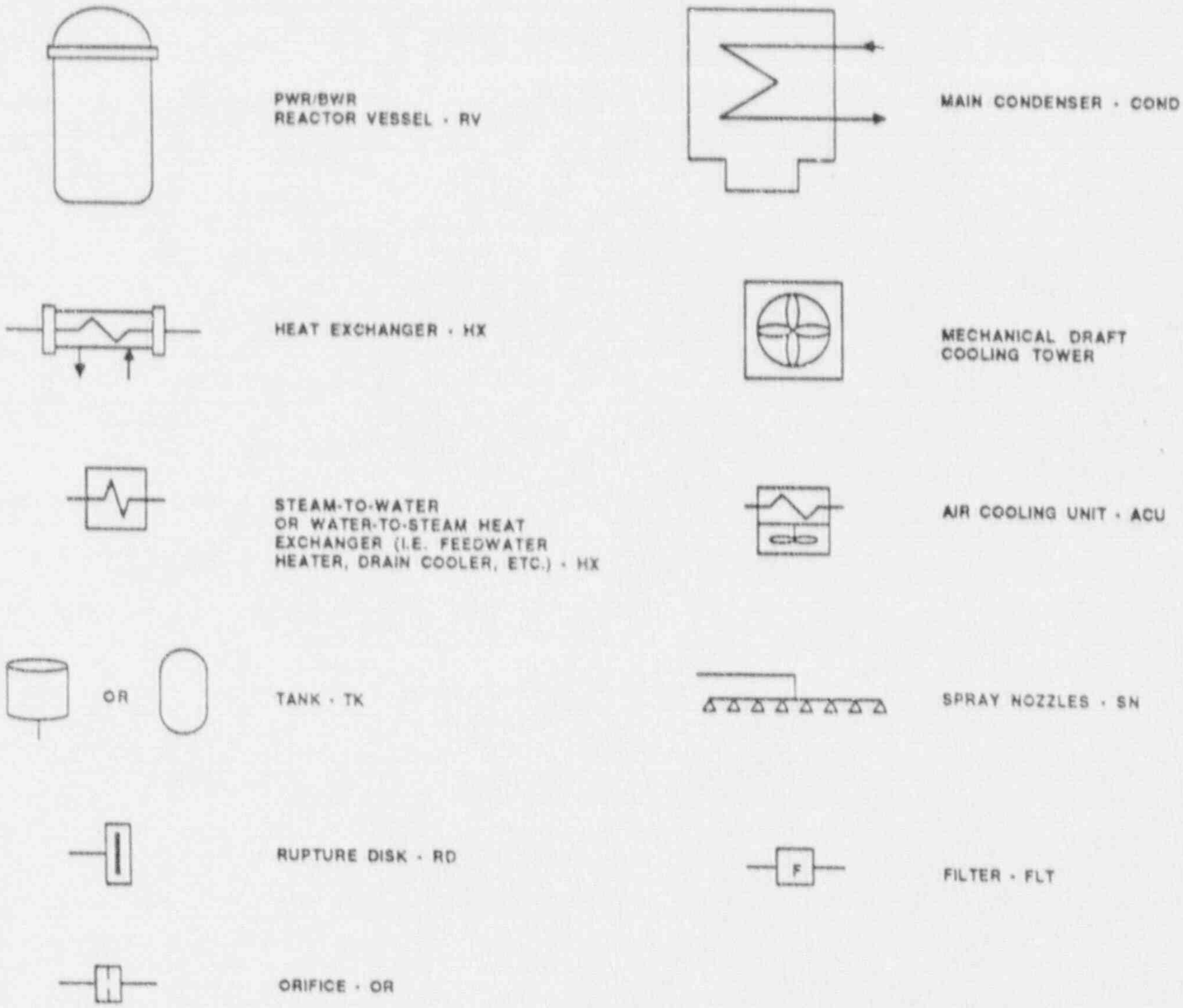

Figure A-1. Key To Symbols In Fluid System Drawings
(Continued)

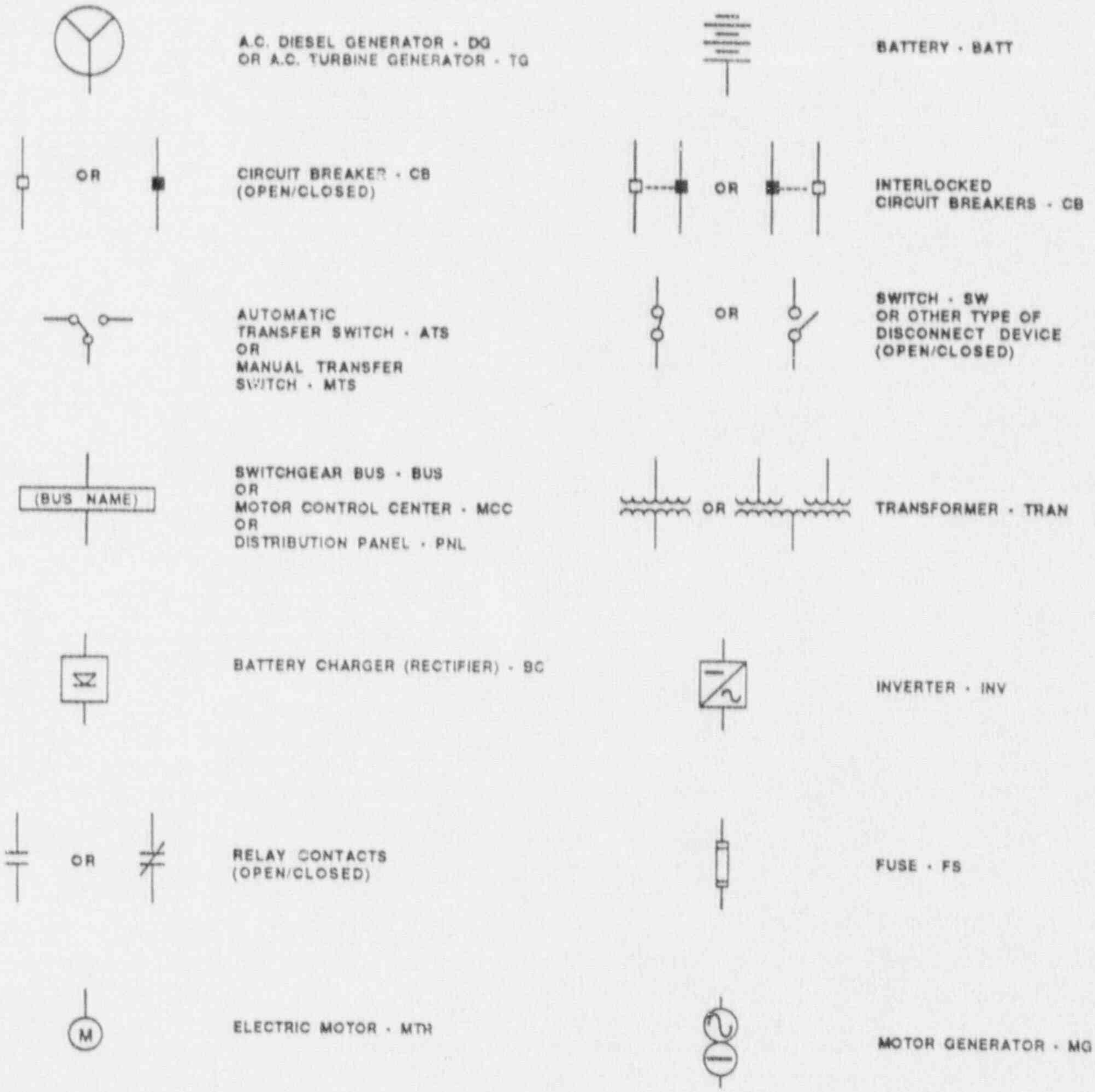

Figure A-2. Key To Symbols In Electrical System Drawings

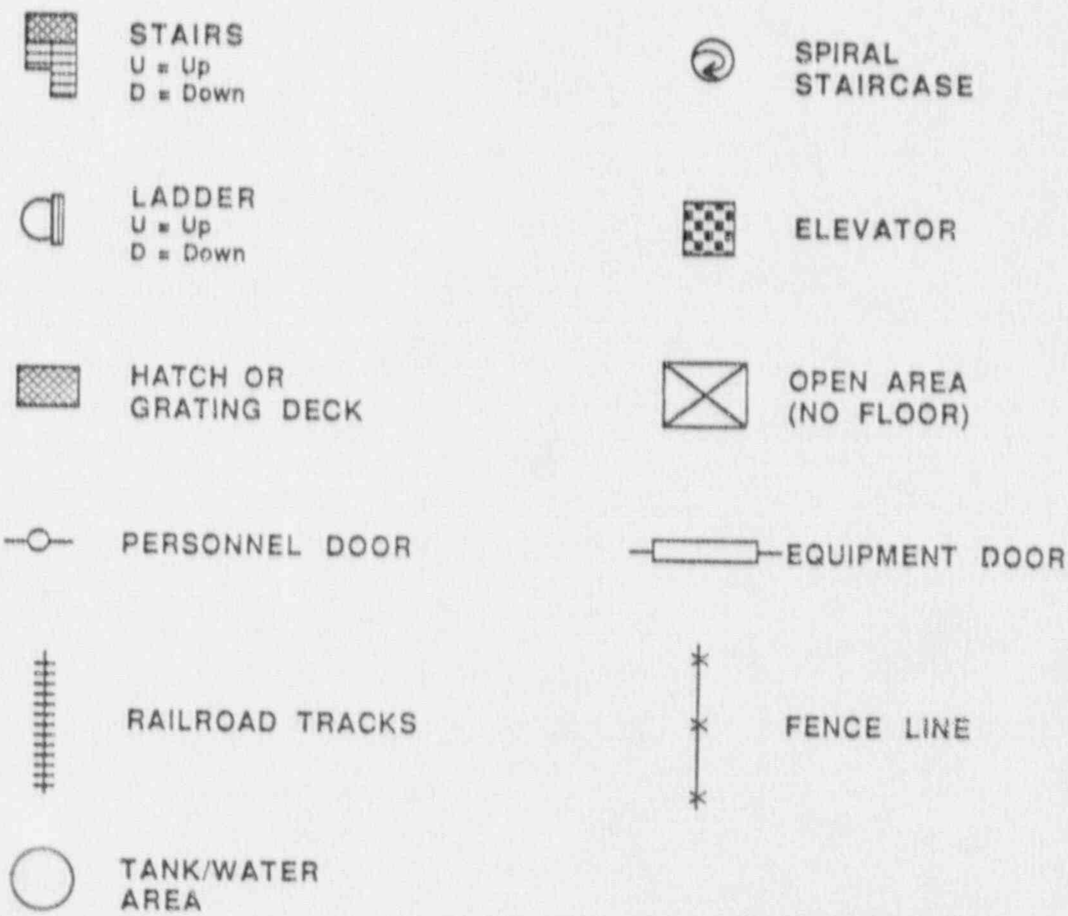

Figure A-3. Key To Symbols In Facility Layout Drawings

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
RCIC	Reactor Core Isolation Cooling System
ECCS	Emergency Core Cooling Systems (including HPCI, LPCI, CS and ADS)
EP	Electric Power System
ESW	Emergency Service Water System
RHRSW	RHR 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 or 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