NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

INDIAN POINT 3

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INDIAN POINT 3

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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.

INDIAN POINT 3
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	9/89	Original report

INDIAN POINT 3 SYSTEM SOURCEBOOK

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

1. SUMMARY DATA ON PLANT

Basic information on the Indian Point 3 nuclear power plant is listed below:

- Docket number	50-286
- Operator	New York Power Authority
- Location	New York, 24 miles north of New York City
- Commercial operation date	8/76
- Reactor type	PWR
- NSSS vendor	Westinghouse
- Number of loops	4
- Power (MWt/MWe)	3025/965
- Architect-engineer	United Engineers & Constructors
- Containment type	Reinforced concrete cylinder with steel liner

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

The Indian Point 3 plant has a Westinghouse PWR four-loop nuclear steam supply system (NSSS) and a dry containment. Other four-loop Westinghouse plants in the United States include:

- Braidwood 1 and 2
- Byron 1 and 2
- Callaway
- Catawba 1 and 2
- Comanche Peak 1 and 2
- Donald C. Cook 1 and 2 (ice condenser containment)
- Diablo Canyon 1 and 2
- Haddam Neck
- Indian Point 2
- McGuire 1 and 2 (ice condenser containment)
- Millstone 3
- Salem 1 and 2
- Seabrook 1
- Sequoyah 1 and 2 (ice condenser containment)
- Shearon Harris
- South Texas 1 and 2
- Trojan
- Vogtle 1 and 2
- Watts Bar 1 and 2
- Wolf Creek
- Yankee Rowe
- Zion 1 and 2

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at Indian Point 3 in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at Indian Point 3 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 Indian Point 3 Systems Covered in this Report

Generic System Name	Plant-Specific System Name	Report Section	USAR Section Reference
Reactor Heat Removal Systems			
- Reactor Coolant System (RCS)	Same	3.1	4
- Auxiliary Feedwater (AFW) and Secondary Steam Relief (SSR) Systems	Same	3.2	10.2.6
- Emergency Core Cooling Systems (ECCS)			
- High-Pressure Injection & Recirculation	Safety Injection System	3.3	6.2
- Low-pressure Injection & Recirculation	Residual Heat Removal System (Recirculation System)	3.3	6.2
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Residual Heat Removal System (part of Auxiliary Coolant System)	3.3	6.2, 9.3
- Main Steam and Power Conversion Systems	Main Steam Supply System, Circulating Water System, Condensate and Feedwater System	X	10
- Other Heat Removal Systems	None identified	-	-
Reactor Coolant Inventory Control Systems			
- Chemical and Volume Control System (CVCS) (Charging System)	Same	3.9	9.2
- ECCS	See ECCS, above	-	-

Table 3-1. Summary of Indian Point 3 Systems Covered in this Report (Continued)

Generic System Name	Plant-Specific System Name	Report Section	USAR Section Reference
Containment Systems			
- Containment	Same	X	5
- Containment Heat Removal Systems			
- Containment Spray System	Same	3.4	6.3
- Containment Fan Cooler System	Containment Air Recirculation Cooling and Filtration System	3.4	5.3, 6.4
- Containment Normal Ventilation Systems	Containment Ventilation System	X	5.3
- Combustible Gas Control Systems	Hydrogen Recombination System, Post-Accident Containment Venting System	X	5.4, 6.8
Reactor and Reactivity Control Systems			
- Reactor Core	Same	X	3
- Control Rod System	Rod Control	X	3, 7.3.2
- Boration Systems	See CVCS, above	-	-
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Reactor Protective System	3.5	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Engineered Safety Features Protection Systems	3.5	7.2
- Remote Shutdown System	Emergency Shutdown Control	3.5	7.7.3, 7.7.4

Table 3-1. Summary of Indian Point 3 Systems Covered in this Report (Continued)

Generic System Name	Plant-Specific System Name	Report Section	USAR Section Reference
Instrumentation & Control (I&C) Systems (continued)			
- Other I&C Systems	Various systems	X	7.3, 7.4, 7.5, 7.6, 7.7
Support Systems			
- Class 1E Electric Power System	Same	3.6	8.2
- Non-Class 1E Electric Power System	Same	3.6	8.2
- Diesel Generator Auxiliary Systems	Same	3.6	8.2.3
- Component Cooling Water (CCW) System	Component Cooling System (part of Auxiliary Coolant System)	3.7	9.3
- Service Water System (SWS)	Same	3.8	9.6.1.
- Other Cooling Water Systems	Spent Fuel Pit Cooling System (part of Auxiliary Coolant System)	X	9.3
- Fire Protection Systems	Same	X	9.6.2
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Air Conditioning, Heating and Ventilation Systems	X	9.8, 9.9
- Instrument and Service Air Systems	Compressed Air System	X	9.6.3
- Refueling and Spent Fuel Systems	Fuel Handling System	X	9.5
- Radioactive Waste Systems	Waste Disposal System	X	11.1
- Radiation Protection Systems	Same	X	11.2

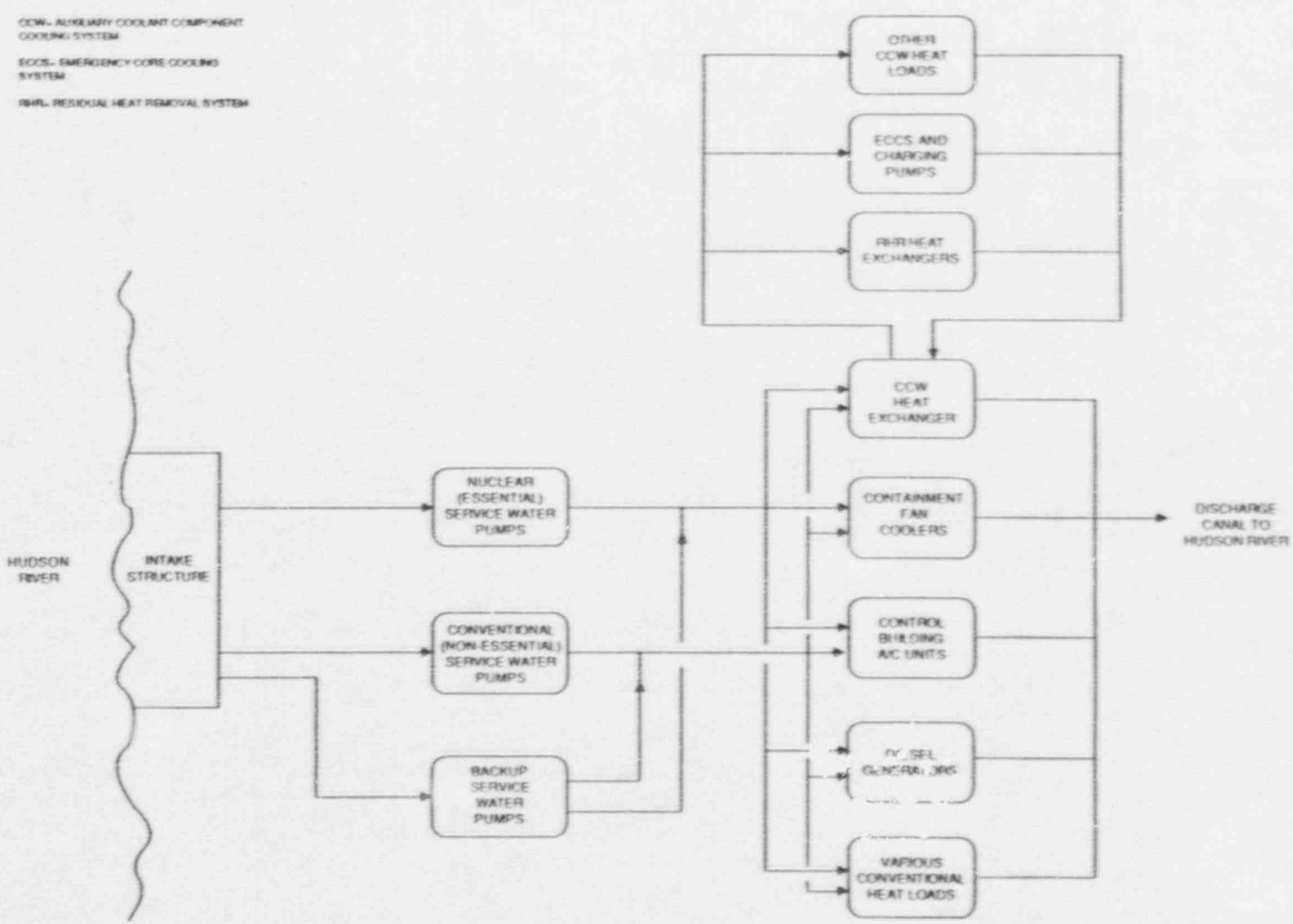

Figure 3-1. Cooling Water Systems Functional Diagram for Indian Point 3

3.1 REACTOR COOLANT SYSTEM (RCS)

3.1.1 System Function

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

3.1.2 System Definition

The RCS includes: (a) the reactor vessel, (b) main coolant loops, (c) main coolant pumps, (d) the primary side of the steam generators, (e) pressurizer, and (f) connected piping out to a suitable isolation valve boundary. An isometric drawing of a 4-loop Westinghouse RCS is shown in Figure 3.1-1. A simplified diagram of the RCS and important system interfaces is shown in Figure 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 main coolant pump in each of the four main coolant loops. RCS pressure is maintained within a prescribed band by the combined action of pressurizer heaters and pressurizer spray. RCS coolant inventory is measured by pressurizer water level which is maintained within a prescribed band by the chemical and volume control system (charging system).

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

Following a transient or small LOCA (if RCS inventory is maintained), reactor core heat is still transferred to secondary coolant in the steam generators. Flow in the RCS is maintained by the main coolant pumps or by natural circulation. The heat transfer path to the ultimate heat sink can be established by using the secondary steam relief system (see Section 3.2) to vent main steam to atmosphere when the power conversion and circulating water systems are not available. If reactor core heat removal by this alternate path is not adequate, the RCS pressure will increase and a heat balance will be established in the RCS by venting steam or reactor coolant to the containment through the pressurizer relief valves. There are two power-operated relief valves and three safety valves on the pressurizer. A continued inability to establish adequate heat transfer to the steam generators will result in a LOCA-like condition (i.e., continuing loss of reactor coolant through the pressurizer relief valves). Repeated cycling of these relief valves has resulted in valve failure (i.e., relief valve stuck open).

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

3.1.4 System Success Criteria

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

- An unmitigatible LOCA is not initiated.
- If a mitigatible LOCA is initiated, then LOCA mitigating systems are successful.
- If a transient is initiated, then either:
  - RCS integrity is maintained and transient mitigating systems are successful, or
  - RCS integrity is not maintained, leading to a LOCA-like condition (i.e. stuck-open safety or relief valve, reactor coolant pump seal failure), and LOCA mitigating systems are successful.

3.1.5 Component Information

A. RCS
   1. Volume: 12032 ft3, including pressurizer
   2. Normal operating pressure: 2250 psia

B. Pressurizer
   1. Volume: 1800 ft3

C. Safety Valves (3)
   1. Set pressure: 2485 psig
   2. Relief capacity: 420,000 lb/hr each

D. Power-Operated Relief Valves (2)
   1. Set pressure: 2335 psig
   2. Relief capacity: 238,000 lb/hr each

E. Steam Generators
   1. Type: U-Tube
   2. Model: Westinghouse 44 Series
   3. Primary-side volume: 944 ft3

F. Pressurizer Heaters
   1. Capacity: 1800 kW
   2. Heatup rate of pressurizer using heaters only: 55°F/hr (approx.)

3.1.6 Support Systems and Interfaces

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

B. Main Coolant Pump Seal Injection Water System
The chemical and volume control system supplies seal water to cool the main coolant pump shaft seals and to maintain a controlled inleakage of seal water into the RCS. Loss of seal water flow may result in RCS leakage through the pump shaft seals which will resemble a small LOCA.

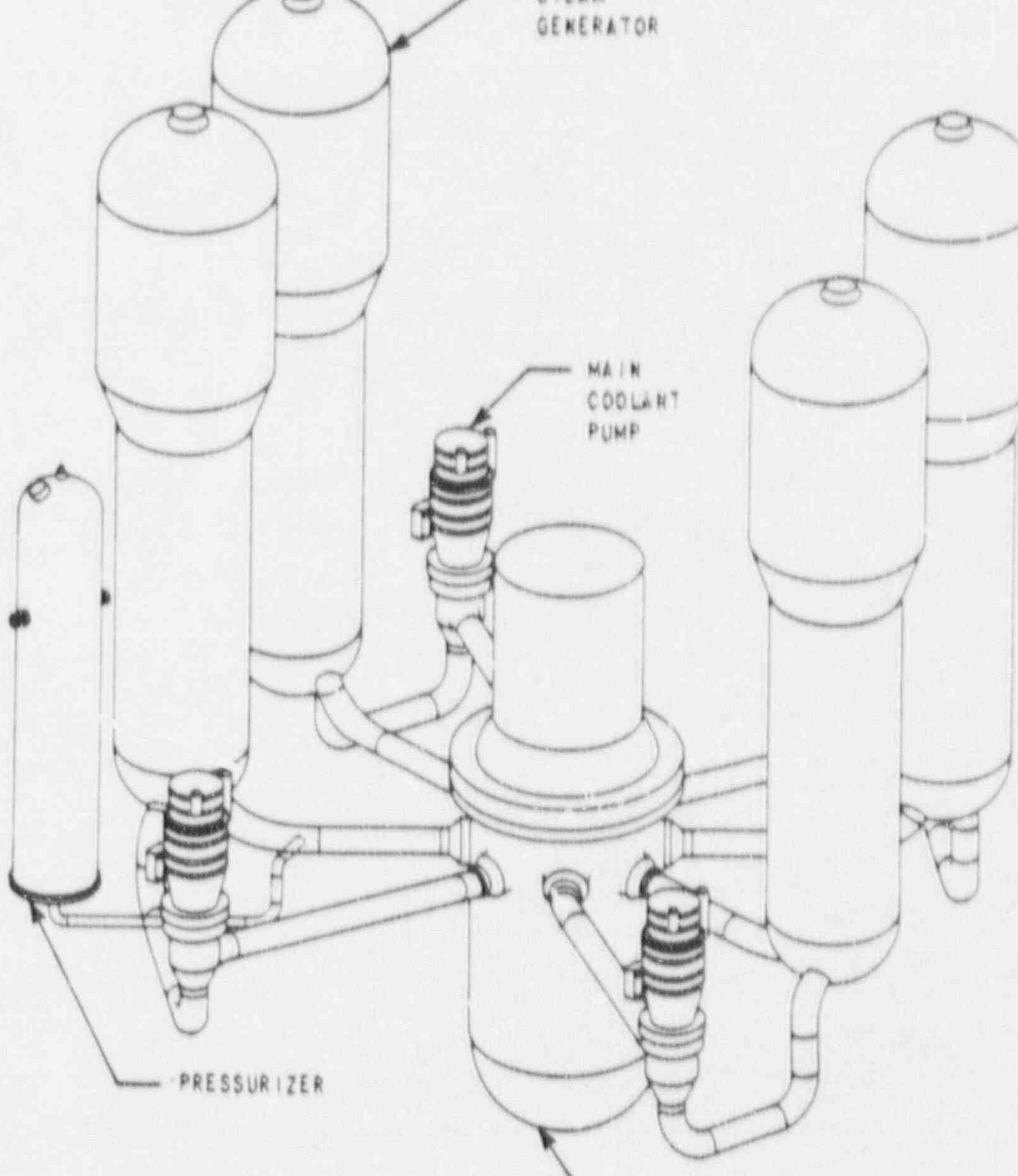

Figure 3.1-1. Isometric View of a 4-Loop Westinghouse RCS.

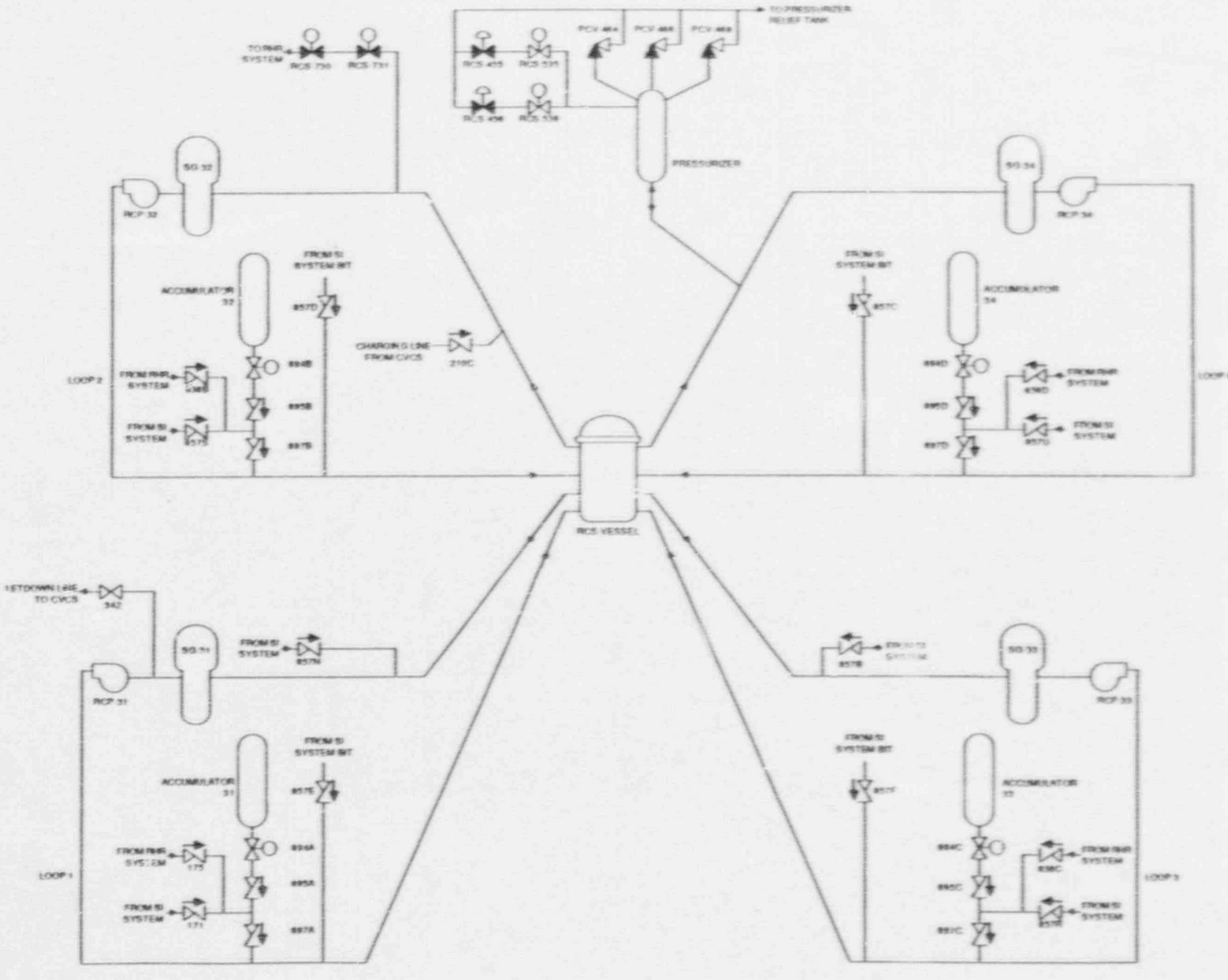

Figure 3.1-2. Indian Point 3 Reactor Coolant System

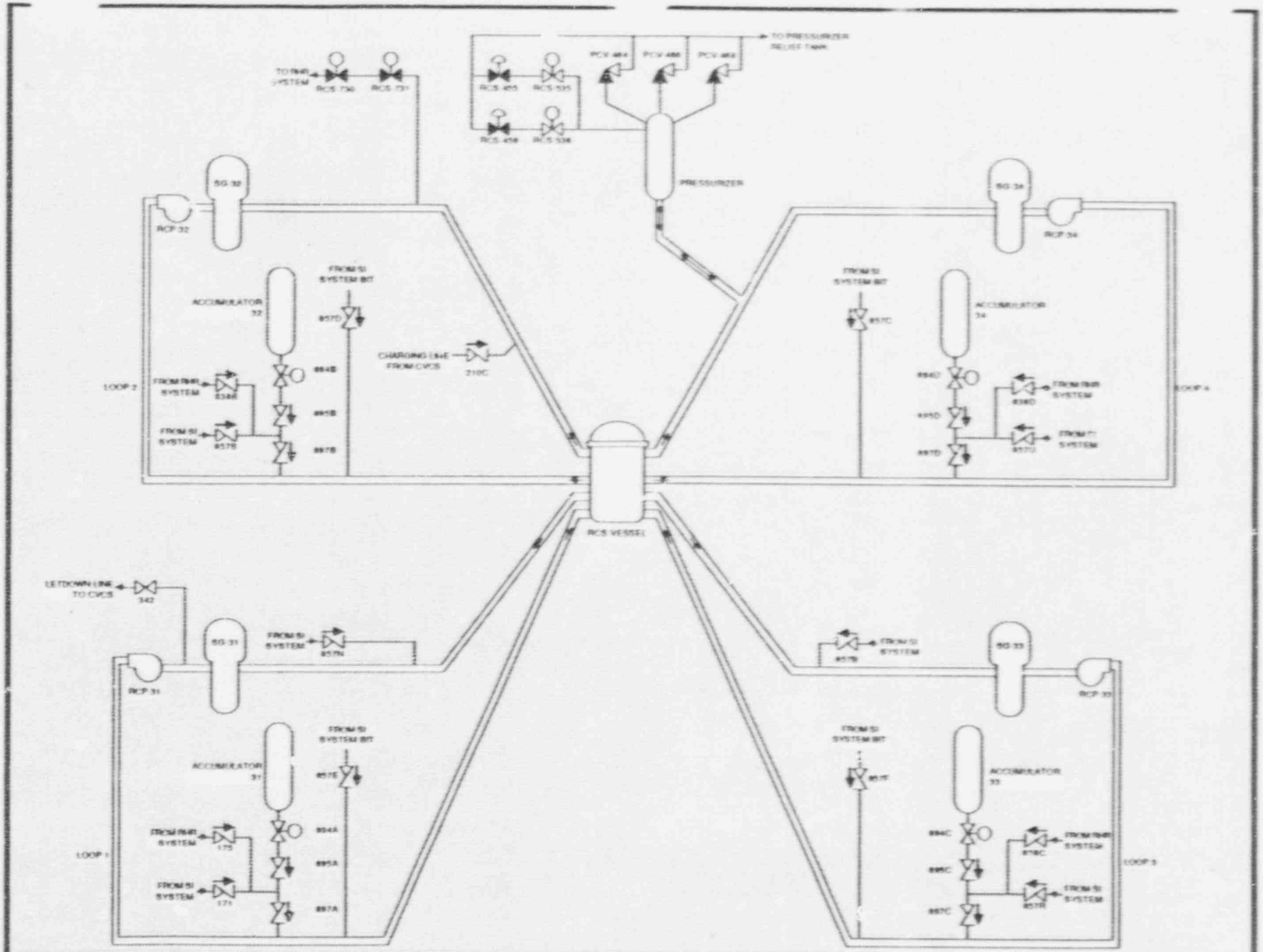

Figure 3.1-3. Indian Point 3 Reactor Coolant System Showing Component Locations

Table 3.1-1. Indian Point 3 Reactor Coolant System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
RCS-456	NV	RC				
RCS-535	MOV	RC	MCC36B	480	55PAB	AC/5A
RCS-536	MOV	RC	MCC36A	480	55PAB	AC/5A
RCS-730	MOV	RC	MCC36A	480	55PAB	AC/5A
RCS-731	MOV	RC	MCC36B	480	55PAB	AC/6A
RCS-VESSEL	RV	RC				
RSC-455	NV	RC				

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

3.2.1 System Function

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

3.2.2 System Definition

The AFW system consists of two motor-driven pumps and one steam turbine-driven pump. Each pump draws suction on the condensate storage tank (CST). A backup source of water is the city water tank, which is shared with Unit 2. The AFW long-term source of water is the offsite city water supply system. Each motor-driven pump supplies two of four steam generators, while the turbine-driven pump supplies all four steam generators. The turbine-driven pump receives its steam supply from two steam generators and exhausts to the atmosphere.

The SSR system includes five safety valves and one power-operated pressure control valve on each of the four main steam lines.

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

3.2.3 System Operation

During normal operation the AFW system is in standby, and is automatically actuated when needed to maintain the secondary coolant inventory in the steam generators. The system can also be manually started from the control room, and the turbine driven pump can be started and controlled locally.

Motor-driven pump 31 has discharge flow paths to steam generators SG 31 and SG 32. Motor-driven pump 33 has discharge flow paths to steam generators SG 33 and SG 34. Turbine-driven pump 32 has discharge flow paths to all four SGs. After actuation of the AFW pumps, level in the SGs is maintained manually from the control room by positioning eight flow control valves, one on each of the pump discharge flow paths. The flow control valves downstream of the turbine-driven pump are all identified as valve 405. In Figures 3.2-1 and 3.2-2 these valves have been denoted as 405A to 405D. The flow control valves downstream of the motor-driven pumps are all identified as valve 406. On Figures 3.2-1 and 3.2-2 these valves have been denoted as 406A to 406D.

The CST is the primary water source for the AFW system. The CST has a total capacity of 600,000 gallons, of which 360,000 gallons is dedicated for AFW system use. When water level in the CST reaches 360,000 gallons the tank outlet is automatically isolated from all other systems. The secondary water source is a 1.5 million gallon city water storage tank which is shared between Units 2 and 3. The city water tank can be aligned as the AFW water source from the control room.

When the main condenser is not available as a heat sink, reactor core decay heat is rejected to an ultimate heat sink by venting to atmosphere via five safety valves or a power-operated pressure control valve on each main steam line.

3.2.4 System Success Criteria

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

- Any one AFW pump can provide adequate flow.
- Water must be provided from at least one source to the AFW pump suctions. Alternative water sources include the condensate storage tank and the city water tank
- Makeup to any two of four steam generators provides adequate decay heat removal from the reactor coolant system.

The SSR system must operate to complete the heat transfer path to the environment. The number of safety valves that must open for the decay heat removal function is not known.

3.2.5 Component Information

A. Steam turbine-driven AFW pump 32
   1. Rated flow: 800 gpm @ 1350 psid
   2. Rated capacity: 100% (Ref. 1)

B. Motor-driven AFW pumps 31 and 33
   1. Rated flow: 400 gpm @ 1350 psid
   2. Rated capacity: 50% (Ref. 1)

C. Condensate storage tank
   1. Capacity: 600,000 gallons

D. Secondary steam relief valves
   1. Five safety valves per main steam line
   2. One power-operated pressu e control valve per main steam line

3.2.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic

      The AFW pumps are automatically actuated based on the following signals (Ref 1):

      a. Turbine driven pump 32
         - 2/3 low-low water level in any 2/4 SGs
         - loss of offsite power concurrent with main turbine-generator trip
      b. Motor-driven pumps 31 and 33
         - 2/3 low-low water level in any one SG
         - either main feedwater pump trip
         - safety injection signal
         - loss of offsite power concurrent with main turbine-generator trip

   2. Remote manual

      The AFW system can be actuated by remote manual means from the main control room

3. Alternate remote manual
   AFW pumps and valves can be actuated and controlled locally.

B. Motive power
   1. The AFW motor-driven pumps and motor-operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.6. Redundant loads are supplied from separate load groups.
   2. Steam supply valve AFW-1139 for the turbine-driven pump is a Class 1E DC load that can be supplied from the station batteries as described in Section 3.6. The specific battery could not be identified.
   3. The AFW turbine-driven pump is supplied with steam from two main steam lines via supply headers upstream of the main steam isolation valves.

C. Other
   1. Lubrication is assumed to be provided locally for AFW pumps, pump motors, and the turbine drive.
   2. Sources of pump and pump room cooling have not been determined.

3.2.7 Section 3.2 References

1. NUREG-0611, "Generic Evaluation of Feedwater Transients and Small Break Loss of Coolant Accidents in Westinghouse-Designed Operating Plants," Appendix X-10, "Indian Point 3 Auxiliary Feedwater System," USNRC, January 1980.

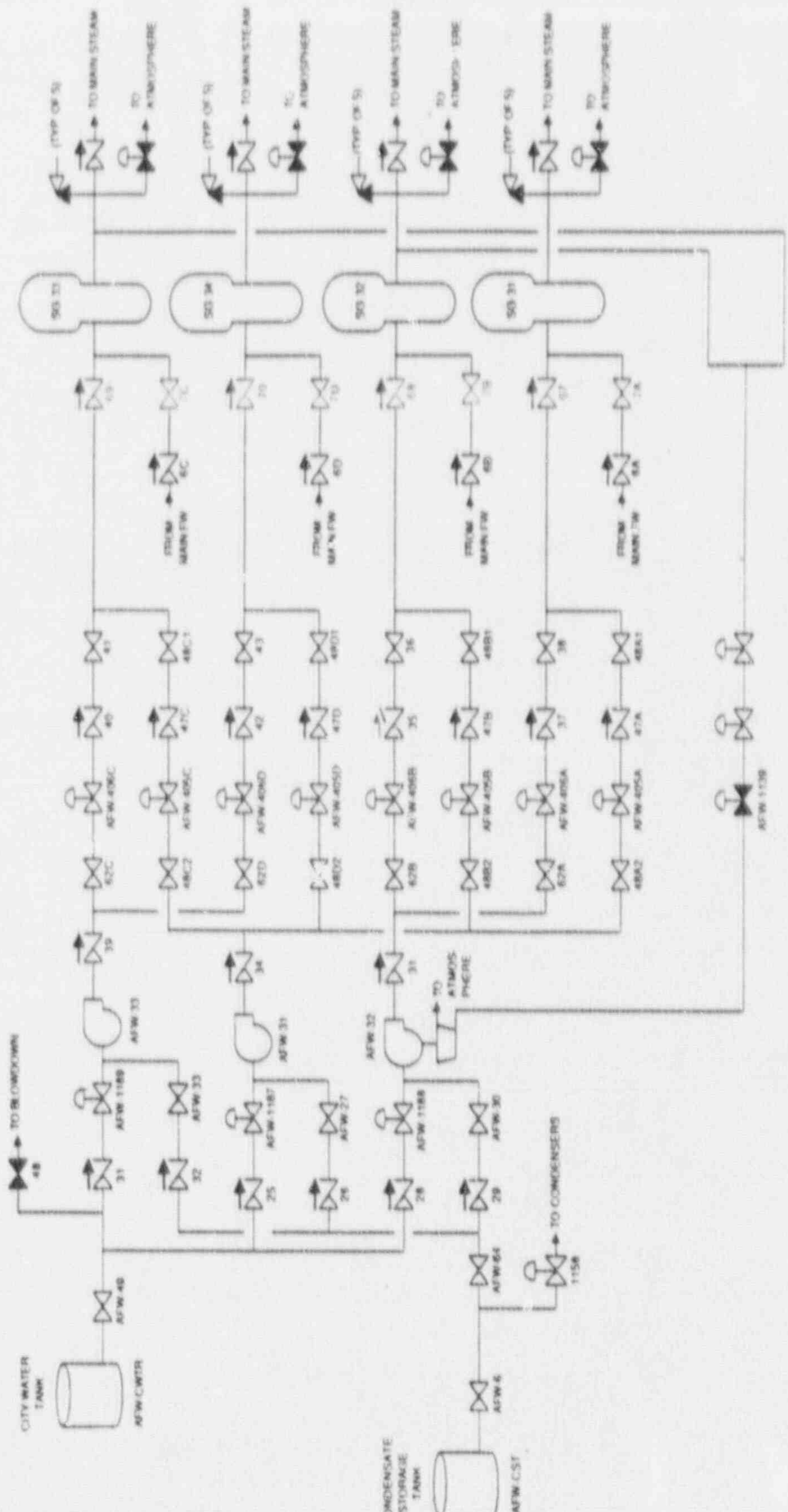

Figure 3.2-1. Indian Point 3 Auxiliary Feedwater System.

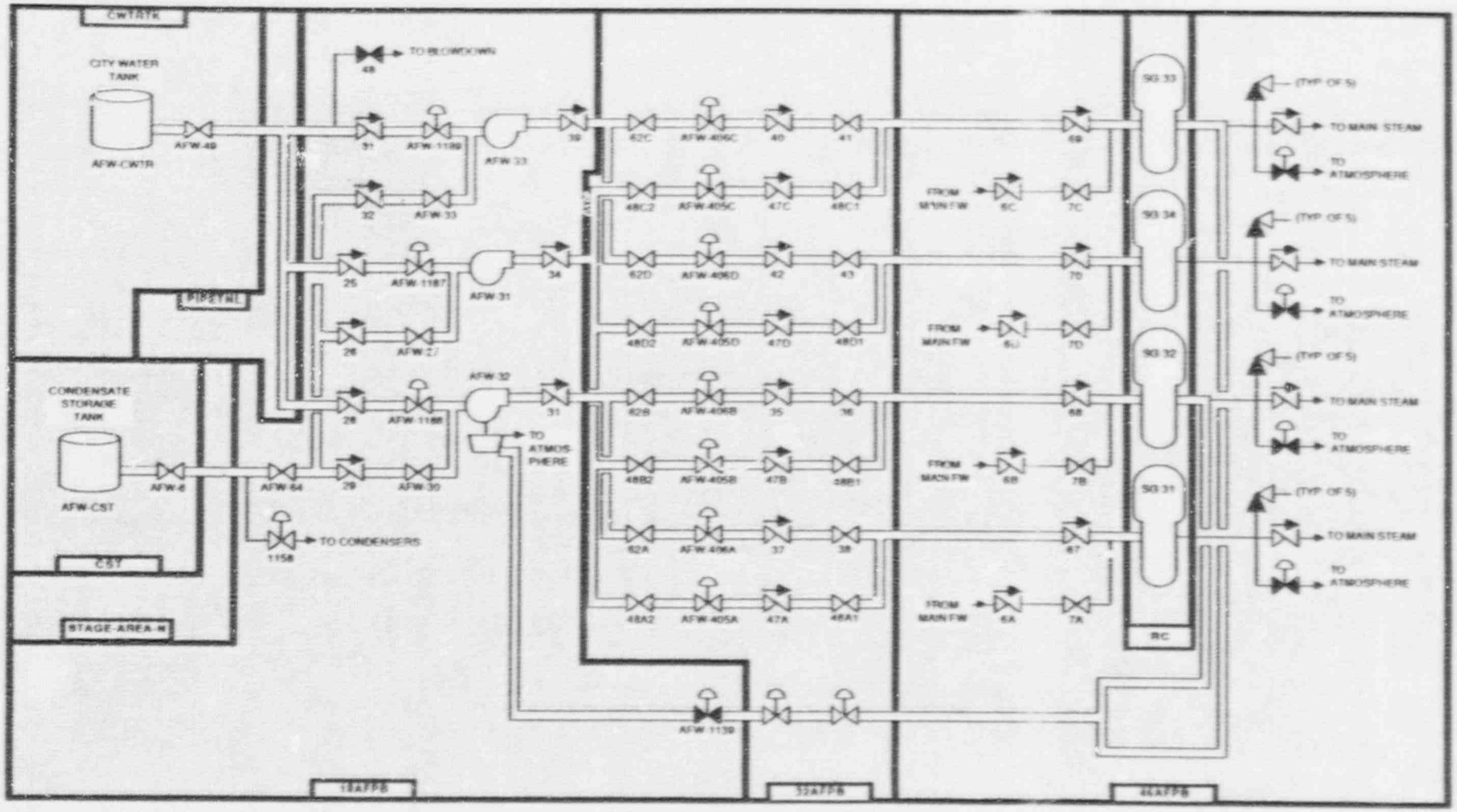

Figure 3.2-2. Indian Point 3 Auxiliary Feedwater System Showing Component Locations.

Table 3.2-1. Indian Point 3 Auxiliary Feedwater System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
AFW-1139	NV	18AFPB				
AFW-1187	NV	18AFPB				
AFW-1188	NV	18AFPB				
AFW-1189	NV	18AFPB				
AFW-27	XV	18AFPB				
AFW-30	XV	18AFPB				
AFW-31	MDP	18AFPB	BUS3A	480	15CB	AC/2A-3A
AFW-32	TDP	18AFPB				
AFW-33	MDP	18AFPB	BUS6A	480	15CB	AC/6A
AFW-33	XV	18AFPB				
AFW-405A	NV	18AFPB				
AFW-405B	NV	18AFPB				
AFW-405C	NV	18AFPB				
AFW-405D	NV	18AFPB				
AFW-406A	NV	18AFPB				
AFW-406B	NV	18AFPB				
AFW-406C	NV	18AFPB				
AFW-406D	NV	18AFPB				
AFW-49	XV	PIPETNL				
AFW-6	XV	CST				
AFW-64	XV	18AFPB				
AFW-CST	TANK	CST				
AFW-CWTR	TANK	CWTRTK				

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 coolant injection function is performed during a relatively short-term period after LOCA initiation, followed by realignment to a recirculation mode of operation to maintain long-term, post-LOCA core cooling. Heat from the reactor core is transferred to the containment. The heat transfer path to the ultimate heat sink is completed by the containment spray systems (see Section 3.4).

3.3.2 System Definition

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

- Passive accumulators
- Safety injection (SI) system
- Residual heat removal (RHR) system

The SI system provides high pressure coolant injection capability. The RHR pumps perform the low pressure injection function. The Refueling Water Storage Tank (RWST) is the water source for both the high and low pressure injection systems. Both systems inject coolant into all four RCS cold legs. The SI system can also inject into two hot legs.

After the injection phase is completed, recirculation (ECR) is performed by two recirculation pumps drawing suction from the recirculation sump inside containment and discharging into the RCS cold legs. The RHR pumps provide a backup recirculation capability from the containment sump.

Simplified drawings of the low pressure injection/recirculation system are shown in Figures 3.3-1 and 3.3-2. The high pressure injection system is shown in Figures 3.3-3 and 3.3-4. A summary of data on selected ECCS components is presented in Table 3.3-1. Interfaces between the accumulators, the ECCS injection and recirculation subsystems and the RCS are shown in Section 3.1.

3.3.3 System Operation

During normal operation, the ECCS is in standby. Following a LOCA, the four safety injection accumulators (one for each loop) will supply borated water to the RCS as soon as RCS pressure drops below accumulator pressure (i.e., about 650 psig). A safety injection signal (SIS) automatically starts the three high pressure safety injection pumps and the two RHR pumps. The SI pumps deliver borated water to two separate discharge headers. The flow from each header is injected into each of the four RCS cold legs. One header contains the Boron Injection Tank (BIT) for rapid injection of highly borated water. The SI pumps provide adequate coolant makeup following a small break which does not immediately depressurize the RCS to the accumulator discharge pressure.

For small breaks, operator action can be taken to augment the RCS depressurization by utilizing the secondary steam dump capability and the auxiliary feedwater (AFW) system (i.e., depressurization due to rapid heat transfer from the RCS).

When the RWST water level drops to a prescribed low level setpoint, the low pressure safety injection pumps are realigned to draw a suction from the containment sump and deliver water to the RCS hot legs or cold legs. If depressurization of the RCS proceeds slowly, high pressure recirculation can be accomplished by aligning the discharge of the RHR pumps to the suction of the SI pumps.

3.3.4 System Success Criteria

For large LOCA, one of two RHR pumps plus three of four SI accumulators are required for emergency coolant injection. Since RCS pressure is relatively low, a break in one RCS loop will not appreciably change the RHR flow rates being injected into the other three loops. The ECI phase is terminated before the RWST is emptied. Emergency coolant recirculation is established by at least one of two recirculation pumps. As a backup, at least one of two RHR pumps can be aligned to the containment sump to perform the ECR function.

If the four cold leg injection lines served by one SI header are intact, then flow from one SI pump is sufficient to meet makeup requirements following a small break which does not immediately depresssurize the RCS to the accumulator discharge pressure. If the small break is in an injection line, two SI pumps are required. Note that SI pump shutoff head is about 1463 psid, therefore, depressurization of the RCS must be augmented by the secondary steam relief system and the auxiliary feedwater system (see Section 3.2).

If depressurization of the RCS proceeds slowly, it is necessary to establish a high-pressure recirculation flow path with one of two recirculation pumps taking a suction on the containment sump and delivering the water to the suction of one or two SI pumps (as discussed above) for injection to the RCS. A backup recirculation capability is provided by aligning at least one of two RHR pumps to the suction of the SI pumps.

Note that the combined capacity of the three reciprocating charging pumps is 294 gpm. While not part of the ECCS, the charging pumps may provide an adequate RCS makeup capacity, at normal RCS pressure, for some small breaks.

3.3.5 Component Information

A. Safety injection (high pressure) pumps 31, 32, and 33
  1. Rated flow: 400 gpm @ 2325 ft head (1008 psid)
  2. Rated capacity: 50%
  3. Shutoff head: 3375 ft head (1463 psid)
  3. Type: horizontal centrifugal

B. Residual heat removal (low pressure) pumps 31 and 32
  1. Rated flow: 3000 gpm @ 332 ft. head (144 psid)
  2. Rated capacity: 100%
  3. Shutoff head: 37[illegible] ft head (161 psid)
  3. Type: vertical centrifugal

C. Recirculation pumps 31 and 32
  1. Rated flow: 3000 gpm @ 332 ft. head (144 psid)
  2. Rated capacity: 100%
  3. Shutoff head: 447 ft head (194 psid)
  4. Type: Vertical centrifugal

D. Safety injection accumulators (4)
  1. Accumulator volume: 1100 ft3
  2. Minimum water volume: 700 ft^3
  3. Nominal operating pressure: 650 psig
  4. Minimum boron concentration: 2000 ppm

E. Refueling water storage tank
  1. Capacity: 395,000 gallons
  2. Design Pressure: Atmospheric
  3. Nominal Boron Concentration: 2000 ppm (estimated)

F. Boron injection tank
   1. Capacity: 900 gallons
   2. Design Pressure: 1750 psig
   3. Nominal Boron Concentration: 21,000 ppm

G. RHR heat exchangers (2)
   1. Design duty: 56.4 x 106 Btu/hr
   2. Type: Vertical, shell and U-tube

3.3.6 Support Systems and Interfaces

A. Control signals
   1. Automatic
      The ECCS injection subsystems are automatically actuated by a safety injection signal (SIS). Conditions initiating an SIS trip are:

      a. Low pressurizer pressure
      b. High containment pressure
      c. High differential pressure between any two steam generators
      d. High steam flow in any 2 of 4 main steam lines coincident with low RCS coolant average temperature (T_{avg}) or low main steam line pressure
      e. Manual actuation
      f. High-High containment pressure

   2. Remote manual
      An SIS signal can be initiated by remote manual means from the main control room. The transition from the injection to the recirculation phase of ECCS operation requires remote manual actions.

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

C. Other
   1. The SI pumps are cooled by the CCW system (see Section 3.7). Booster pumps connected to the shafts of the SI pumps are designed to circulate about 15 gpm of CCW per SI pump (assuming all CCW pumps are inoperable). The SI pumps can operate indefinitely in this condition, using the CCW water as a heat sink. (Ref. 1)
   2. The RHR pumps are cooled by the component cooling water (CCW) system (see Section 3.7). Cooling water for the RHR pump seals is not required when the temperature of the pumped fluid is less than 150°F (i.e. as during the injection phase of LOCA response). (Ref. 1)
   3. The internal recirculation pump motors are cooled by the CCW system (see Section 3.7).
   4. Lubrication is assumed to be provided locally for the SI, RHR, and recirculation pumps and motors.
   5. Local room coolers are provided for the recirculation pumps and for the SI pumps.

3.3.7 Section 3.3 References

1. Indian Point 3 FSAR, Section 6.2.

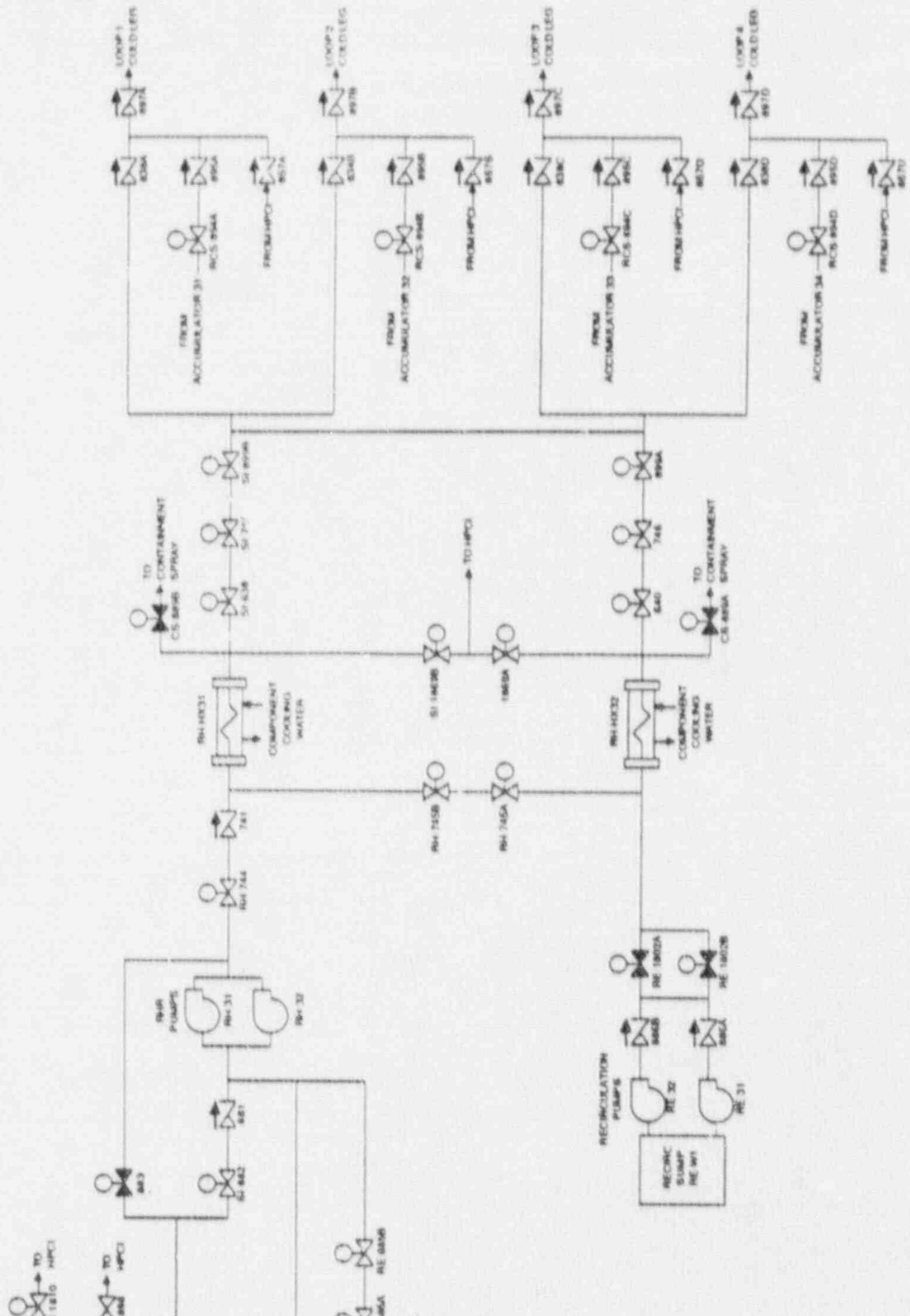

Figure 3.3-1. Indian Point 3 Low Pressure Injection/Recirculation System.

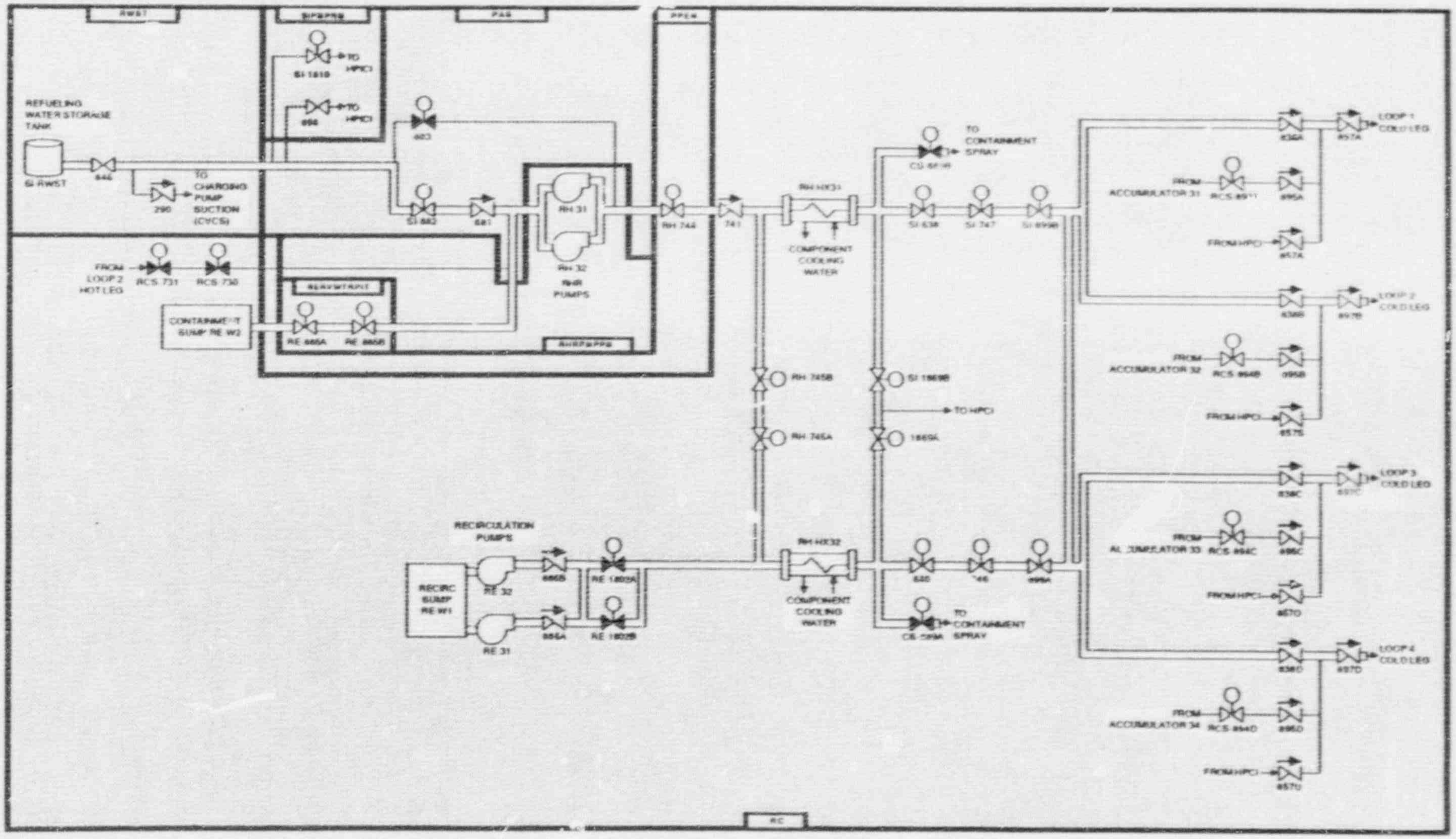

Figure 3.3-2. Indian Point 3 Low Pressure Injection/Recirculation System Showing Component Locations.

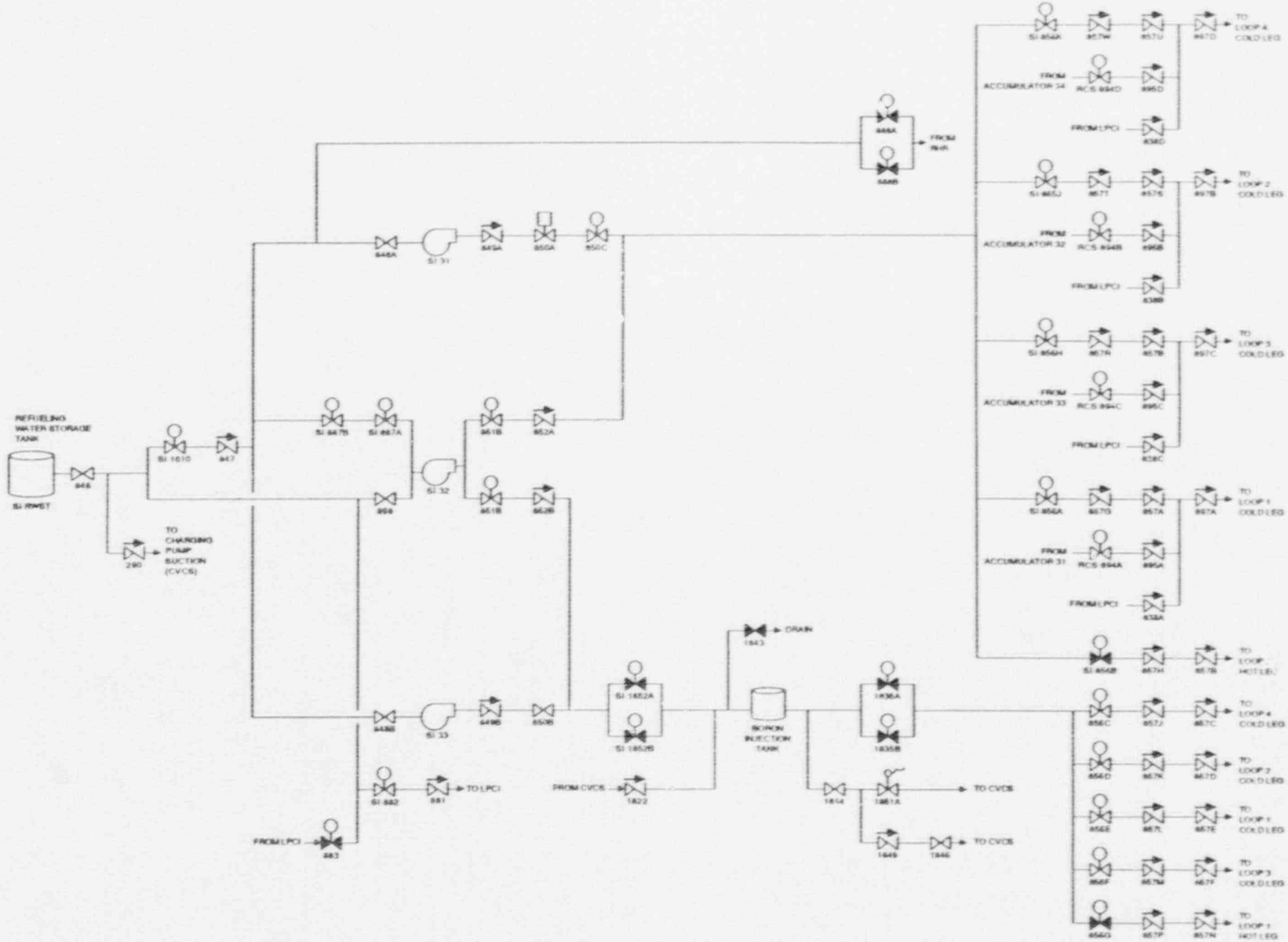

Figure 3.3-3. Indian Point 3 High Pressure Injection System.

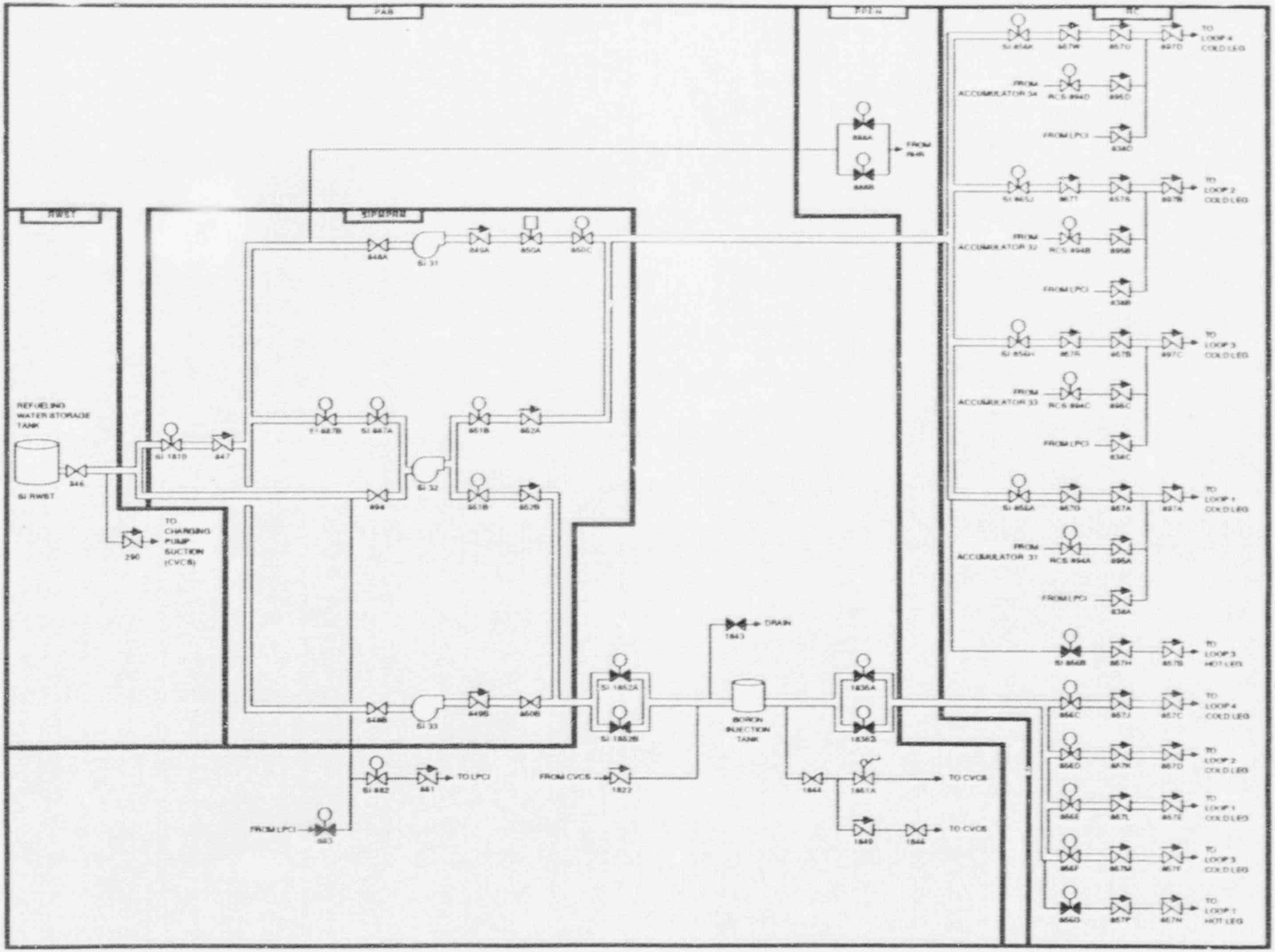

Figure 3.3-4. Indian Point 3 High Pressure Injection System Showing Component Locations.

Table 3.3-1. Indian Point 3 Emergency Core Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
RCS-894A	MOV	RC	MCC36A	480	55PAB	AC/5A
RCS-894B	MOV	RC	MCC36B	480	55PAB	AC/6A
RCS-894C	MOV	RC	MCC36A	480	55PAB	AC/5A
RCS894D	MOV	RC	MCC36B	480	55PAB	AC/6A
RE-1802A	MOV	RC	MCC36A	480	55PAB	AC/5A
RE-1802B	MOV	RC	MCC36B	480	55PAB	AC/6A
RE-31	MDP	RC	BUS5A	480	15CB	AC/5A
RE-32	MDP	RC	BUS6A	480	15CB	AC/6A
RE-885A	MOV	SERVWTRPIT	MCC36A	480	55PAB	AC/5A
RE-885B	MOV	SERVWTRPIT	MCC36B	480	55PAB	AC/6A
RE-W1	TANK	RC				
RE-W2	TANK	RC				
RH-31	MDP	RHRPMPRM	BUS3A	480	15CB	AC/2A-3A
RH-32	MDP	RHRPMPRM	BUS6A	480	15CB	AC/6A
RH-744	MOV	PPEN	MCC36A	480	55PAB	AC/5A
RH-745A	MOV	RC	MCC36B	480	55PAB	AC/6A
RH-745B	MOV	RC	MCC36A	480	55PAB	AC/5A
SI-1810	MOV	SIPMPRM	MCC36A	480	55PAB	AC/5A
SI-1852A	MOV	PAB	MCC36A	480	55PAB	AC/6A
SI-1852B	MOV	PAB	MCC36B	480	55PAB	AC/6A
SI-1869B	MOV	RC	MCC36B	480	55PAB	AC/6A
SI-31	MDP	SIPMPRM	BUS5A	480	15CB	AC/5A
SI-32	MDP	SIPMPRM	BUS2A	480	15CB	AC/2A-3A
SI-33	MDP	SIPMPRM	BUS6A	480	15CB	AC/6A
SI-638	MOV	RC	MCC36B	480	55PAB	AC/6A
SI-747	MOV	RC	MCC36A	480	55PAB	AC/5A
SI-856A	MOV	RC				

Table 3.3-1. Indian Point 3 Emergency Core Cooling System Data Summary for Selected Components (continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
SI-856B	MOV	RC	MCC36B	480	55PAB	AC/6A
SI-856H	MOV	RC	MCC36B	480	55PAB	AC/6A
SI-856J	MOV	RC	MCC36B	480	55PAB	AC/6A
SI-856K	MOV	RC				
SI-882	MOV	PAB	MCC36B	480	55PAB	AC/6A
SI-887A	MOV	SIPMPRM	MCC36A	480	55PAB	AC/5A
SI-887B	MOV	SIPMPRM	MCC36B	480	55PAB	AC/6A
SI-899B	MOV	RC	MCC36B	480	55PAB	AC/6A
SI-RWST	TANK	RWST				

3.4 POST-ACCIDENT HEAT REMOVAL SYSTEM (PAHRS)

3.4.1 System Function

The PAHRS is an integrated set of subsystems that provide the functions of containment heat removal and containment pressure control following a loss of coolant accident. In conjunction with the ECCS, the PAHRS completes the post-LOCA heat transfer path from the reactor core to the ultimate heat sink. The Containment Spray System, a subsystem of the PAHRS, also serves to remove elemental iodine from the containment atmosphere.

3.4.2 System Definition

Adequate containment heat removal capability is provided by two separate, full capacity systems.

- Containment Spray (CS) system
- Containment Air Recirculation Cooling and Filtration system

The Containment Spray system operates in sequential modes. During the first mode the containment spray pumps spray a portion of the Refueling Water Storage Tank (RWST) into the entire containment atmosphere. After the contents of the RWST are exhausted, water for containment spray is recirculated by diverting a portion of the ECCS recirculation flow to the spray headers. The diversion of the recirculation spray flow takes place downstream of the RHR heat exchangers.

The Containment Air Recirculation Cooling and Filtration System is designed to recirculate and cool the containment atmosphere after a LOCA. This system consists of five containment cooling fans. These fans are cooled by the service water system, providing heat transfer to the ultimate heat sink.

Simplified drawings of the Containment Spray system are shown in Figures 3.4-1 and 3.4-2. The containment cooling fans are shown in the diagrams of the service water system (see Section 3.8).

3.4.3 System Operation

The Containment Spray system consists of two pumps, each supplying two 360 degree ring headers located in the containment dome area. The spray system will be actuated by high containment pressure. During the injection phase a portion of the contents of the RWST are sprayed into the containment atmosphere by the CS pumps. During this mode the contents of the spray additive tank (sodium hydroxide) are mixed into the spray system to provide adequate iodine removal from the containment atmosphere by a washing action. Because the addition of the spray additive could cause considerable damage to materials and equipment within the containment the spray additive valves have a timer which delays their opening for two minutes following a spray initiation signal. This gives the operator a chance to determine whether the spray signal is erroneous, and operate a "cancel" button on the main control board which will prevent the spray additive valves from opening.

When the RWST is exhaused, or sufficient sump level is obtained, recirculation spray flow will be initiated. The operator can remotely open the stop valves on either of the two spray recirculation lines. The flow will be split so that at least 600 gpm is delivered to the core and the remainder to the spray headers. With this split flow, decay heat can be removed from the RCS and the containment pressure maintained below design limits. This mode of operation will be continued for at least two hours following the accident in order to complete the removal of iodine from the containment atmosphere.

The air recirculation system consists of five 20% capacity air handling units. Either all five, or at least three of five, will be started after an accident, depending on the availability of emergency power. The location of the distribution ductwork ensures that the air is directed to all areas requiring ventilation before returning to the air handling units. The fans are operating during normal operation. In the event of an accident, the flow is split so that part of the flow passes through the filtration portion of the unit and the remainder goes directly to the cooling coils. The bypass flow control is accomplished via a damper, that is positioned by redundant solenoid valves.

Any of the following combination of equipment will provide sufficient heat removal capability to maintain the post-accident containment pressure below design limits, assuming that the core residual heat is released to the containment as steam:

- Both containment spray pumps (and one of the two spray valves in the recirculation path)
- All five containment cooling fans
- One containment spray pump and any three of five containment cooling fans

3.4.4 System Succes Criteria

The containment cooling function is performed by the containment spray system and the containment air recirculation system. Each system is rated at 100% of the required cooling capacity. Any of the following combinations of equipment will provide sufficient containment heat removal capability to maintain post-accident containment pressure below the design limit, assuming that the core residual heat is released to the containment as steam (Ref. 1):

- All containment fan cooler units
- Both containment spray pumps during the injection phase and one of two recirculation pumps with an open recirculation flow path during the recirculation phase
- Any three of five containment fan cooler units plus one containment spray pump during the injection phase

3.4.5 Component Information

A. Containment Spray Pumps (2)
   1. Rated flow: 2600 gpm @ 427 ft head (185 psid)
   2. Rated capacity: 50%
   3. Shutoff head: 457 ft., or 198 psig at 60°F
   4. Type: horizontal centrifugal

B. Spray Additive Tank
   1. Capacity: 5100 gal
   2. Design pressure: 300 psig
   3. Nominal NaOH concentration: 30 w/o

C. Containment Fan Coolers (5)
   1. Rated flow: 34,000 cfm @ 47 psig and 271°F
   2. Rated heat transfer: 76.32 x 106 Btu/hr @ 47 psig and 271°F
   3. Rated capacity: 20% each FCU

The recirculation pumps and RHR heat exchangers used during the recirculation spray phase were described in Section 3.3.

3.4.6 Support Systems and Interfaces

A. Control Signals
  1. Automatic
    a. The containment spray system is automatically actuated whenever the coincidence of two sets of two-out-of-three high-high containment pressure (approximately 50% of design value) signals occur.
    b. The containment fan cooler dampers and solenoid valves are switched to the accident position upon receipt of a safety injection signal.
  2. Remote manual
    a. All PAHRS subsystems can be actuated by remote manual means from the control room. A safety injection signal can be initiated manually.
    b. The transition from the injection to the recirculation phase of containment spray system operation requires remote manual actions.

B. Motive Power
The CS pumps and motor-operated valves, and the containment fan cooler motors, are Class 1E AC loads that can be supplied from the standby diesel generators, as described in Section 3.6. Redundant loads are supplied from separate load groups.

C. Cooling Water
  1. The RHR heat exchangers, used during recirculation, are cooled by the component cooling water system (see Section 3.7).
  2. The containment fan cooling units are supplied with cooling water by the service water system (see Section 3.8).

D. Other
  1. The CS pumps do not require cooling water. The cooling water requirements for the RHR and recirculation pumps are discussed in Section 6.2.
  2. Lubrication is assumed to be provided locally for the CS pumps.
  3. Sources of pump room cooling have not been determined.

3.4.7 Section 3.4 References

1. Indian Point 3 FSAR, Section 6.4.3.

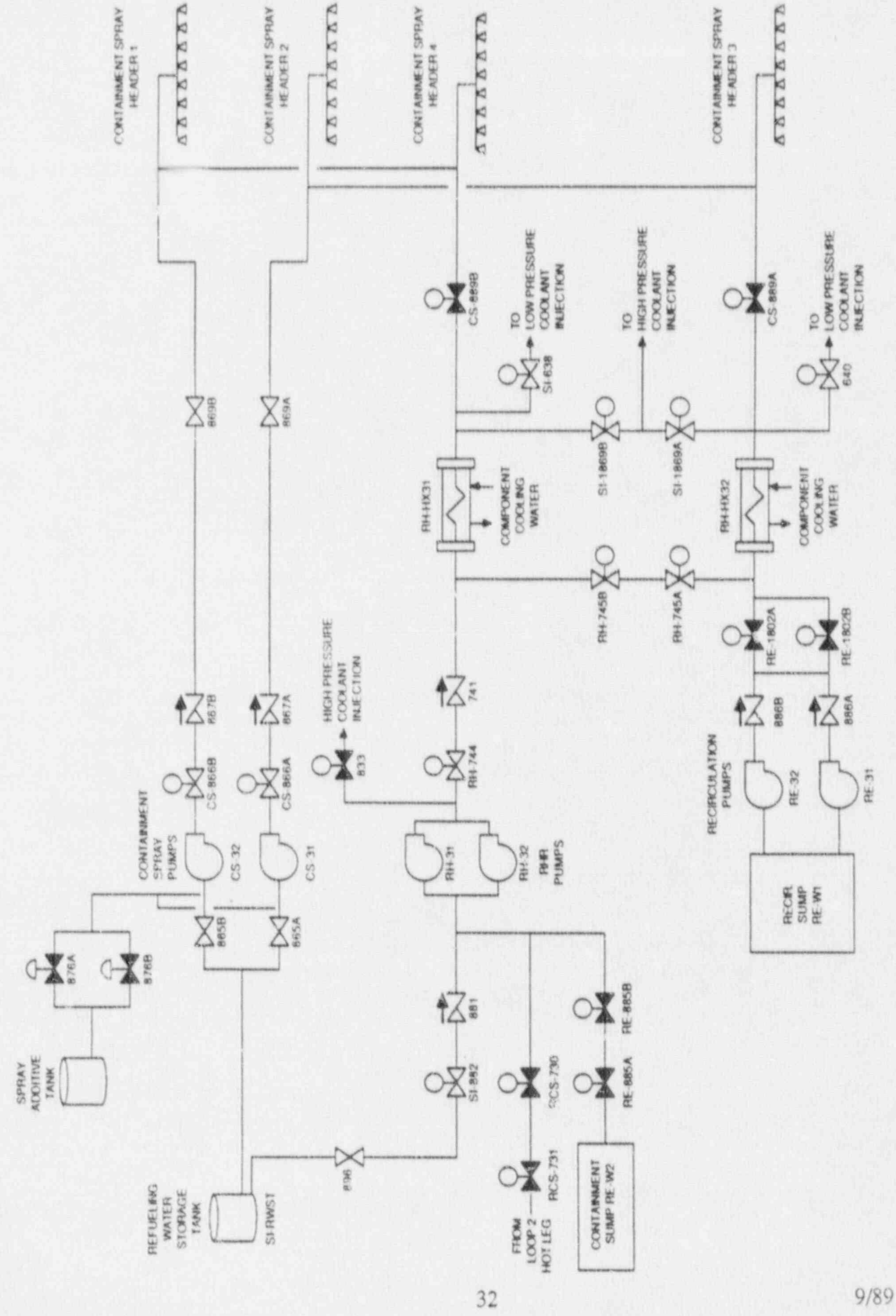

Figure 3.4-1. Indian Point 3 Containment Spray System.

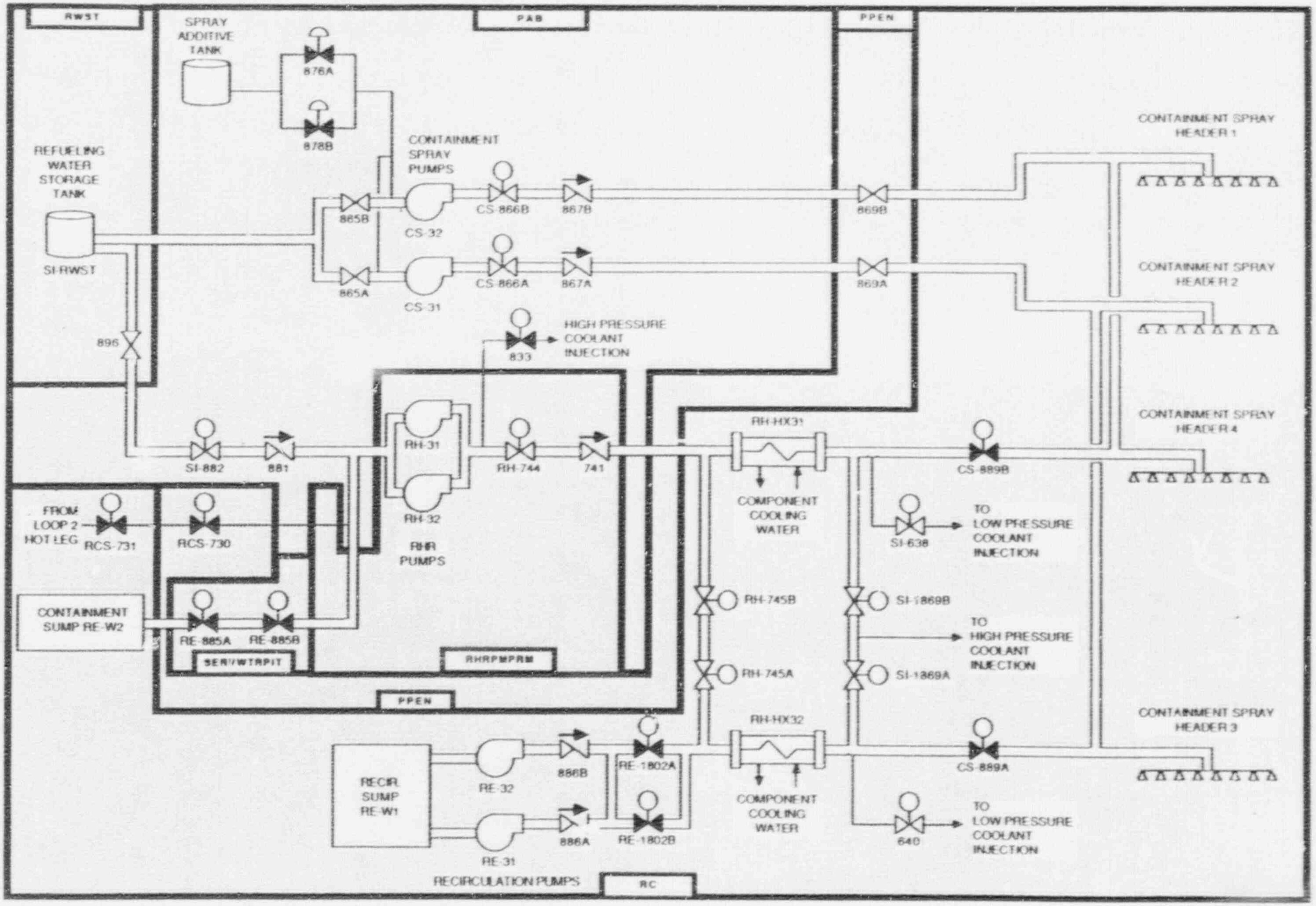

Figure 3.4-2. Indian Point 3 Containment Spray System Showing Component Locations.

Table 3.4-1. Indian Point 3 Post-Accident Heat Removal System DataSummary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
CRF-31	FCU	RC	BUS5A	480	15CB	AC/5A
CRF-31	FCU	RC	BUS5A	480	15CB	AC/5A
CRF-32	FCU	RC	BUS2A	480	15CB	AC/2A-3A
CRF-32	FCU	RC	BUS2A	480	15CB	AC/2A-3A
CRF-33	FCU	RC	BUS5A	480	15CB	AC/5A
CRF-33	FCU	RC	BUS5A	480	15CB	AC/5A
CRF-34	FCU	RC	BUS3A	480	15CB	AC/2A-3A
CRF-34	FCU	RC	BUS3A	480	15CB	AC/2A-3A
CRF-35	FCU	RC	BUS6A	480	15CB	AC/6A
CRF-35	FCU	RC	BUS6A	480	15CB	AC/6A
CS-31	MDP	PAB	BUS5A	480	15CB	AC/5A
CS-32	MDP	PAB	BUS6A	480	15CB	AC/6A
CS-866A	MOV	PAB	MCC36A	480	55PAB	AC/5A
CS-866B	MOV	PAB	MCC36B	480	55PAB	AC/6A
CS-889A	MOV	RC	MCC36A	480	55PAB	AC/5A
CS-889B	MOV	RC	MCC36B	480	55PAB	AC/6A

3.5 INSTRUMENTATION AND CONTROL (I & C) SYSTEMS

3.5.1 System Function

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

3.5.2 System Definition

The RPS includes sensor and transmitter units, logic units, and output trip relays that operate reactor trip circuit breakers to cause a reactor scram. The ESFAS includes independent sensor and transmitter units, logic units and relays that interface with the control circuits for the many different sets of components that can be actuated by the ESFAS. Reactor shutdown from outside of the control room can be accomplished by transfering control of required equipment to alternate control sites.

3.5.3 System Operation

A. RPS

The Westinghouse RPS (or Reactor Trip System, RTS) has four input instrument channels (1, 2, 3, and 4), and two output actuation trains (C and D). RPS inputs are listed below:

- Manual
- Overpower nuclear flux
- Overtemperature delta T
- Overpower delta T
- Low pressurizer pressure
- High pressurizer pressure
- High pressurizer water level
- Low reactor coolant flow
- Undervoltage on reactor coolant pump bus
- Underfrequency on reactor coolant pump bus
- RCP circuit breaker open
- Safety injection signal (SIS)
- Turbine generator trip
- Steam/feedwater flow mismatch
- Low-low steam generator water level
- High intermediate range nuclear flux
- High source range nuclear flux

The C and D logic trains independently generate a reactor trip command when prescribed parameters are outside the safe operating range. Either RPS train is capable of opening a separate and independent reactor trip circuit breaker to cause a scram. The manual scram A and B circuits bypass the RPS C and D logic trains and send a reactor trip command directly to shunt trip circuitry in the reactor trip circuit breakers.

B. ESFAS

The ESFAS has four input instrument channels and two output actuation trains (A and B). In general, each train controls equipment powered from different Class 1E AC electrical buses. An individual component usually receives an actuation signal from only one ESFAS train. It is assumed that train A actuates components powered by bus 5A, and train B actuates components powered by bus 6A. It is unknown which train actuates components powered by buses 2A and 3A, but it is suspected that train A actuates bus 3A components and train B actuates bus 2A components. The ESFAS generates the following signals: (a) safety injection signal (SIS), (b) auxiliary feedwater actuation, (3) containment isolation, (4) main feedwater line isolation, (5) main steam line isolation, (6) containment spray actuation and (7) containment recirculation system actuation. The control room operators can manually trip the various ESFAS logic subsystems. Details regarding ESFAS actuation logic are included in the system description for the actuated system.

C. Remote Shutdown

Controls that are critical to the safe shutdown of the plant which are available outside the control room are described below (Ref. 1).

Local stop/start pushbutton motor controls with a selector switch are provided at each of the motors for the equipment listed below. The selector switch will transfer control of the switchgear from the Control Room to local at the motor. Placing the local selector switch in the local operating position will give an annunciator alarm in the Control Room and will turn out the motor control position lights on the Control Room panel. The equipment consists of:

- Motor driven auxiliary feedwater pumps
- Charging pumps
- Boric acid transfer pumps

Remote stop/start pushbutton motor controls with a selector switch are provided for each of the motors for the equipment listed below. These controls are grouped at one point in the switchgear room convenient for operation. The selector switch will transfer control of the switchgear from the Control Room to the remote point. Placing the selector switch to local operation will give an annunciator alarm in the Control Room and will turn out the motor control position lights on the Control Room panel. The equipment consists of:

- Service water pumps 31 thru 36
- Containment air recirculation fans
- Control room air handling unit including control for the air inlet dampers

Key operated control switches located on MCC 312A provided local control for the following equipment when using their alternate power sources:

- Component cooling water pump 32
- Charging pump 31 or charging pump 32
- Backup service water pump 38

Switching cabinets have been provided to permit local operation of Diesel Generator 3, its associated 480V load centers and to permit local indication of safe shutdown instrumentation (steam generator level, pressurizer level and pressurizer pressure), independent of the effects of a cable spreading room fire.

Speed control is provided locally for the following equipment:

- Turbine driven auxiliary feedwater pump
- Charging pump

Local valve control is provided for the following:

- Main feed regulators
- Auxiliary feed control valves (these valves are located local to the auxiliary feedwater pumps.)
- Atmospheric dump valves (normally auto control at hot shutdown.)
- Letdown orifice isolation valves (locally to the charging pumps)
- All other valves requiring operation during hot standby

The local controls consist of local stop and start buttons with selector switch and position lamp.

3.5.4 System Success Criteria

A. RPS

The RPS uses hindrance logic (normal = 1, trip = 0) in both the input and output logic. Therefore, a channel will be in a trip state when input signals are lost, when control power is lost, or when the channel is temporarily removed from service for testing or maintenance (i.e. the channel has a fail-safe failure mode). A reactor scram will occur upon loss of control power to the RPS. A reactor scram usually is implemented by the scram circuit breakers which must open in response to a scram signal. Typically, there are two series scram circuit breakers in the power path to the scram rods. In this case, one of two circuit breakers must open. Details of the scram system for Indian Point 3 have not been determined.

B. ESFAS

A single component usually receives a signal from only one ESFAS output train. ESFAS Trains A and B must be available in order to automatically actuate their respective components. ESFAS typically uses hindrance input logic (normal = 1, trip = 0) and transmission output logic (normal = 0, trip = 1). In this case, an input channel will be in a trip state when input signals are lost, when control power is lost, or when the channel is temporarily removed from service for testing or maintenance (i.e. the channel has a fail-safe failure mode). Control power is needed for the ESFAS output channels to send an actuation signal. Note that there may be some ESFAS actuation subsystems that utilize hindrance output logic. For these subsystems, loss of control power will cause system or component actuation, as is the case with the RPS. Details of the ESFAS system for Indian Point 3 have not been determined.

C. Manually-Initiated Protective Actions

When reasonable time is available, certain protective actions may be performed manually by plant personnel. The control room operators are capable of operating individual components using normal control circuitry, or operating groups of components by manually tripping the RPS or an ESFAS subsystem.

The control room operators also may send qualified persons into the plant to operate components locally or from some other remote control location (i.e., the remote shutdown panel or a motor control center). To make these judgments, data on key plant parameters must be available to the operators.

3.5.5 Support Systems and Interfaces

A. Control Power

1. RPS

   The RPS is powered from 118 VAC vital buses 31, 32, 33, and 34 (see Section 3.6).

2. ESFAS

   The ESFAS input instrument channels most likely are powered from 118 VAC vital buses 1 to 4. The ESFAS Train A and B output logic is powered from 125 VDC distribution panels 31 and 32 respectively. These distributions panels are powered by batteries 31 and 32, respectively.

3.5.6 Section 3.5 References

1. Indian Point 3 FSAR (Update), Section 7.7.3.

3.6 ELECTRIC POWER SYSTEM

3.6.1 System Function

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

3.6.2 System Definition

The onsite Class 1E electric power system consists of four 480 VAC buses, designated 2A, 3A, 5A and 6A. There are three standby diesel generators connected to three of the four buses. Diesel generator 31 is connected to bus 2A, diesel generator 32 is connected to bus 6A, and diesel generator 33 is connected to bus 5A. Bus 3A is automatically connected to bus 2A during diesel generator operation, and the two buses are operated as a unit from a single diesel generator.

Emergency power for vital instruments, control, and emergency lighting is supplied by four 125 VDC station batteries. The batteries energize four DC distribution panels. Four 120 VAC instrument buses are connected to the distribution panels through inverters.

A simplified one-line diagram of the electric power system is shown in Figure 3.6-1. A summary of data on selected electric power system components is presented in Table 3.6-1. A partial listing of electrical sources and loads is presented in Table 3.6-2.

3.6.3 System Operation

During normal operation, the Class 1E electric power system is supplied by station service power from the main generator and the 138 kV switchyard. The normal source for buses 5A and 6A is the 138 kV system, via the station auxiliary transformer and 6900 volt buses 5 and 6. The normal source for buses 2A and 3A is the main generator, via the unit auxiliary transformer and 6900 volt buses 2 and 3. When the unit is not operating buses 2A and 3A are supplied by the 138 kV system, via switching at the 6900 volt level. The transfer from the preferred power source to the diesel generators is accomplished automatically by opening the normal source circuit breakers and then reenergizing the Class 1E portion of the electric power system from the diesel generators. Following a start command, each diesel generator is designed to reach rated speed and be capable of accepting loads within 10 seconds, and energizing essential post-accident loads within 30 seconds.

The DC power system normally is supplied through the battery chargers, with the batteries "floating" on the system, maintaining a full charge. Upon loss of AC power, the entire DC load draws from the batteries.

The 120 VAC vital buses normally receive power either from 480 VAC motor control centers through a step-down transformer or from DC distribution panels through an inverter.

Redundant safety equipment such as motor driven pumps and motor operated valves are supplied by different 480 VAC buses. For the purpose of discussion, this equipment has been grouped into "load groups". Load group 5A contains components receiving electric power from bus 5A. Load group 6A contains components powered by bus 6A. Load group 2A-3A contains components powered by either bus 2A or bus 3A. These two buses are connected to the same diesel generator and are operated as a unit.

3.6.4 System Success Criteria

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

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

3.6.5 Component Information

A. Standby diesel generators (3)
  1. Maximum continuous rating: 1750 kW
  2. 2 hour rating: 1950 kW
  3. Rated voltage: 480 VAC
  4. Manufacturer: Alco

B. Batteries (4)
  1. Type: Lead-acid
  2. Cells: 60

3.6.6 Support Systems and Interfaces

A. Control Signals
  1. Automatic
     The standby diesel generators are automatically started based on:
     - Undervoltage on the normal bus
     - Safety injection signal (SIS, see Section 3.3)
  2. Remote manual
     The diesel generators can be started, and many distribution circuit breakers can be operated from the main control room.

B. Diesel Generator Auxiliary Systems
  1. Diesel Cooling Water System
     Heat is transferred from a jacket water system to the service water system. Each diesel receives redundant cooling water supplies from the SW "A", "B" and "C" headers.
  2. Diesel Starting System
     The air starting system for each diesel is capable of 4 start attempts without requiring AC power to recharge the starting air accumulators.
  3. Diesel Fuel Oil Transfer and Storage System
     A 175 gallon "day tank" supplies the relatively short-term (approximately 75 minutes) fuel needs of each diesel. The day tanks are automatically replenished from separate underground storage tanks during engine operation.
  4. Diesel Lubrication System
     Each diesel generator has its own lubrication system.

5. Combustion Air Intake and Exhaust System
This system supplies fresh air to the diesel intake, and directs the diesel exhaust outside of the diesel building.
6. Diesel Room Ventilation System
This system maintains the environmental conditions in the diesel room within limits for which the diesel generator and switchgear have been qualified. This system may be needed for long-term operation of the diesel generator.

C. Switchgear and Battery Room Ventilation Systems
Details on switchgear and battery room ventilation systems have not been determined.

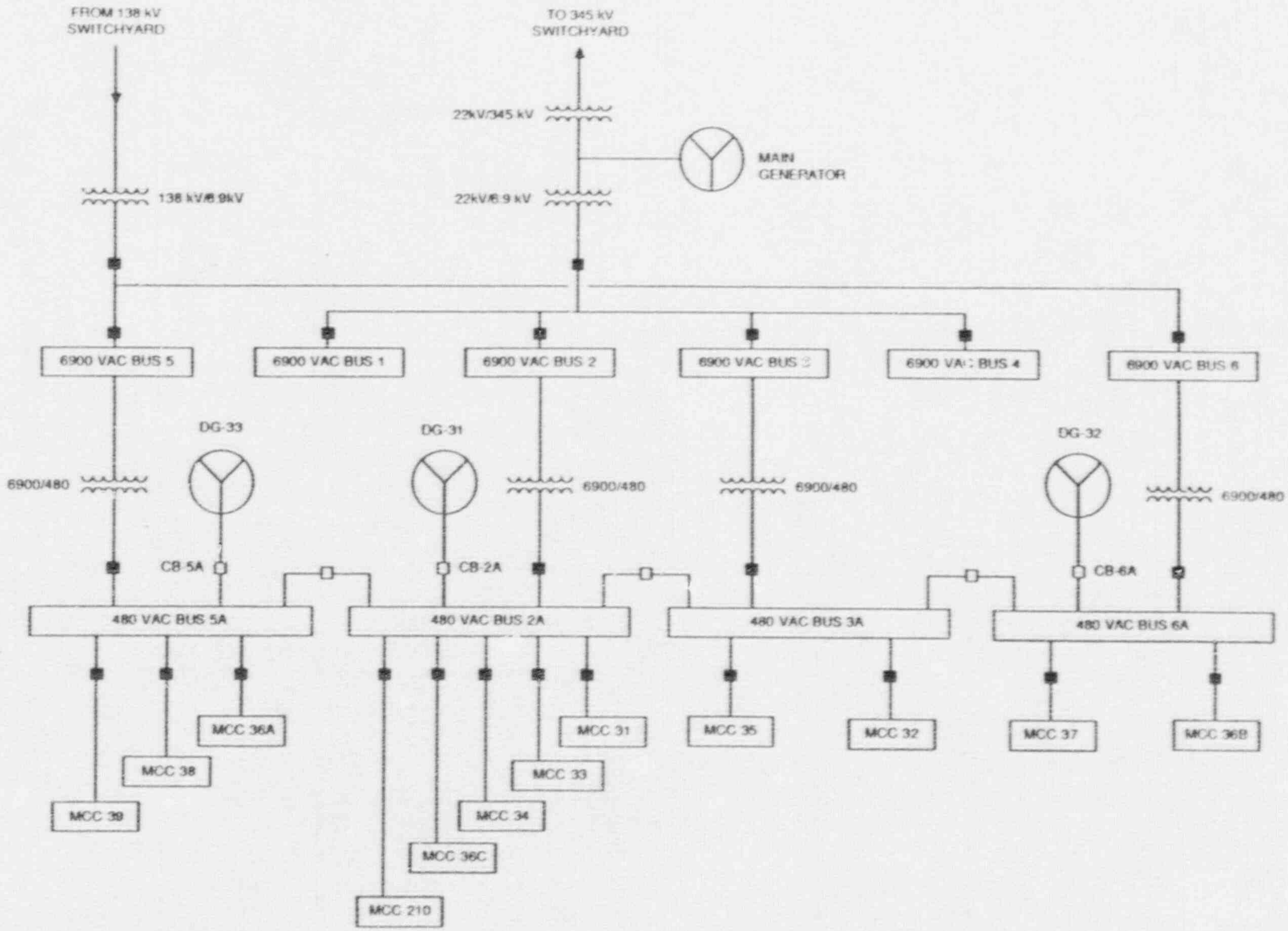

Figure 3.6-1. Indian Point 3 6900 and 480 VAC Electric Power System.

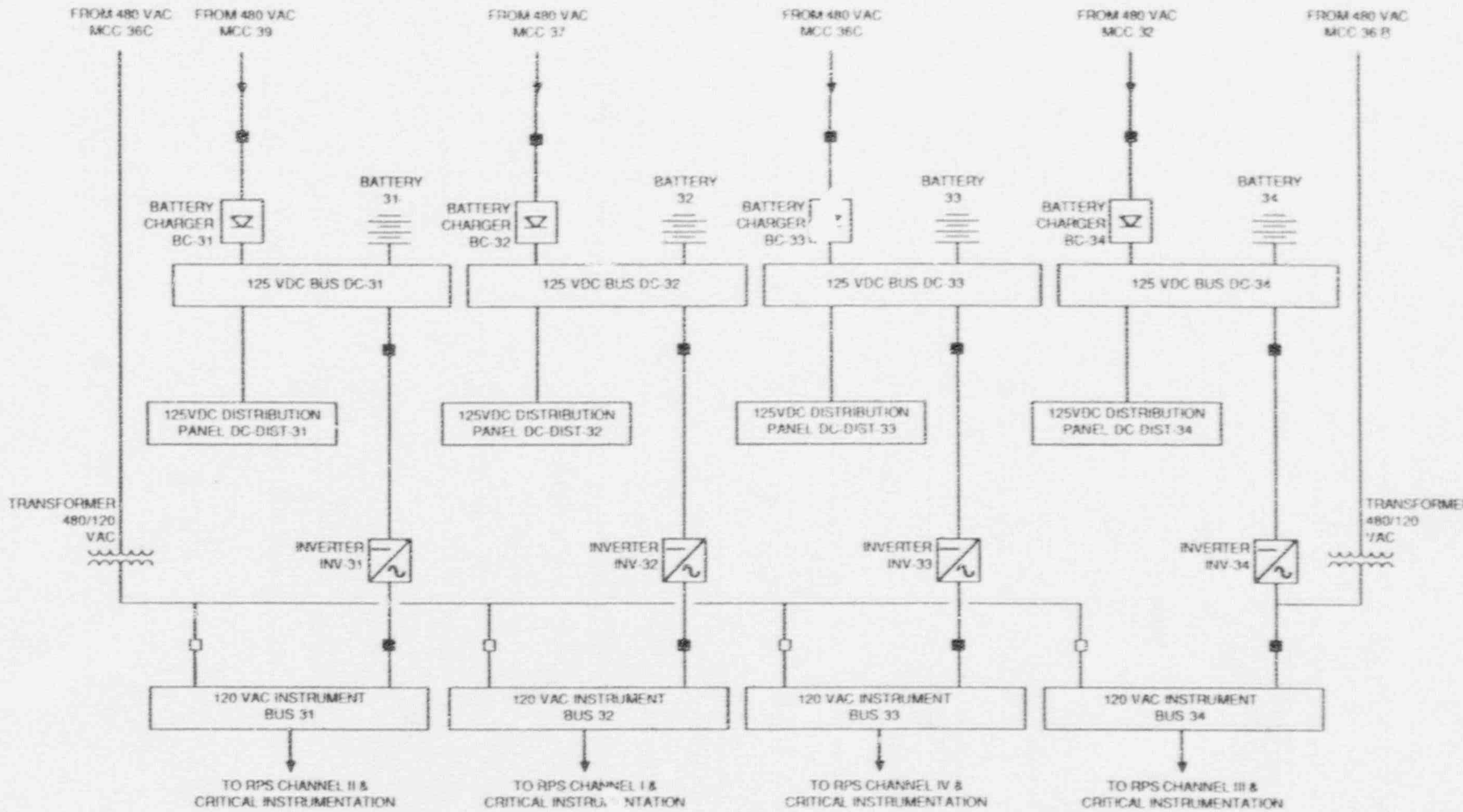

Figure 3.6-2. Indian Point 3 125 VDC and 120 VAC Electric Power System.

Table 3.6-1. Indian Point 3 Electric Power System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
BATT31	BATT	BAT31RM				DC/31
BATT32	BATT	BATRM32				DC/32
BATT33	BATT	DGRM31				DC/33
BC-31	BC	33CB	MCC39	480	33CB	AC/5A
BC-32	BC	33CB	MCC37	480	55PAB	AC/6A
BC-33	BC	15CB	MCC36C	480	15CB	AC/2A-3A
BUS2A	BUS	15CB	DG-31	480	DGRM31	AC/2A-3A
BUS3A	BUS	15CB	DG-31	480	DGRM31	AC/2A-3A
BUS5A	BUS	15CB	DG-33	480	DGRM33	AC/5A
BUS6A	BUS	15CB	DG-32	480	DGRM32	AC/6A
CB-2A	CB	15CB				
CB-3A	CB	15CB				
CB-5A	CB	15CB				
CB-6A	CB	15CB				
DC-31	BUS	33CB	BATT31	125	BAT31RM	DC/31
DC-32	BUS	33CB	BATT32	125	BATRM32	DC/32
DC-33	BUS	15CB	BATT33	125	DGRM31	DC/33
DG-31	DG	DGRM31				AC/2A-3A
DG-32	DG	DGRM32				AC/6A
DG-33	DG	DGRM33				AC/5A
INST-BUS-31	BUS	CR	INV-31	118	33CB	DC/31
INST-BUS-32	BUS	CR	INV-32	118	33CB	DC/32
INST-BUS-33	BUS	CR	INV-33	118		DC/33
INST-BUS-34	BUS	CR	INV-34	118		DC/34
INV-31	INV	33CB	DC-31	125	33CB	DC/31
INV-32	INV	33CB	DC-32	125	33CB	DC/32
INV-33	INV	33CB	DC-33	125	15CB	DC/33

Table 3.6-1. Indian Point 3 Electric Power System Data Summary for Selected Components (continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
INV-34	INV	33CB	DC-34	125	33CB	DC/34
MCC36A	MCC	55PAB	BUS5A	480	15CB	AC/5A
MCC36B	MCC	55PAB	BUS6A	480	15CB	AC/6A
MCC36C	MCC	15CB	BUS2A	480	DGRM31	AC/2A-3A
MCC37	MCC	55PAB	BUS6A	480	15CB	AC/6A
MCC39	MCC	33CB	BUS5A	480	15CB	AC/5A

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Indian Point 3

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BATT31	125	DC/31	BAT31RM	EP	DC-31	BUS	33CB
BATT32	125	DC/32	BATRM32	EP	DC-32	BUS	33CB
BATT33	125	DC/33	DGRM31	EP	DC-33	BUS	15CB
BUS2A	480	AC/2A-3A	15CB	AC	CC-32	MDP	CCWPMPRM
BUS2A	480	AC/2A-3A	15CB	ECCS	SI-32	MDP	SIPMPRM
BUS2A	480	AC/2A-3A	DGRM31	EP	MCC36C	MCC	15CB
BUS2A	480	AC/2A-3A	15CB	PAHRS	CRF-32	FCU	RC
BUS2A	480	AC/2A-3A	15CB	PAHRS	CRF-32	FCU	RC
BUS2A	480	AC/2A-3A	15CB	SW	SW-22	MDP	INTK
BUS3A	480	AC/2A-3A	15CB	AFW	AFW-31	MDP	18AFPB
BUS3A	480	AC/2A-3A	15CB	CVCS	CH-CH32	MDP	55PAB
BUS3A	480	AC/2A-3A	15CB	ECCS	RH-31	MDP	RHRPMPRM
BUS3A	480	AC/2A-3A	15CB	PAHRS	CRF-34	FCU	RC
BUS3A	480	AC/2A-3A	15CB	PAHRS	CRF-34	FCU	RC
BUS3A	480	AC/2A-3A	15CB	SW	SW-35	MDP	INTK
BUS3A	480	AC/2A-3A	15CB	SW	SW-38	MDP	ESWPLTF
BUS5A	480	AC/5A	15CB	AC	CC-31	MDP	CCWPMPRM
BUS5A	480	AC/5A	15CB	CVCS	CH-CH31	MDP	55PAB
BUS5A	480	AC/5A	15CB	ECCS	RE-31	MDP	RC
BUS5A	480	AC/5A	15CB	ECCS	SI-31	MDP	SIPMPRM
BUS5A	480	AC/5A	15CB	EP	MCC36A	MCC	55PAB
BUS5A	480	AC/5A	15CB	EP	MCC39	MCC	33CB
BUS5A	480	AC/5A	15CB	PAHRS	CRF-31	FCU	RC
BUS5A	480	AC/5A	15CB	PAHRS	CRF-31	FCU	RC
BUS5A	480	AC/5A	15CB	PAHRS	CRF-33	FCU	RC
BUS5A	480	AC/5A	15CB	PAHRS	CRF-33	FCU	RC
BUS5A	480	AC/5A	15CB	PAHRS	CS-31	MDP	PAB
BUS5A	480	AC/5A	15CB	SW	SW-31	MDP	INTK
BUS5A	480	AC/5A	15CB	SW	SW-34	MDP	INTK
BUS5A	480	AC/5A	15CB	SW	SW-37	MDP	ESWPLTF
BUS6A	480	AC/6A	15CB	AC	CC-33	MDP	CCWPMPRM

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Indian Point 3 (continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS6A	480	AC/6A	15CB	AFW	AFW-33	MDP	18AFPB
BUS6A	480	AC/6A	15CB	CVCS	CH-CH33	MDP	55PAB
BUS6A	480	AC/6A	15CB	ECCS	RE-32	MDP	RC
BUS6A	480	AC/6A	15CB	ECCS	RH-32	MDP	RHRPMPRM
BUS6A	480	AC/6A	15CB	ECCS	SI-33	MDP	SIPMPRM
BUS6A	480	AC/6A	15CB	EP	MCC36B	MCC	55PAB
BUS6A	480	AC/6A	15CB	EP	MCC37	MCC	55PAB
BUS6A	480	AC/6A	15CB	PAHRS	CRF-35	FCU	RC
BUS6A	480	AC/6A	15CB	PAHRS	CRF-35	FCU	RC
BUS6A	480	AC/6A	15CB	PAHRS	CS-32	MDP	PAB
BUS6A	480	AC/6A	15CB	SW	SW-33	MDP	INTK
BUS6A	480	AC/6A	15CB	SW	SW-36	MDP	INTK
BUS6A	480	AC/6A	15CB	SW	SW-39	MDP	ESWPLTF
DC-31	125	DC/31	33CB	EP	INV-31	INV	33CB
DC-32	125	DC/32	33CB	EP	INV-32	INV	33CB
DC-33	125	DC/33	15CB	EP	INV-33	INV	33CB
DC-34	125	DC/34	33CB	EP	INV-34	INV	33CB
DG-31	480	AC/2A-3A	DGRM31	EP	BUS2A	BUS	15CB
DG-31	480	AC/2A-3A	DGRM31	EP	BUS3A	BUS	15CB
DG-32	480	AC/6A	DGRM32	EP	BUS6A	BUS	15CB
DG-33	480	AC/5A	DGRM33	EP	BUS5A	BUS	15CB
INV-31	118	DC/31	33CB	EP	INST-BUS-31	BUS	CR
INV-32	118	DC/32	33CB	EP	INST-BUS-32	BUS	CR
INV-33	118	DC/33		EP	INST-BUS-33	BUS	CR
INV-34	118	DC/34		EP	INST-BUS-34	BUS	CR
MCC36A	480	AC/5A	55PAB	AC	CC-822A	MOV	PPEN
MCC36A	480	AC/5A	55PAB	CVCS	CH-BA31	MDP	55PAB
MCC36A	480	AC/5A	55PAB	ECCS	RCS-894A	MOV	RC
MCC36A	480	AC/5A	55PAB	ECCS	RCS-894C	MOV	RC
MCC36A	480	AC/5A	55PAB	ECCS	RE-1802A	MOV	RC
MCC36A	480	AC/5A	55PAB	ECCS	RE-885A	MOV	SERVWTRPIT

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Indian Point 3 (continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC36A	480	AC/5A	55PAB	ECCS	RH-7[illegible]	MOV	PPEN
MCC36A	480	AC/5A	55PAB	ECCS	RH-745B	MOV	RC
MCC36A	480	AC/5A	55PAB	ECCS	SI-1810	MOV	SIPMPRM
MCC36A	480	AC/6A	55PAB	ECCS	SI-1852A	MOV	PAB
MCC36A	480	AC/5A	55PAB	ECCS	SI-747	MOV	RC
MCC36A	480	AC/5A	55PAB	ECCS	SI-887A	MOV	SIPMPRM
MCC36A	480	AC/5A	55PAB	PAHRS	CS-866A	MOV	PAB
MCC36A	480	AC/5A	55PAB	PAHRS	CS-889A	MOV	RC
MCC36A	480	AC/5A	55PAB	RCS	RCS-536	MOV	RC
MCC36A	480	AC/5A	55PAB	RCS	RCS-730	MOV	RC
MCC36B	480	AC/6A	55PAB	AC	CC-822B	MOV	PPEN
MCC36B	480	AC/6A	55PAB	CVCS	CH-112B	MOV	PAB
MCC36B	480	AC/6A	55PAB	CVCS	CH-BA32	MDP	55PAB
MCC36B	480	AC/6A	55PAB	ECCS	RCS-894B	MOV	RC
MCC36B	480	AC/6A	55PAB	ECCS	RCS894D	MOV	RC
MCC36B	480	AC/6A	55PAB	ECCS	RE-[illegible]02B	MOV	RC
MCC36B	480	AC/6A	55PAB	ECCS	RE-885B	MOV	SERVWTRPIT
MCC36B	480	AC/6A	55PAB	ECCS	RH-745A	MOV	RC
MCC36B	480	AC/6A	55PAB	ECCS	SI-1852B	MOV	PAB
MCC36B	480	AC/6A	55PAB	ECCS	SI-1869B	MOV	RC
MCC36B	480	[illegible]	55PAB	ECCS	SI-638	MOV	RC
MCC36B	480	AC/6A	55PAB	ECCS	SI-856B	MOV	RC
MCC36B	480	AC/6A	55PAB	ECCS	SI-856H	MOV	RC
MCC36B	480	AC/6A	55PAB	ECCS	SI-856J	MOV	RC
MCC36B	480	AC/6A	55PAB	ECCS	SI-882	MOV	PAB
MCC36B	480	AC/6A	55PAB	ECCS	SI-887B	MOV	SIPMPRM
MCC36B	480	AC/6A	55PAB	ECCS	SI-899B	MOV	RC
MCC36B	480	AC/6A	55PAB	PAHRS	CS-866B	MOV	PAB
MCC36B	480	AC/6A	55PAB	PAHRS	CS-889B	MOV	RC
MCC36B	480	AC/6A	55PAB	RCS	RCS-535	MOV	RC
MCC36B	480	AC/6A	55PAB	RCS	RCS-731	MOV	RC

Table 3.C-2. Partial Listing of Electrical Sources and Loads at Indian Point 3 (continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC36C	480	AC/2A-3A	15CB	EP	BC-33	BC	15CB
MCC37	480	AC/6A	55PAB	CVCS	CH-PW31	MDP	PAB
MCC37	480	AC/6A	55PAB	CVCS	CH-PW32	MDP	PAB
MCC37	480	AC/6A	55PAB	EP	BC-32	BC	33CB
MCC39	480	AC/5A	33CB	EP	BC-31	BC	33CB

3.7 AUXILIARY COOLANT COMPONENT COOLING WATER SYSTEM (CCW)

3.7.1 System Function

The Auxiliary Coolant System consists of three subsystems, the Component Cooling Water (CCW) System, the Residual Heat Removal (RHR) System, and the Spent Fuel Pit Cooling System. This section will focus on the Component Cooling Water system. The RHR system is discussed in Section 3.3 (ECCS) due to its role as a low pressure injection and recirculation system.

The CCW system is designed to remove residual and sensible heat from the RCS during plant shutdown by cooling the RHR heat exchangers, to cool the letdown flow to the Chemical and Volume Control System during power operation, and to provide cooling to dissipate heat from various primary plant components.

3.7.2 System Definition

The CCW system is a closed loop cooling system consisting of three parallel pumps and two main headers. The cooling loads are divided between the two headers in such a manner to ensure that each header serves a redundant set of components needed to establish and maintain a safe shutdown condition following a design basis accident. Each header contains a heat exchanger that transfers heat to the service water system. Two surge tanks, one for each header, accommodate expansion, contraction, and inleakage of water.

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

3.7.3 System Operation

During normal power operation two component cooling pumps and one component cooling heat exchanger are in service to support equipment in the Primary Auxiliary Building and the containment. Water is normally supplied to all components served by the CCW system, including components that are not operating. One standby pump provides 50% backup pumping capacity and the second heat exchanger provides 100% backup cooling capability. During plant shutdown and during the recirculation phase following a LOCA, all three pumps and both heat exchangers are normally utilized to remove the residual and sensible heat. If one pump or heat exchanger is not operative, safe shutdown of the plant is not affected, however the time for cooldown is extended.

Heat loads supported by the CCW system include the following:

- RHR heat exchangers
- RHR pumps
- SI pumps
- Recirculation pumps
- Charging pumps

Component cooling is also provided for other components, such as the reactor cooling pumps and components of the Chemical and Volume Control System. At the reactor coolant pump, component cooling water removes heat from the bearing oil and the thermal barrier.

3.7.4 System Success Criteria

The CCW system can provide adequate cooling for decay heat removal with one CCW pump, or one heat exchanger out of service. Normally two CCW pumps and two heat exchangers are used for residual heat removal (i.e. during a cooldown, or following a LOCA) (Ref. 1).

The CCW pumps are not started following a LOCA with station blackout. Under this condition, the only heat removal requirement is for the bearings of the SI pumps and motor cooling for the recirculation pumps. The water volume of the CCW system serves as a heat sink. Estimates cited in the FSAR (Ref. 2) suggest that the SI and recirculation pumps will be adequately cooled for an extended period of time without flow in the CCW system.

3.7.5 Component Information

A. Component Cooling Water Pumps 31, 32, and 33
   1. Rated flow: 3600 gpm @ 220 ft head (95 psid)
   2. Rated capacity: 50%
   3. Type: horizontal centrifugal

B. Component Cooling Heat Exchangers 31 and 32
   1. Design duty: 31.4×10^6 Btu/hr
   2. Type: shell and straight tube

3.7.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The CCW pumps are not automatically actuated.
   2. Remote Manual
      The CCW pumps can be actuated by remote manual means from the control room.

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

C. Other
   1. The CCW heat exchangers are cooled by the service water system (see Section 3.8).
   2. Lubrication is assumed to be provided locally for the CCW pumps.
   3. Sources of pump and pump room cooling have not been determined.
   4. CCW makeup water is provided by the primary water treatment plant.

3.7.7 Section 3.7 References

1. Indian Point 3 FSAR, Section 9.3.1.

2. Indian Point 3 FSAR, Section 9.3.3.

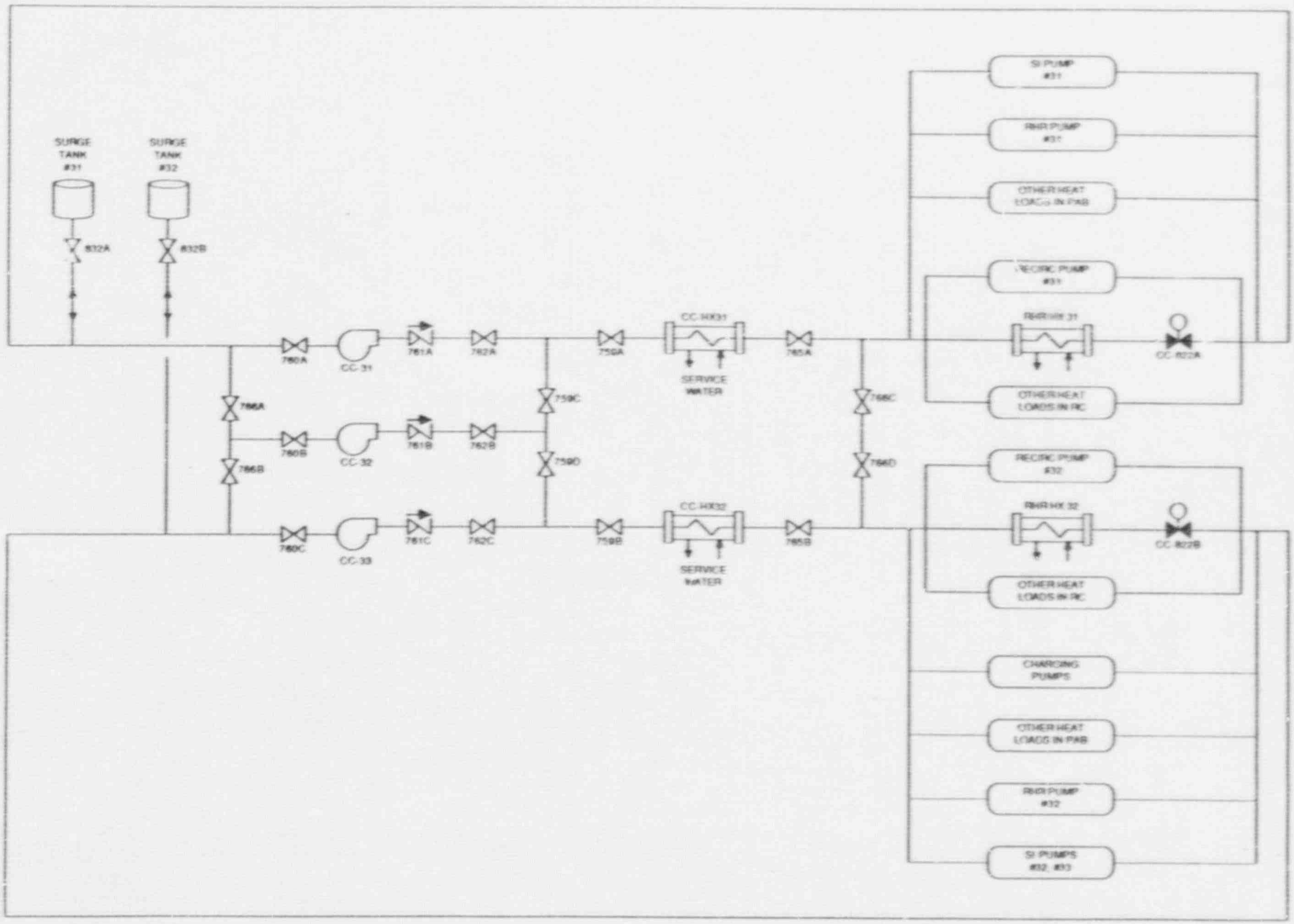

Figure 3.7-1. Indian Point 3 Auxiliary Coolant Component Cooling Water System.

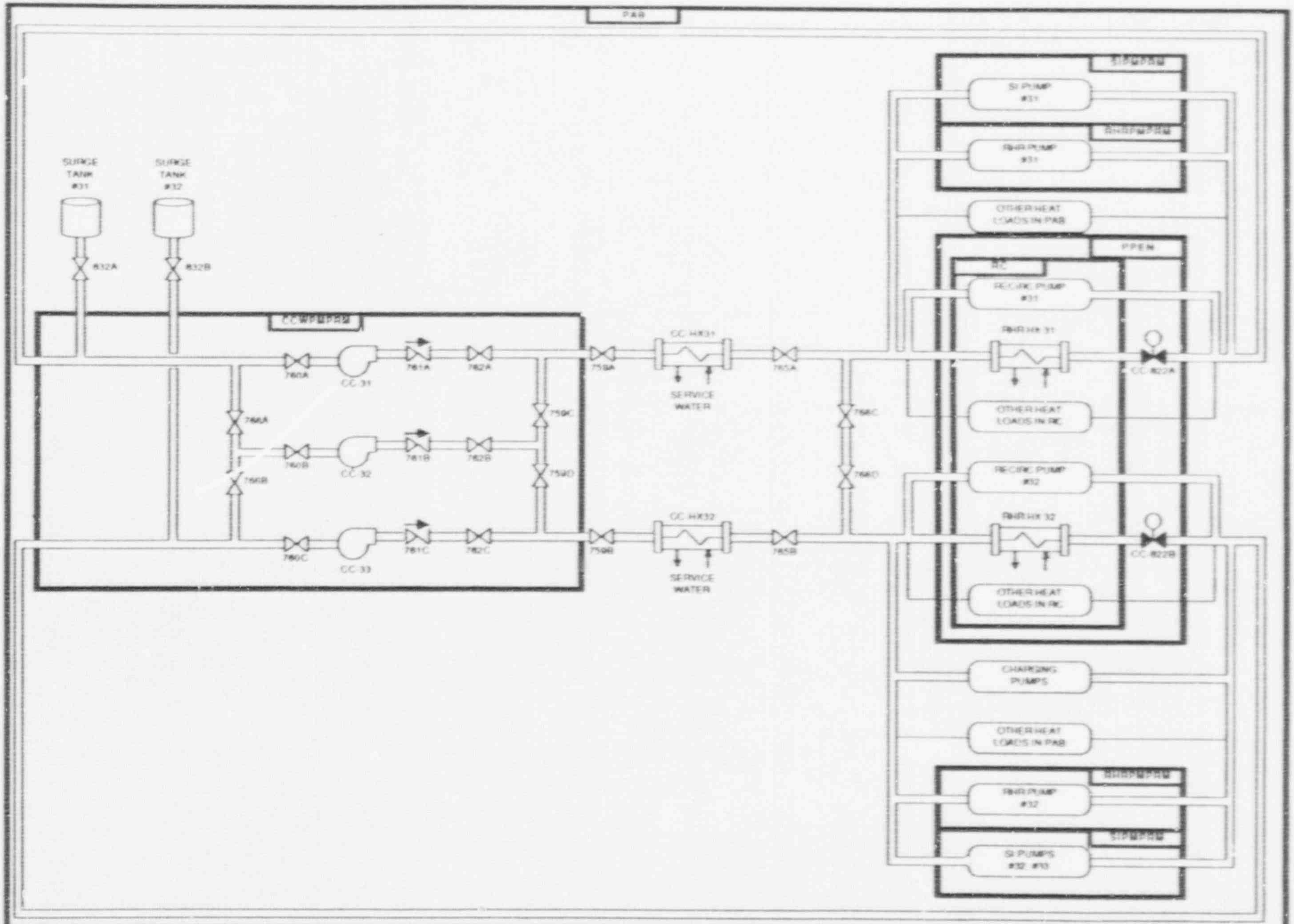

Figure 3.7-2. Indian Point 3 Auxiliary Coolant Component Cooling Water System Showing Component Locations.

Table 3.7-1. Indian Point 3 Auxiliary Coolant Component Cooling Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
CC-31	MDP	CCWPMPRM	BUS5A	480	15CB	AC/5A
CC-32	MDP	CCWPMPRM	BUS2A	480	15CB	AC/2A-3A
CC-33	MDP	CCWPMPRM	BUS6A	480	15CB	AC/6A
CC-822A	MOV	PPEN	MCC[illegible]A	480	55PAB	AC/5A
CC-822B	MOV	PPEN	MCC36B	480	55PAB	AC/6A
CC-HX31	HX	PAB				
CC-HX32	HX	PAB				
RH-HX31	HX	RC				
RH-HX32	HX	RC				

3.8 SERVICE WATER SYSTEM (SWS)

3.8.1 System Function

The Service Water System supplies cooling water from the ultimate heat sink, the Hudson River, to various heat loads in both the primary and secondary portions of the plant. The system is designed to provide a continuous flow of cooling water to these systems and components necessary for plant safety either during normal operation or under abnormal and accident conditions.

3.8.2 System Definition

The Service Water System contains two headers, an "essential" header and a "non-essential" header, each supplied by three motor-driven pumps. Each set of three SWS pumps can supply the essential loads while the other set of pumps is supplying the non-essential loads. In addition, a backup service water system, consisting of three more pumps and a separate supply line, can be brought into service as required. The backup system utilizes a separate intake structure. The SWS supplies cooling water to the diesel generators, the component cooling heat exchangers, and the containment fan cooler units.

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

3.8.3 System Operation

One SWS loop, normally Loop B, is denoted "essential" service water, while the other loop is denoted "non-essential" service water. During normal operation the essential loads can be cooled by any one of the three service water pumps on the essential header. Essential loads are those which must be supplied with cooling water in the event of a blackout and/or LOCA and include the following:

- Containment fan cooler units (filter units and motor coolers)
- Diesel generators
- Instrument air compressors
- Other heat loads served by the essential header
  - Main turbine oil coolers
  - Feedwater pump oil coolers
  - Seal oil coolers

Non-essential loads can be supplied by any two of the three service water pumps on the non-essential header. These loads include the following:

- Component cooling water system heat exchangers
- Control building air conditioners
- Circulating water pump seals
- Intake screen wash
- Closed cooling system
- Flash evaporators
- Main turbine auxiliaries
  - Iso-phase bus
  - Exciter
  - Hydrogen coolers

The CCW heat exchangers are considered non-essential loads in the sense that service water to the CCW heat exchangers is not required during the injection phase of a LOCA. By manual valve operation the essential loads can be transferred to the supply line carrying the non-essential loads, and vice versa.

The backup service water pumps are manually aligned to supply the essential loads when needed. Cooling water needs of major SWS heat loads are as follows:

Equipment	Required SWS Flow Rate
- Each of the five containment fan cooler units	2000 gpm
- Each of the three diesel generators	400 gpm
- Each of the two component cooling water heat exchanger	5000 gpm
- Each of the two control room air conditioners	40 gpm

The fan coolers and diesels are aligned to the essential header, and the CCW heat exchangers and control room air conditions are aligned to the non-essential header.

3.8.4 System Success Criteria

Following a simultaneous accident and loss of offsite power, the cooling water requirements for all five fan cooler units and the other essential loads can be supplied by any two out three pumps on the designated essential header.

3.8.5 Component Information

A. Service Water Pumps 31, 32, 33, 34, 35, and 36
  1. Rated flow: 5000 gpm @ 220 ft head (95 psid)
  2. Rated capacity: 50%
  3. Type: vertical centrifugal

B. Backup Service Water Pumps 37, 38, and 39
  1. Rated flow: 5000 gpm @ 220 ft head (95 psid)
  2. Rated capacity: 50%
  3. Type: vertical centrifugal

C. Ultimate Heat Sink - Hudson River

3.8.6 Support Systems and Interfaces

A. Control Signals
  1. Automatic
     The service water pumps are not automatically actuated.
  2. Remote Manual
     The SWS pumps can be actuated by remote manual means from the control room.

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

C. Other
  1. Lubrication is assumed to be provided locally for the SWS pumps.
  2. Sources of pump and pump room cooling have not been determined.

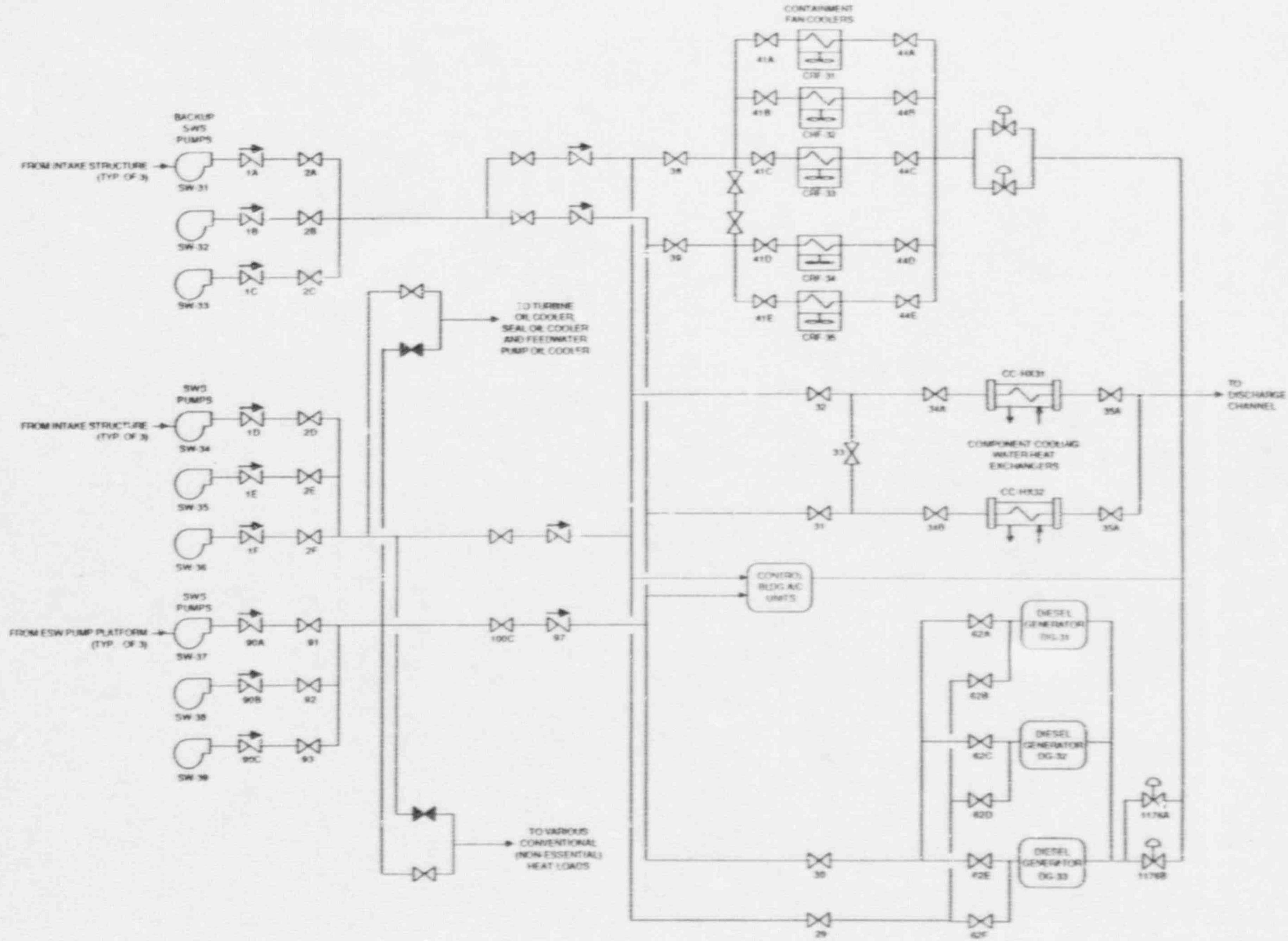

Figure 3.8-1. Indian Point 3 Service Water System

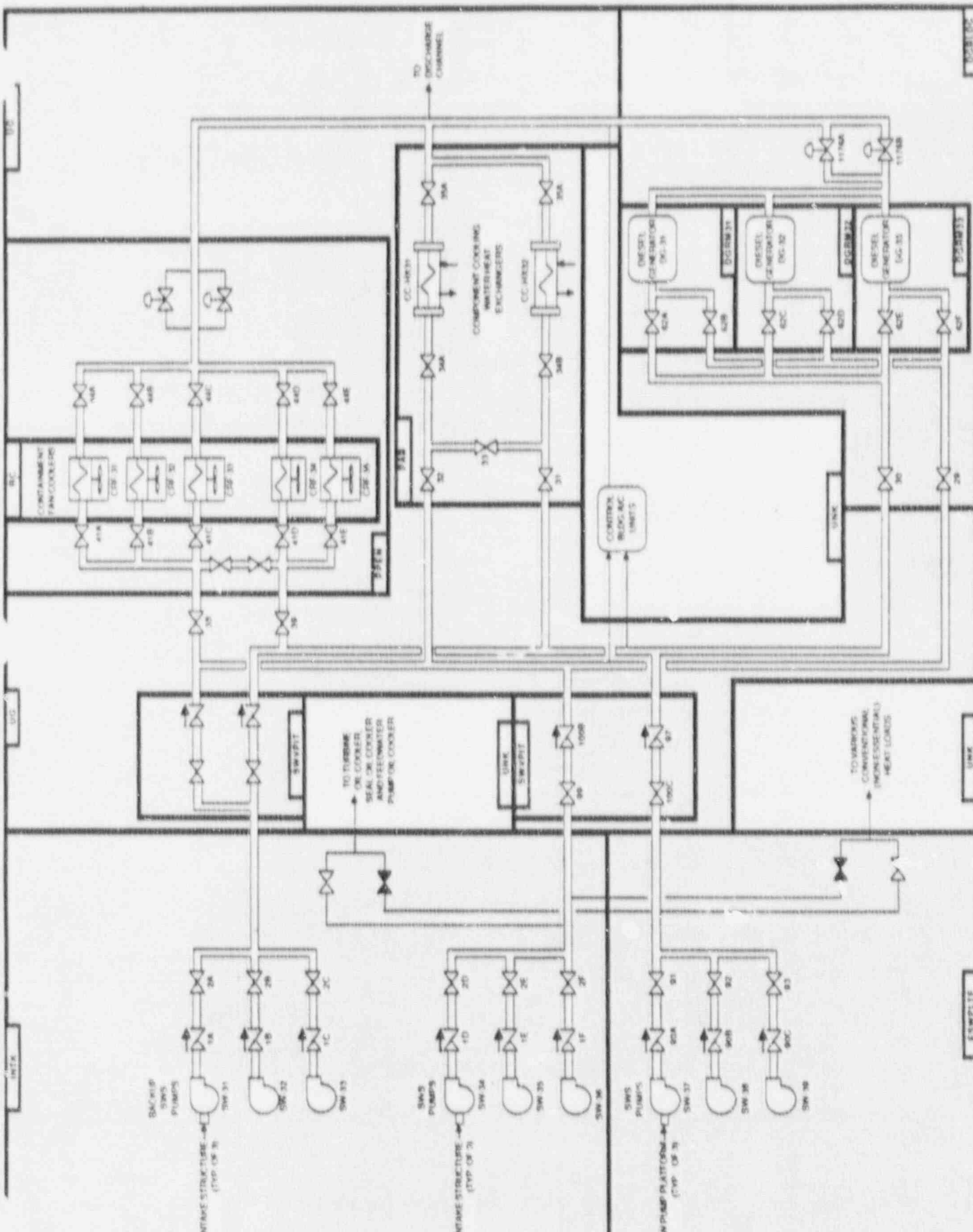

Figure 3.8-2. Indian Point 3 Service Water System Showing Component Locations.

Table 3.8-1. Indian Point 3 Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
SW-22	MDP	INTK	BUS2A	480	15CB	AC/2A-3A
SW-31	MDP	INTK	BUS5A	480	15CB	AC/5A
SW-33	MDP	INTK	BUS6A	480	15CB	AC/6A
SW-34	MDP	INTK	BUS5A	480	15CB	AC/5A
SW-35	MDP	INTK	BUS3A	480	15CB	AC/2A-3A
SW-36	MDP	INTK	BUS6A	480	15CB	AC/6A
SW-37	MDP	ESWPLTF	BUS5A	480	15CB	AC/5A
SW-38	MDP	ESWPLTF	BUS3A	480	15CB	AC/2A-3A
SW-39	MDP	ESWPLTF	BUS6A	480	15CB	AC/6A

3.9 CHEMICAL AND VOLUME CONTROL SYSTEM (CVCS)

3.9.1 System Function

The CVCS is responsible for maintaining the proper water inventory in the Reactor Coolant System and maintaining water purity and the proper concentration of neutron absorbing and corrosion inhibiting chemicals in the reactor coolant. The makeup function of the CVCS is assumed to be required to maintain the plant in a long-term hot shutdown condition. The charging pumps do not perform an emergency core cooling function.

3.9.2 System Definition

The CVCS provides a means for injection of control poison in the form of boric acid solution, chemical additions for corrosion control, and reactor coolant cleanup and degasification. This system also adds makeup water to the RCS, reprocesses water letdown from the RCS, and provides seal water injection to the reactor coolant pump seals.

RCS makeup is provided through a charging line which enters RCS loop 1 cold leg on the suction side of the reactor coolant pump. An alternate charging connection is provided to the hot leg of loop 2. The CVCS contains heat exchangers, demineralizers, boric acid tanks, a volume control tank, and three charging pumps to provide makeup and chemical control.

Simplified drawings of the CVCS, focusing on the makeup function, are shown in Figures 3.9-1 and 3.9-2. A summary of data on selected CVCS components is presented in Table 3.9-1.

3.9.3 System Operation

During normal plant operation, one charging pump is running with its suction aligned to the Volume Control Tank (VCT). The letdown flow from the RCS is directed to the VCT. The reactor makeup control subsystem of the CVCS maintains the desired inventory in the VCT.

The reactor makeup control is normally set to the "Automatic Makeup" position. In this mode if the level in the VCT reaches a low setpoint of 21.4% (Ref. 1), a preset solution of concentrated boric acid and primary water is mixed in the boric acid blender and directed to the charging pump suction header. The low-level signal from the VCT will start one boric acid transfer pump and one primary makeup pump, and open the valves to the charging pumps. If level in the VCT reaches a low-low setpoint of 8.5% (Ref. 1), the charging pumps will be automatically aligned to take a suction on the refueling water storage tank (RWST). If a safety injection signal is initiated the charging pumps will be tripped.

3.9.4 Component Information

A. Charging Pumps 31, 32, and 33
   1. Rated flow: 98 gpm
   2. Rated capacity: 100%
   3. Type: positive displacement

B. Boric Acid Transfer Pumps (2)
   1. Rated flow: 75 gpm @ 235 ft head (102 psid)
   2. Rated capacity: 100%
   3. Type: centrifugal

C. Primary Water Makeup Pumps (2)
  1. Rated flow: 150 gpm @ 235 ft head
  2. Rated capacity: 100%
  3. Type: centrifugal

D. Boric Acid Tanks (2)
  1. Capacity: 7000 gallons
  2. Design pressure: atmospheric
  3. Boric acid concentration: 11.5 - 13.0 w/o

E. Primary Water Storage Tank
  1. Capacity: 165,000 gallons
  2. Design pressure: atmosphere

3.9.5 Support Systems and Interfaces

A. Control Signals
  1. Automatic
     a. During normal operation one charging pump is controlled automatically. As pressurizer level increases, pump speed decreases, and vice versa. On low VCT level, one boric acid transfer pump and one primary water makeup pump are started, and appropriate valves are opened. On low-low VCT level, valve 112B to the RWST is opened.
     b. The charging pumps are tripped upon a safety injection signal.
  2. Remote Manual
     The charging pumps, boric acid transfer pumps and primary water makeup pump can be actuated by remote manual means from the control room.

B. Motive Power
  1. The charging pumps, boric acid pumps, and primary water makeup pumps are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.6.
  2. The source of power for the flow control valves could not be determined, however, it is assumed they fail open.

C. Other
  1. The charging pumps are cooled by the Component Cooling Water system (see Section 3.7).
  2. Lubrication of the charging pumps is assumed to be provided locally.
  3. Lubrication, ventilation, and cooling for the boric acid transfer pumps and the primary water makeup pumps are assumed to be provided locally.

3.9.6 Section 3.9 References

1. NUREG/CR-4400, "The Impact of Mechanical and Maintenance - Induced Failures of Main Reactor Coolant Pump Seals on Plant Safety", USNRC, December 1985.

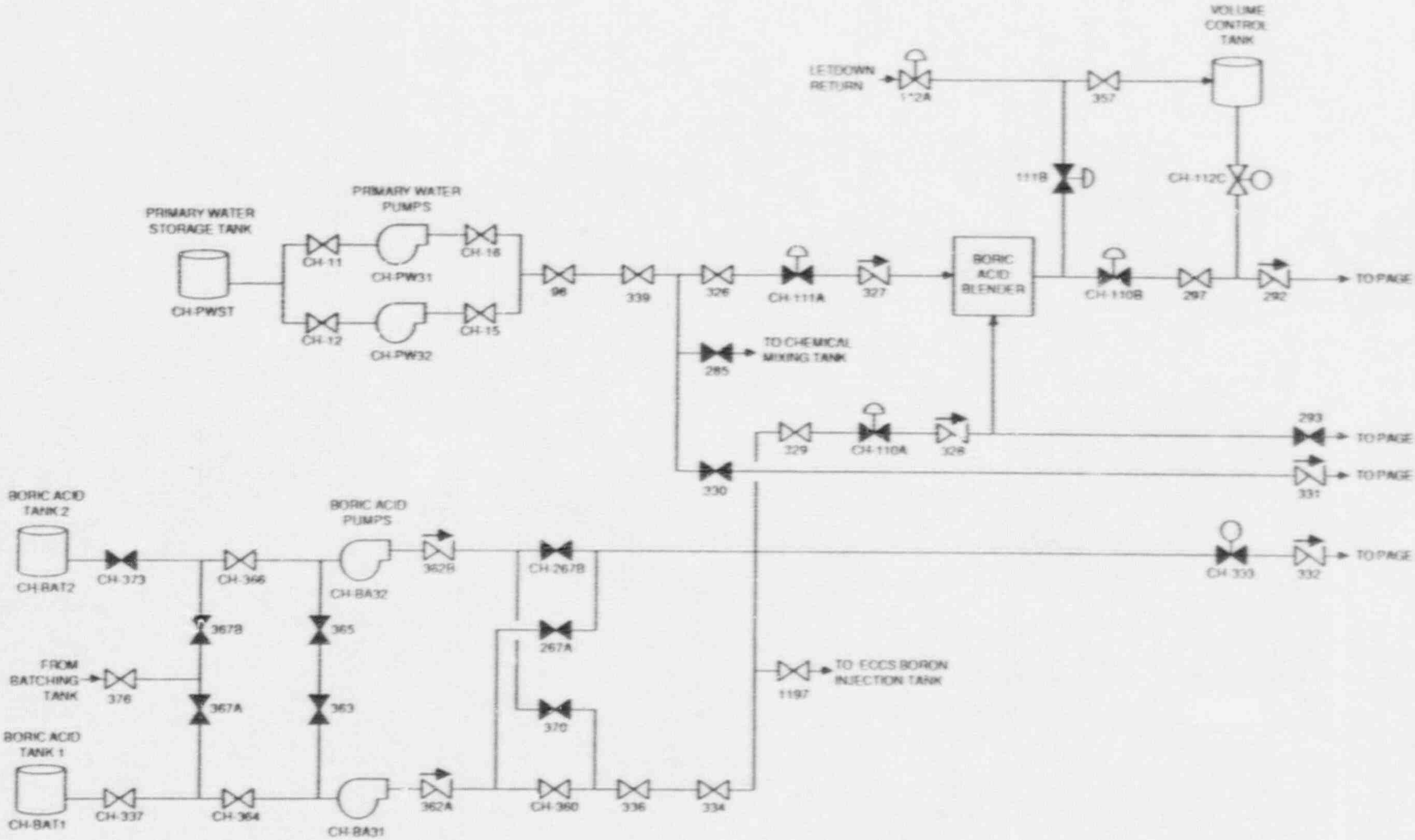

Figure 3.9-1. Indian Point 3 Chemical and Volume Control System. (Page 1 of 2)

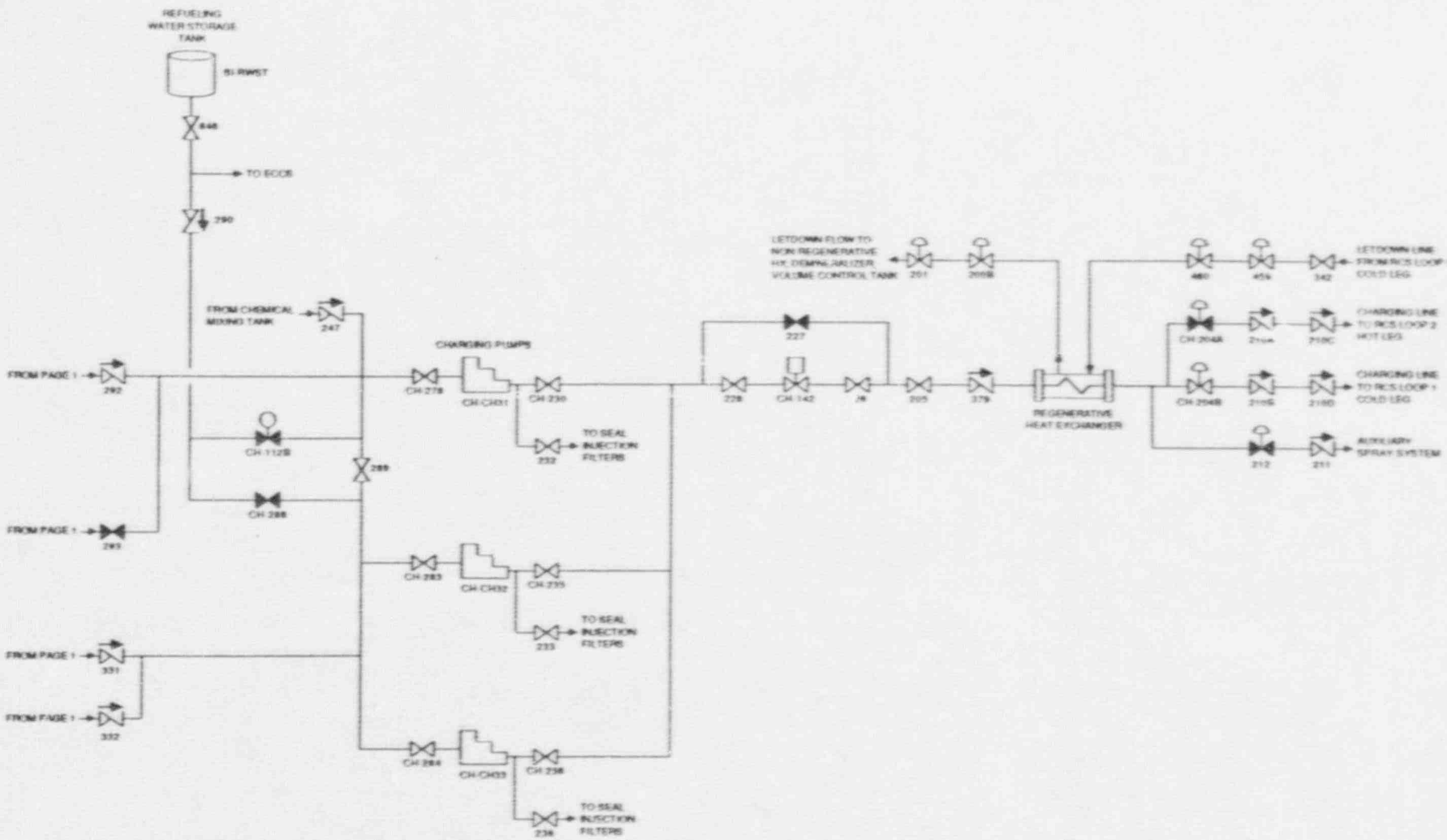

Figure 3.9-1. Indian Point 3 Chemical and Volume Control System. (Page 2 of 2)

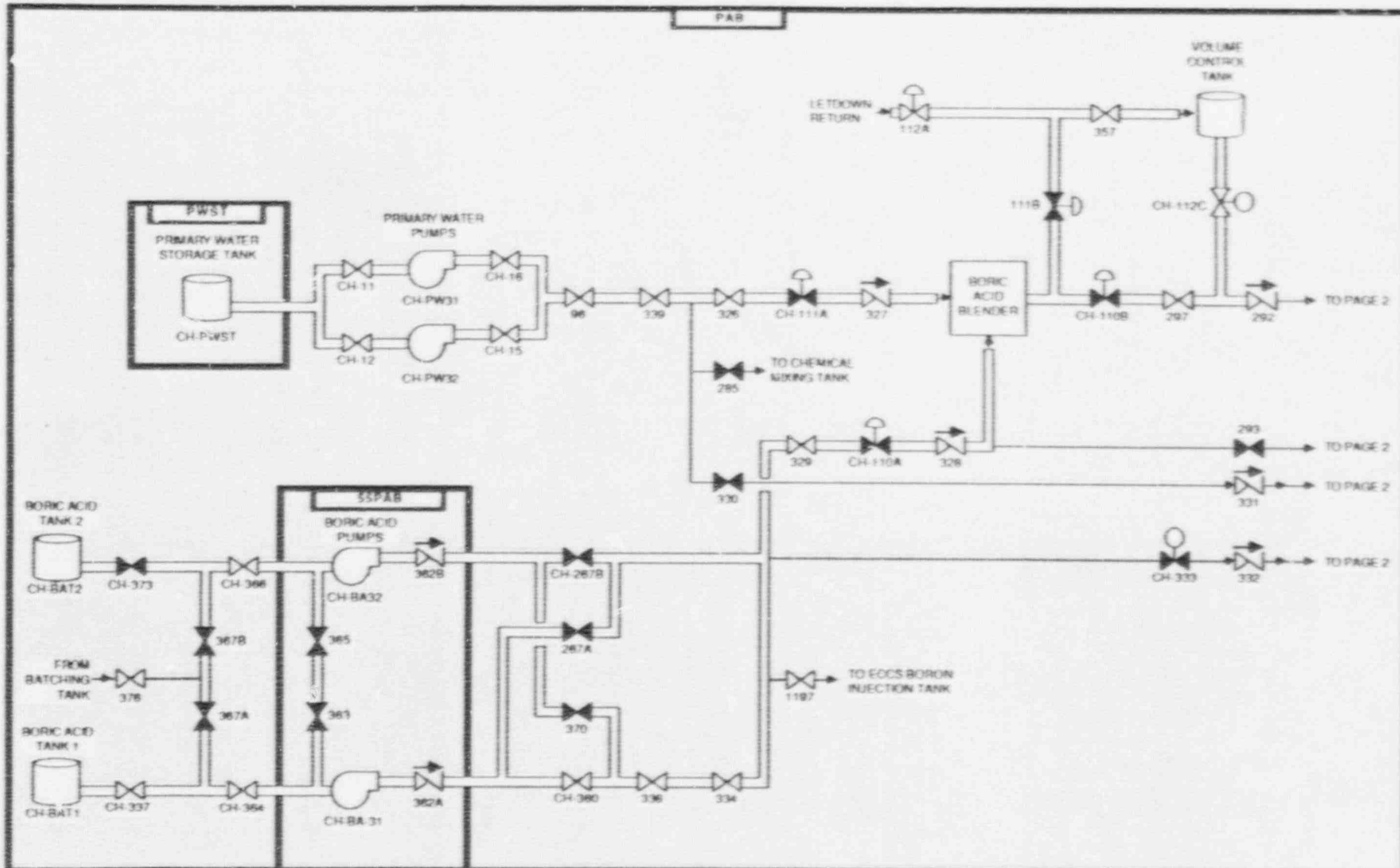

Figure 3.9-2. Indian Point 3 Chemical and Volume Control System Showing Component Locations. (Page 1 of 2)

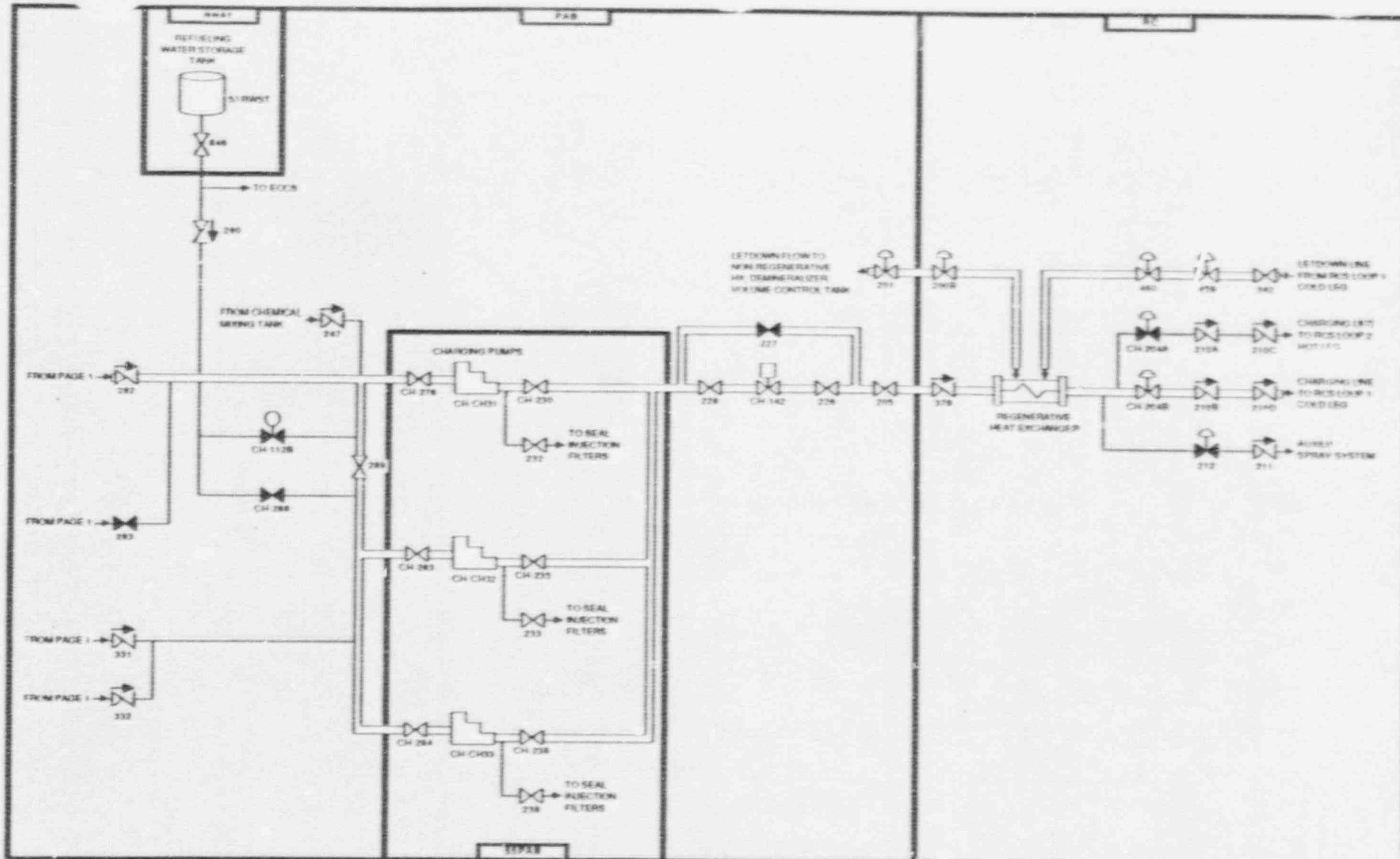

Figure 3.9-2. Indian Point 3 Chemical and Volume Control System Showing Component Locations. (Page 2 of 2)

Table 3.9-1. Indian Point 3 Chemical and Volume Control System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
CH-11	XV	PAB				
CH-110A	NV	PAB				
CH-110B	NV	PAB				
CH-111A	NV	PAB				
CH-112B	MOV	PAB	MCC36B	480	55PAB	AC/6A
CH-12	XV	PAB				
CH-142	HV	PAB				
CH-15	XV	PAB				
CH-16	XV	PAB				
CH-204A	NV	RC				
CH-204B	NV	RC				
CH-230	XV	55PAB				
CH-235	XV	55PAB				
CH-236	XV	55PAB				
CH-267B	XV	55PAB				
CH-278	XV	55PAB				
CH-283	XV	55PAB				
CH-284	XV	55PAB				
CH-288	XV	PAB				
CH-337	XV	PAB				
CH-360	XV	55PAB				
CH-364	XV	55PAB				
CH-366	XV	55PAB				
CH-373	XV	PAB				
CH-BA31	MDP	55PAB	MCC36A	480	55PAB	AC/5A
CH-BA32	MDP	55PAB	MCC36B	480	55PAB	AC/6A
CH-BAT1	TANK	PAB				

Table 3.9-1. Indian Point 3 Chemical and Volume Control System Data Summary for Selected Components (continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMER. LOAD GRP.
CH-BAT2	TANK	PAB				
CH-CH31	MDP	55PAB	BUS5A	480	15CB	AC/5A
CH-CH32	MDP	55PAB	BUS[illegible]	480	15CB	AC/2A-3A
CH-CH33	MDP	55PAB	BUS6A	480	15CB	AC/6A
CH-PW31	MDP	PAB	MCC37	480	55PAB	AC/6A
CH-PW32	MDP	PAB	MCC37	480	55PAB	AC/6A
CH-PWST	TANK	PWST				

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Indian Point Nuclear Generating Station is located on a site of approximately 235 acres of land on the east bank of the Hudson River in upper Westchester County, New York. The site is approximately 24 miles north of New York City. The nearest city is Peekskill, 2.5 miles northeast of the plant. The power station contains two operating units (Indian Point 2 and 3) plus a third unit (Indian Point 1) that is no longer in operation. Unit 3 is adjacent to and south of Unit 1. A general view of the Indian Point site and vicinity is shown in Figure 4-1 (from Ref. 1).

The major structures at this unit include the containment building, turbine building, primary auxiliary building, auxiliary feedwater building, control building, diesel generator building, intake structure, and fuel storage building. A site plot plan for Indian Point 3 is shown in Figure 4-2.

The containment structure is reinforced concrete cylinder with a steel liner. The building contains the reactor vessel, reactor coolant pumps, steam generators, pressurizer, two RHR heat exchangers, and two recirculation pumps. Pumps, piping, and valving for the reactor coolant system is completely contained within the containment structure. Section views of the containment building are shown in Figure 4-3. Access to the building is via an equipment hatch or a personnel hatch. The penetration area is on the south and west sides of the containment. This area contains all the piping and electrical feeds into the containment.

The primary auxiliary building (PAB) is located to the southeast of the containment. It contains much of the plant's safety-related equipment, specifically the high pressure injection pumps, RHR pumps, containment spray pumps, charging pumps, component cooling water pumps and heat exchangers, and motor control centers supplying power to safety system components. A section view of the primary auxiliary building is shown in Figure 4-4.

The auxiliary feedwater (AFW) building is located west of the containment, between the containment and the turbine building. It contains the AFW pumps and valves on the 18 ft. level (area 18AFPB) and AFW piping rising through the 32 ft. and 46 ft. levels (areas 32AFPB and 46 AFPB) before entering the containment.

The control building is located southwest of the PAB and east of the turbine building. It contains the control room, cable spreading room, switchgear room, and battery rooms. Electrical cables exit the cable spreading room to the east and enter the electrical tunnel.

The diesel generator building is adjacent to the control building. It contains the three diesel generators, each in a separate room.

The intake structure is located west of the turbine building, along the Hudson River. This structure contains the service water pumps and intake screens.

The turbine building, located west of the containment, houses the turbine generator and the associated power generating auxiliaries. A section view of the turbine building is shown in Figure 4-5.

The fuel storage building is located on the east side of the containment. This building contains the spent fuel pool, associated cooling equipment, and storage for new fuel.

4.2 FACILITY LAYOUT DRAWINGS

Figures 4-6 through 4-11 are simplified building layout drawings of the Indian Point 3 containment, primary auxiliary building, control building, auxiliary feedwater building, and fuel storage building. The turbine and service building, maintenance shop, and technical support building are not shown on these drawings. Major rooms, stairways, elevators, and doorways are shown in the simplified layout drawings, however, many interior walls have been omitted for clarity. Labels printed in uppercase correspond to the location codes listed in Table 4-1 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

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

4.3 SECTION 4 REFERENCES

1. Heddleson, F.A., "Design Data and Safety Features of Commercial Nuclear Power Plants.", ORNL-NSIC-55, Volume 1, Oak Ridge National Laboratory, Nuclear Safety Information Center, December 1973.

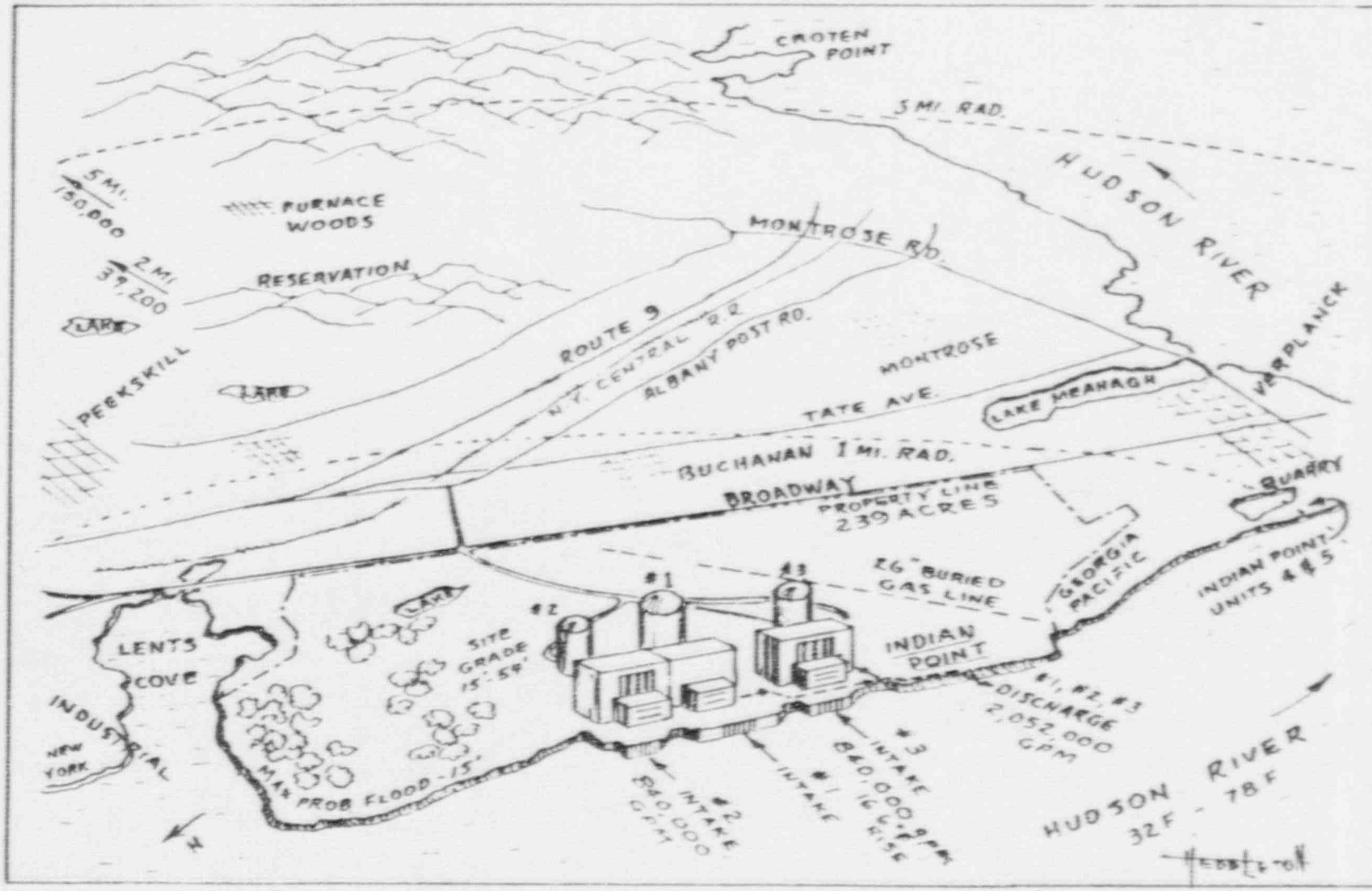

Figure 4-1. General View of the Indian Point Site and Vicinity

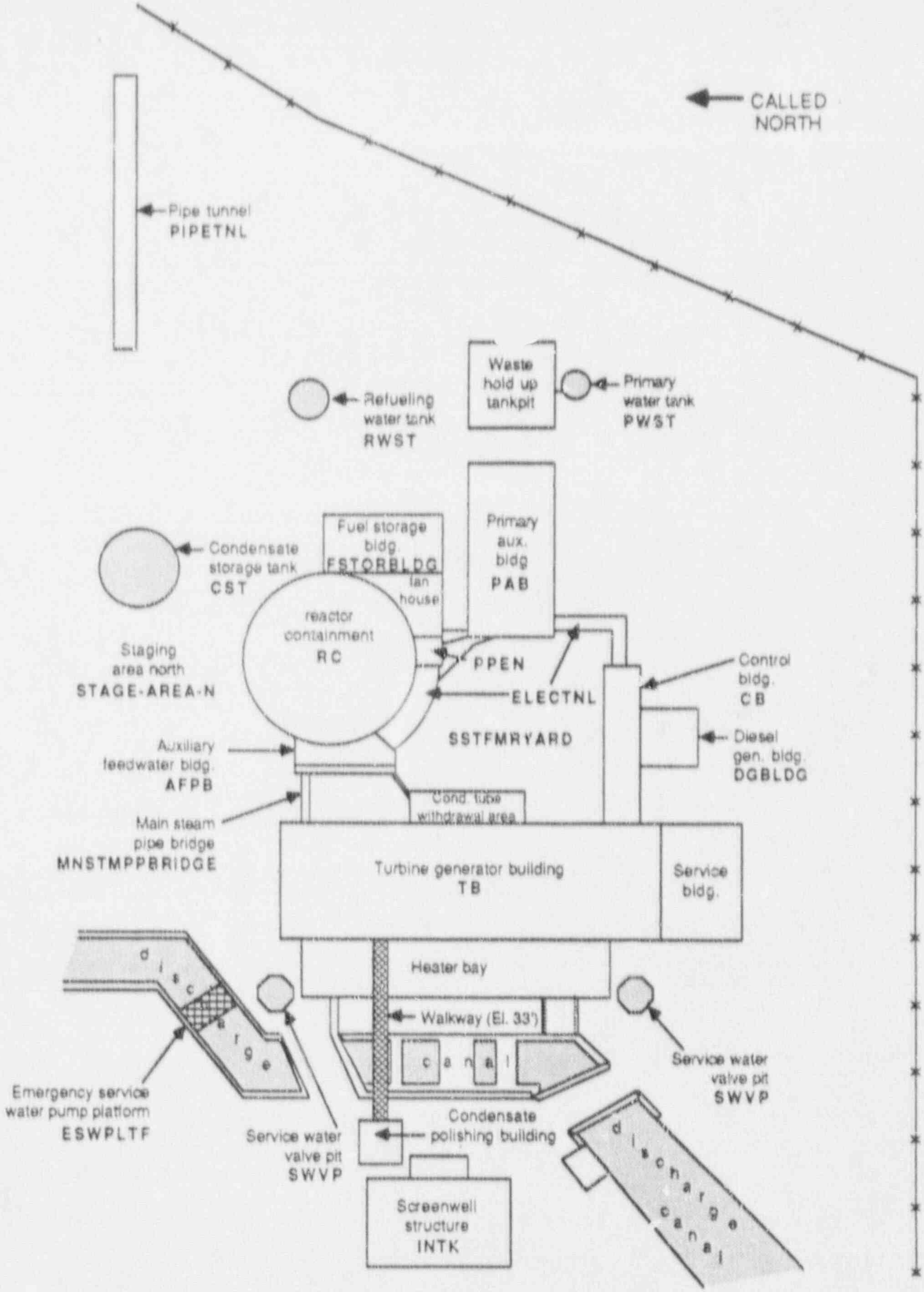

Figure 4-2. Indian Point Unit 3 Plot Plan

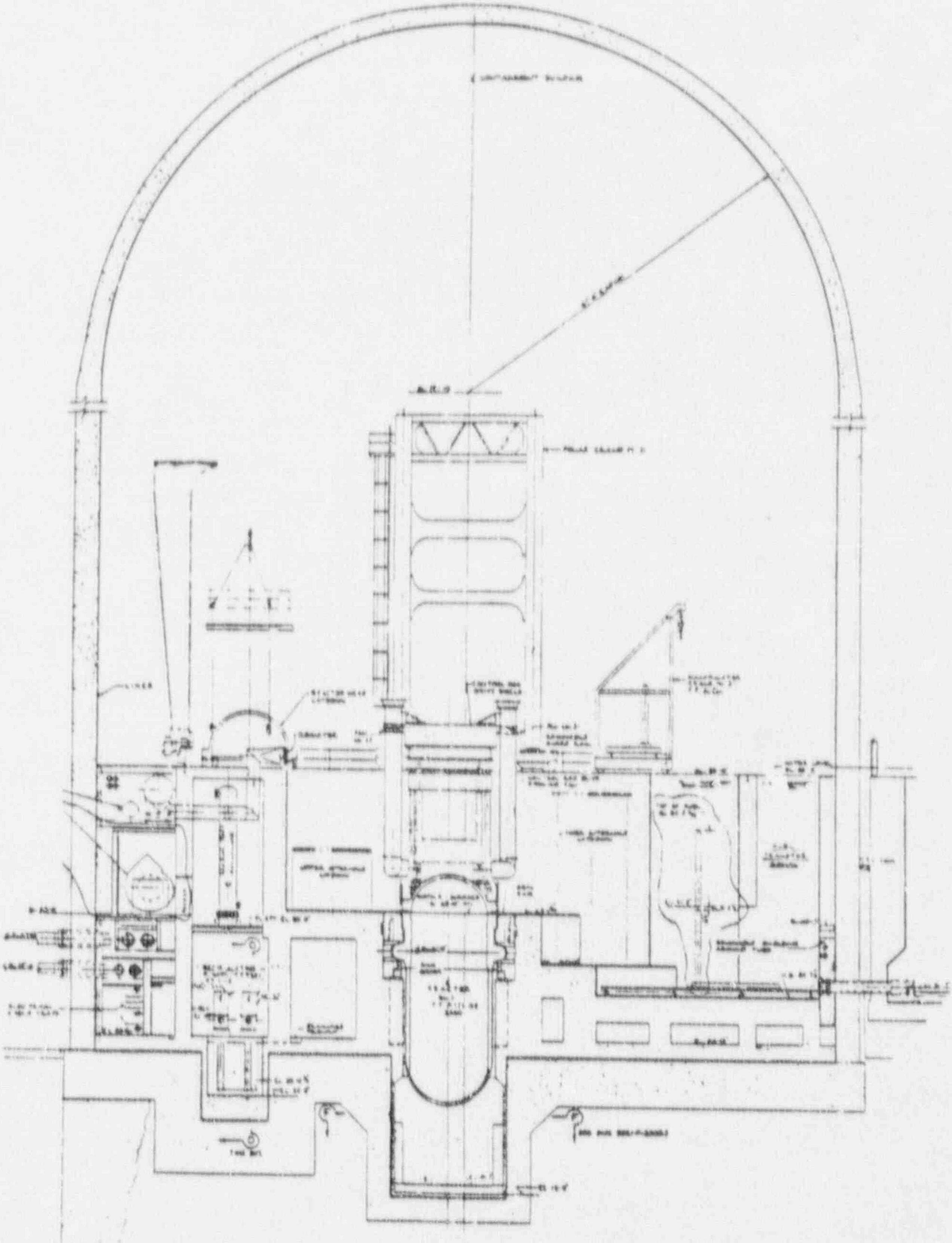

Figure 4-3. Section Views of Indian Point 3 Containment Building (Page 1 of 2)

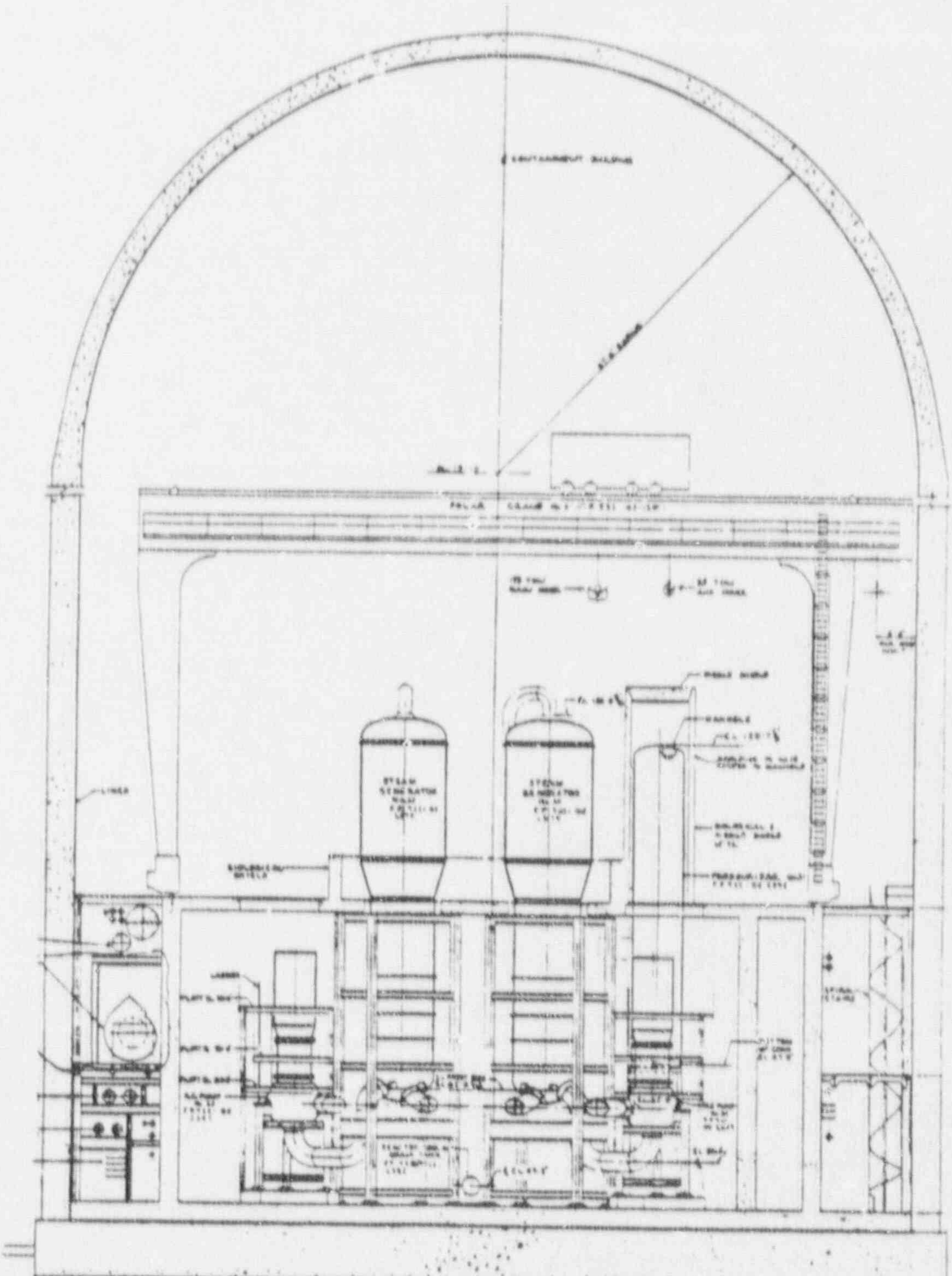

Figure 4-3. Section Views of Indian Point 3 Containment Building
(Page 2 of 2)

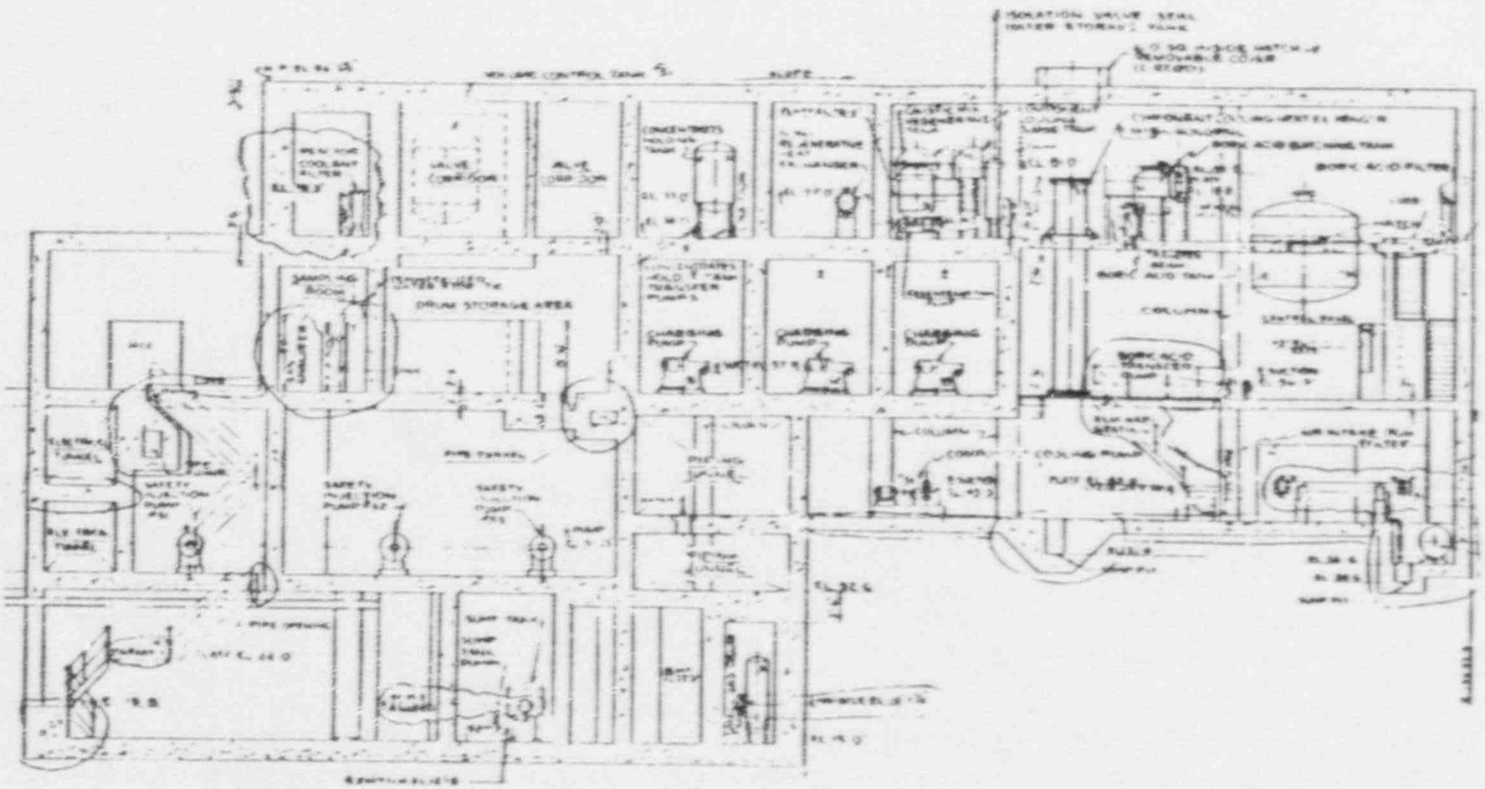

Figure 4-4. Section View of indian Point 3 Primary Auxilary Building

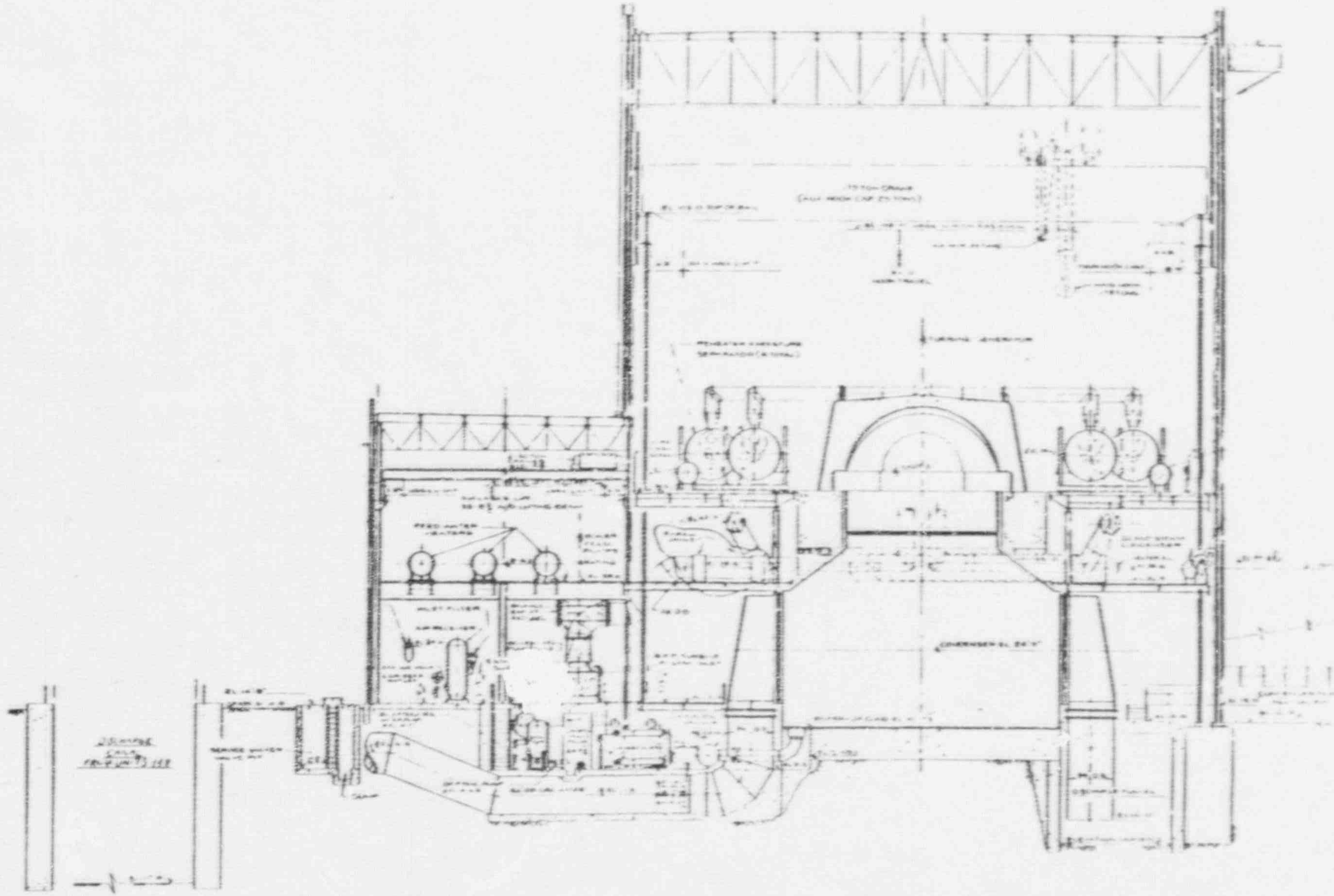

Figure 4-5. Section View of Indian Point 3 Turbine Building

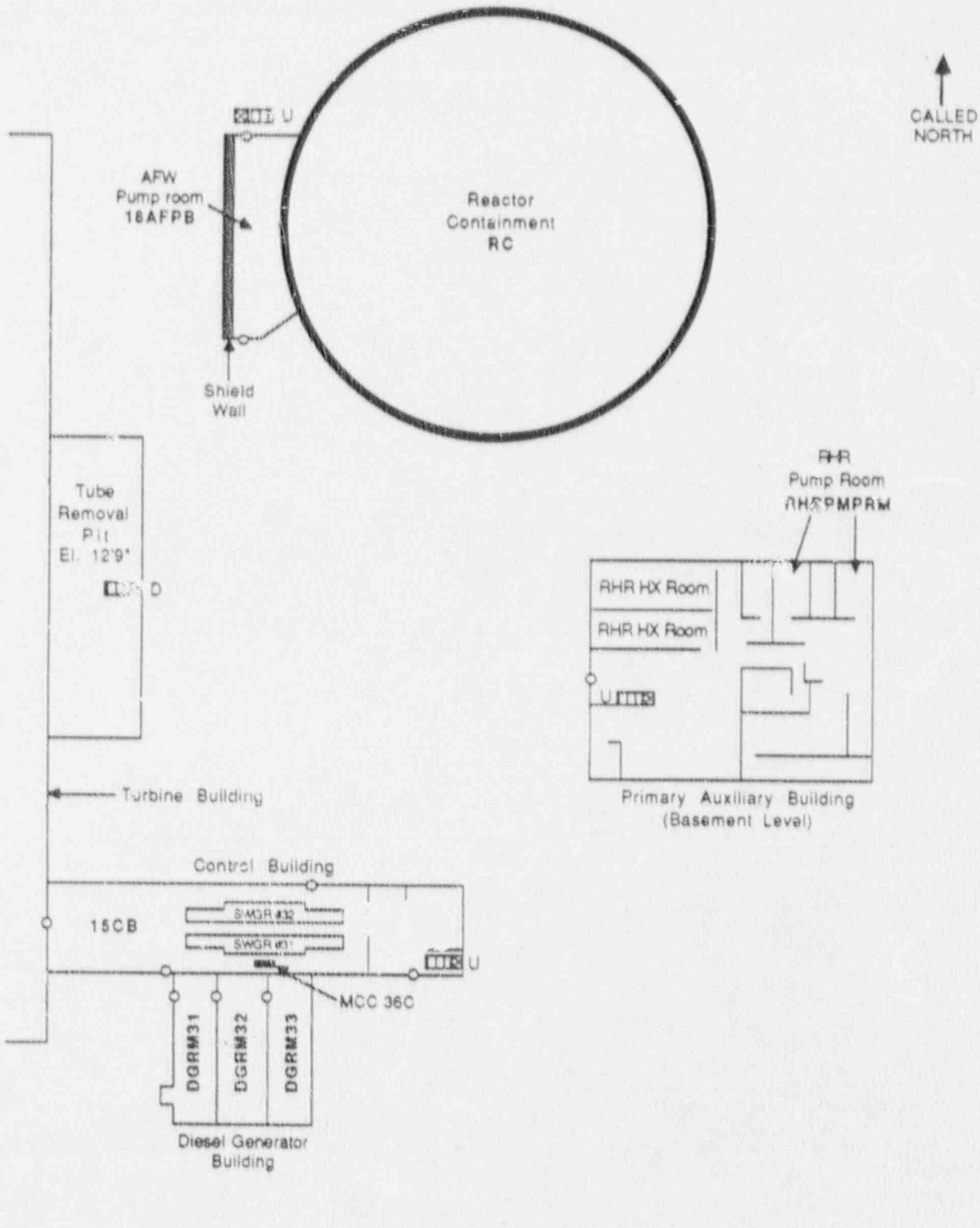

Figure 4-6. Indian Point Unit 3 Station Arrangement Elevation 15'

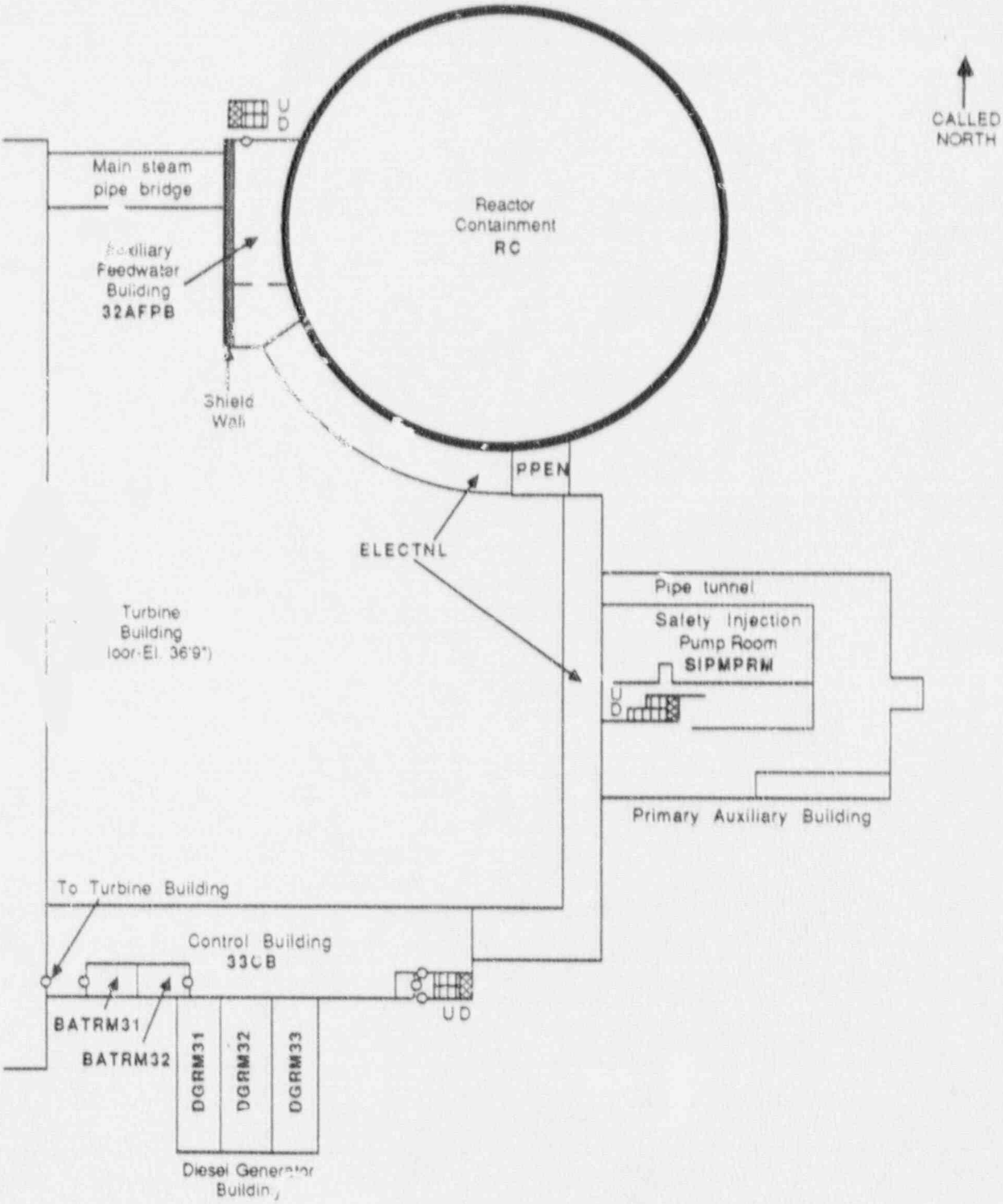

Figure 4-7. Indian Point Unit 3 Station Arrangement
Elevation 33'

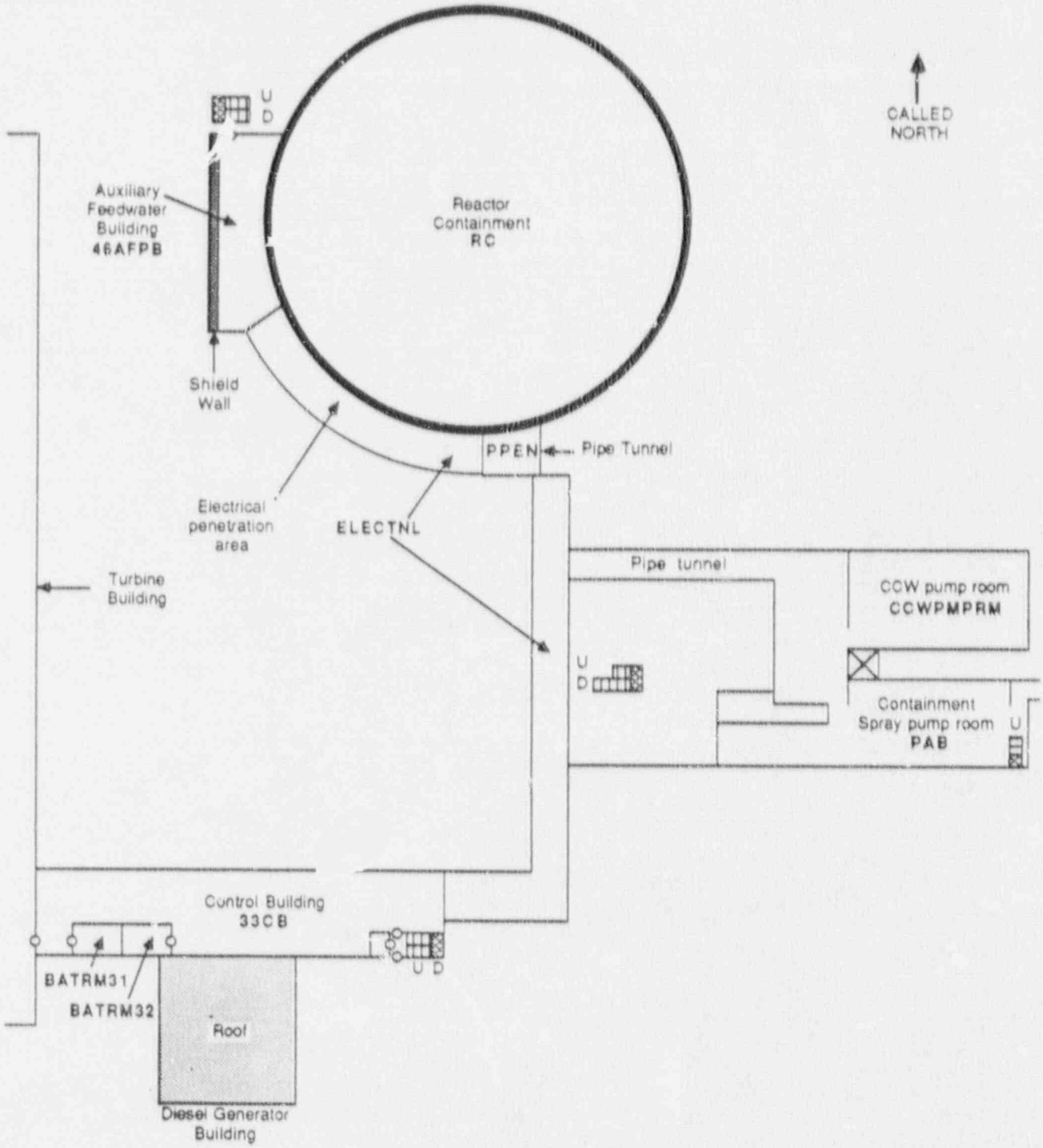

Figure 4-8. Indian Point Unit 3 Station Arrangement Elevation 41'

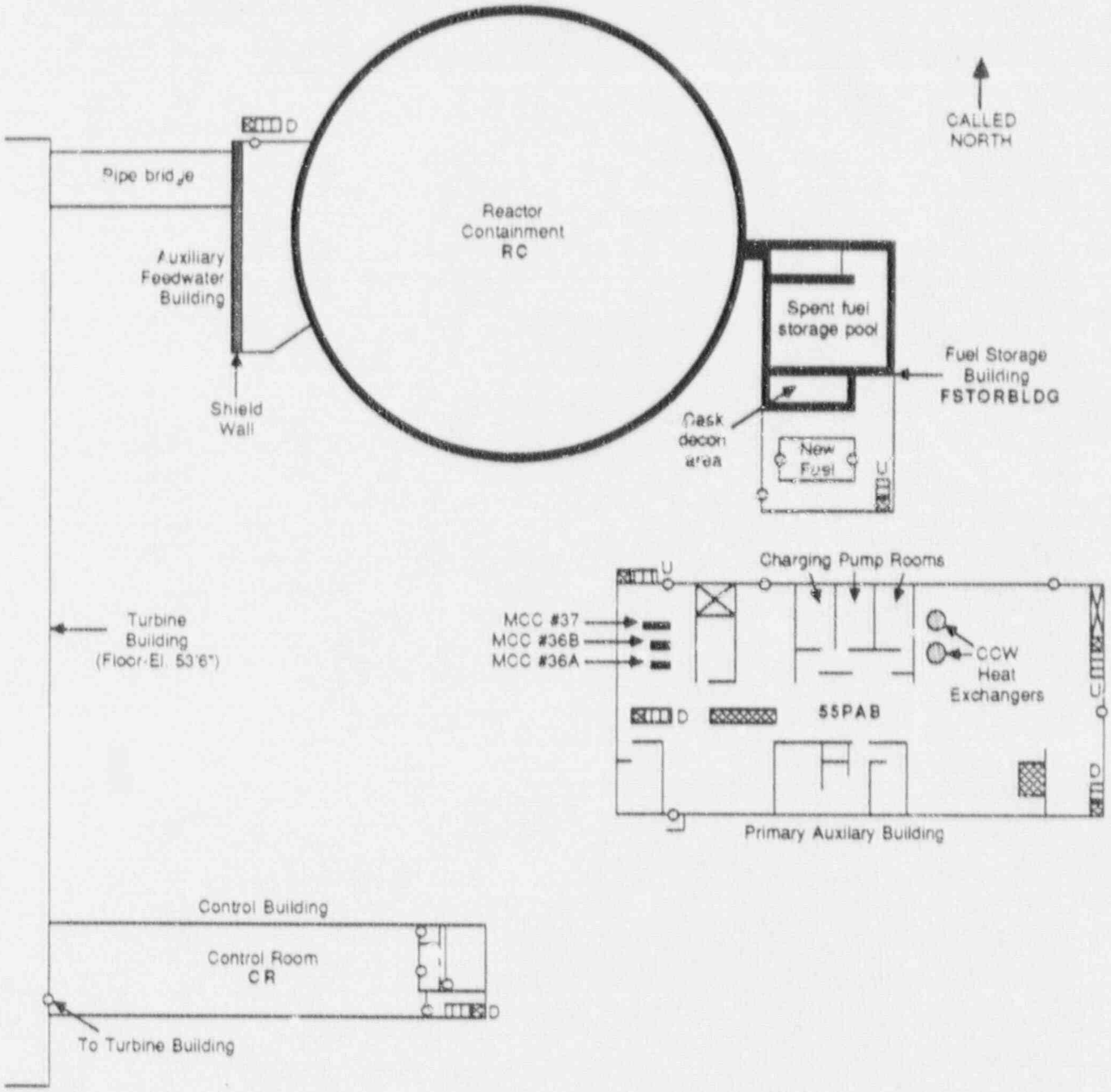

Figure 4-9. Indian Point Unit 3 Station Arrangement
Elevation 55'

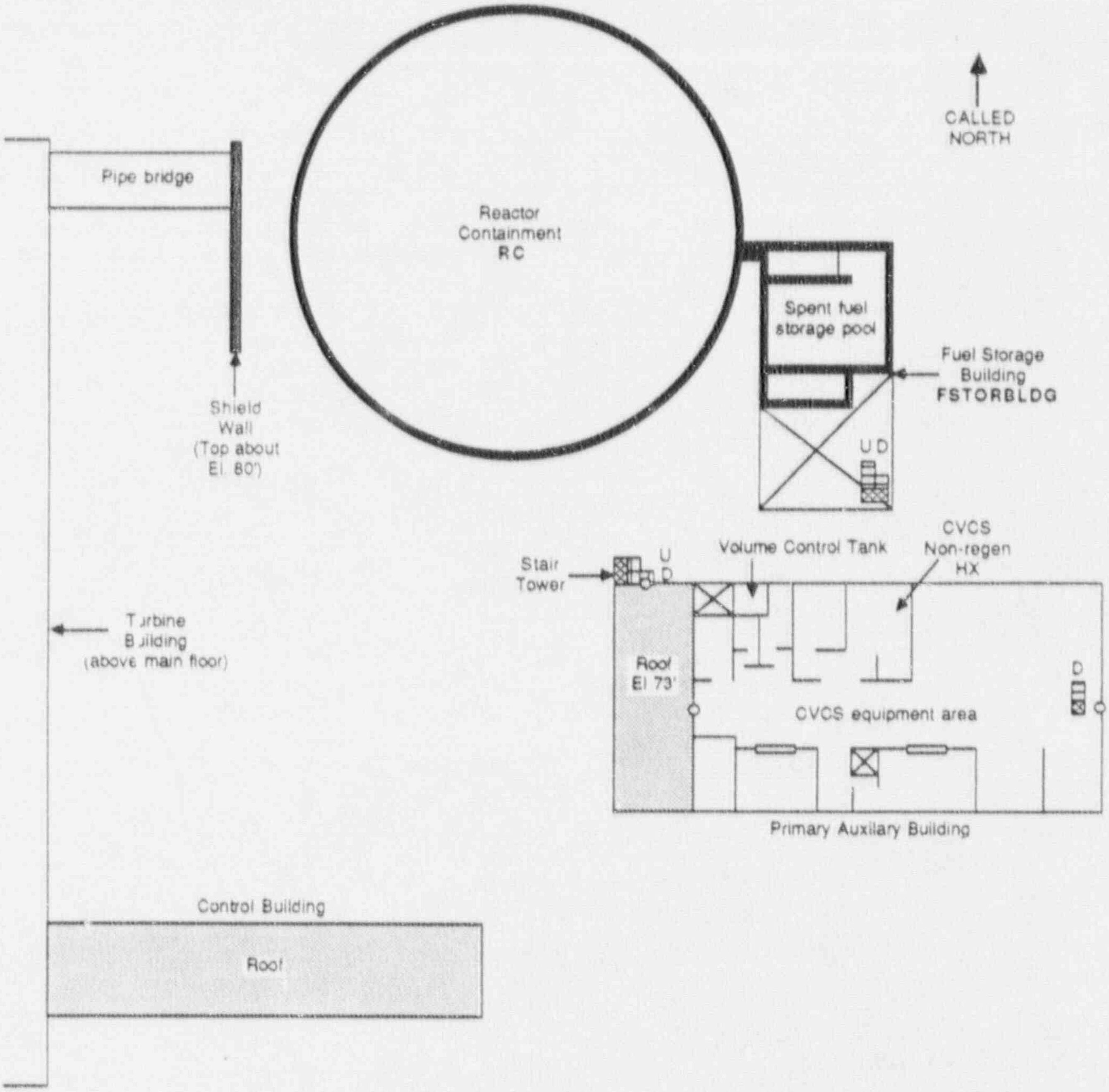

Figure 4-10. Indian Point Unit 3 Station Arrangement
Elevation 73'

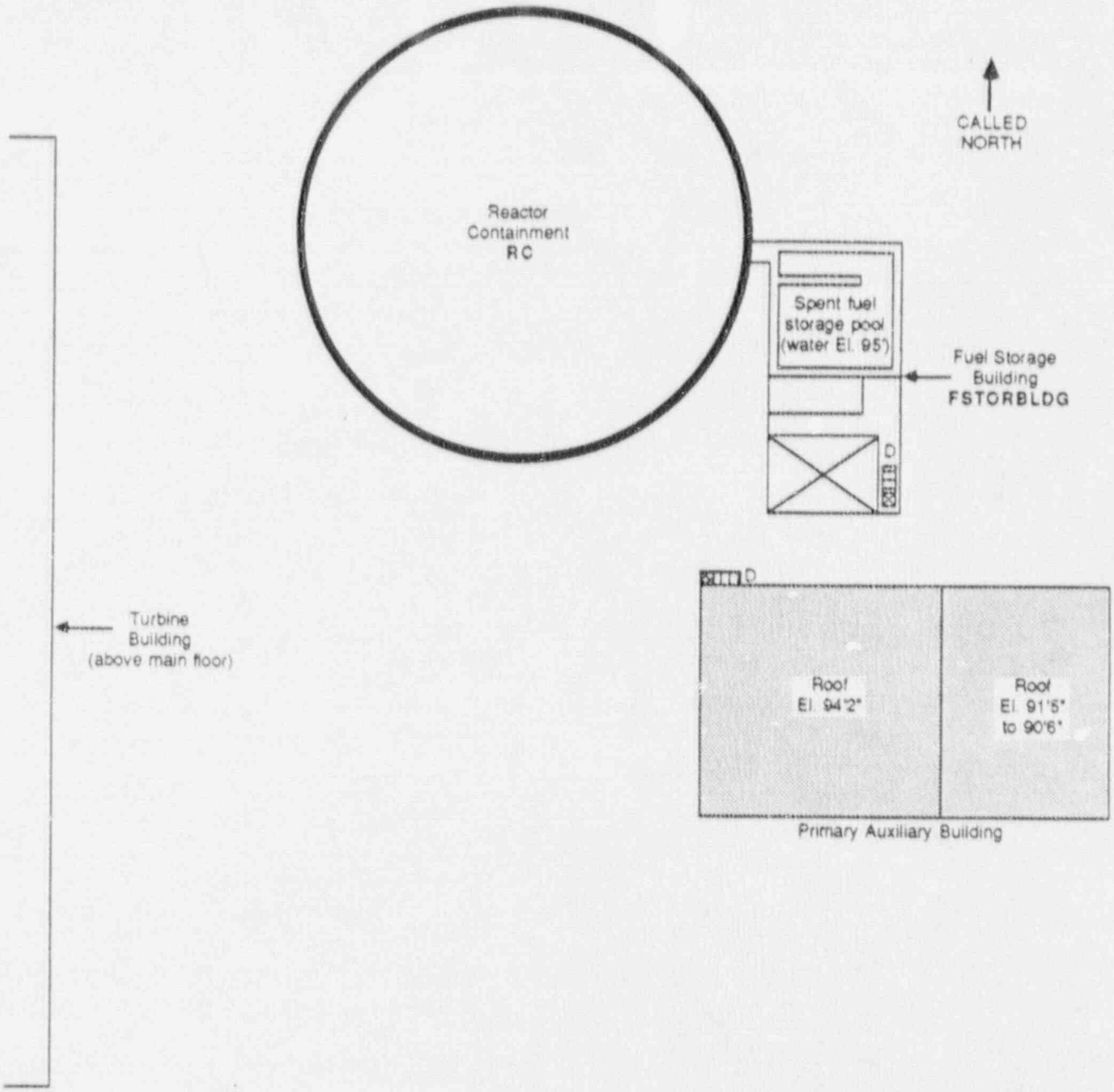

Figure 4-11. Indian Point Unit 3 Station Arrangement
Elevation 95'

Table 4-1. Definition of Indian Point 3 Building and Location Codes

	Codes	Descriptions
1.	15CB	15' elevation of the Control Building
2.	18AFPB	18' elevation of the Auxiliary Feedwater Pump Building
3.	32AFPB	32' elevation of the Auxiliary Feedwater Pump Building
4.	33CB	33' elevation of the Control Building
5.	46AFPB	46' elevation of the Auxiliary Feedwater Pump Building
6.	55PAB	55' elevation of the Primary Auxiliary Building
7.	BAT31RM	Battery #31 Room, located on the 33' elevation of the Control Building
8.	BATRM32	Battery #32 Room, located on the 33' elevation of the Control Building
9.	CCWPMPRM	Component Cooling Water Pump Room, located on the 41' elevation of the Primary Auxiliary Building
10.	CR	Control Room, located on the 53' elevation of the Control Building
11.	CST	Condensate Storage Tank, located outside northeast of the Reactor Containment
12.	CWTRTK	City Water Tank, located outside approximately 1800' east of the plant.
13.	DGBLDG	Diesel Generator Building
14.	DGRM31	Diesel Generator #31 Room
15.	DGRM32	Diesel Generator #32 Room
16.	DGRM33	Diesel Generator #33 Room
17.	ELECTNL	Primary Auxiliary Building and Reactor Containment
18.	ESWPLTF	Emergency Service Water Pump Platform Structure located over the Unit #1 Discharge Tunnel approximately 100' northwest of the Turbine Building
19.	FSTORBLDG	Fuel Storage Building

Table 4-1. Definition of Indian Point 3 Building and Location Codes (Continued)

Codes		Descriptions
20.	INTK	Intake Structure, located at the river - west of the Turbine Building
21.	MNSTMPPBRIDGE	Main Steam Pipe Bridge - outdoor structure between the Reactor Containment and the Turbine Building
22.	PAB	Primary Auxiliary Building
23.	PIPETNL	Pipe Tunnel from City Water Tank to the plant
24.	PPEN	Pipe Penetration Area - structure with Pipe tunnels between Primary Auxiliary Building and Reactor Containment
25.	PWST	Primary Water Storage Tank
26.	RC	Reactor Containment Structure
27.	RHRPMPRM	Residual Heat Removal Pump Room, located on the 15' elevation of the Primary Auxiliary Building
28.	RWST	Refueling Water Storage Tank, located outdoors approximately 200' east of the Reactor Containment
29.	SERVWTRPIT	Service Water Pit, valve pit located in the Primary Auxiliary Building
30.	SIPMPRM	Safety Injection Pump Room, located on the 34' elevation of the Primary Auxiliary Building
31.	SSTFMRYARD	Station Service Transformer Yard - outdoor area enclosed by the Turbine, Control, and Primary Auxiliary Buildings, and Reactor Containment Structure
32.	STAGE-AREA-N	Staging Area - North - outdoor area between the Auxiliary Feedwater Pump Building and the Condensate Storage Tank
33.	SWVP	Service Water Valve Pit, located outside approximately 50' northwest of the Turbine Building
34.	TB	Turbine Building

Table 4-2. Partial Listing of Components by Location at Indian Point 3

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
15CB	EP	DC-33	BUS
15CB	EP	BUS2A	BUS
15CB	EP	CB-2A	CB
15CB	EP	BUS6A	BUS
15CB	EP	CB-6A	CB
15CB	EP	BUS5A	BUS
15CB	EP	CB-5A	CB
15CB	EP	BUS3A	BUS
15CB	EP	CB-3A	CB
15CB	EP	BC-33	BC
15CB	EP	MCC36C	MCC
18AFPB	AFW	AFW-27	XV
18AFPB	AFW	AFW-1187	NV
18AFPB	AFW	AFW-31	MDP
18AFPB	AFW	AFW-33	MDP
18AFPB	AFW	AFW-32	TDP
18AFPB	AFW	AFW-1139	NV
18AFPB	AFW	AFW-405A	NV
18AFPB	AFW	AFW-406A	NV
18AFPB	AFW	AFW-30	XV
18AFPB	AFW	AFW-33	XV
18AFPB	AFW	AFW-64	XV
18AFPB	AFW	AFW-1188	NV
18AFPB	AFW	AFW-1189	NV
18AFPB	AFW	AFW-405B	NV
18AFPB	AFW	AFW-405C	NV
18AFPB	AFW	AFW-405D	NV
18AFPB	AFW	AFW-406B	NV
18AFPB	AFW	AFW-406C	NV
18AFPB	AFW	AFW-406D	NV

Table 4-2. Partial Listing of Components by Location at Indian Point 3 (continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
33CB	EP	DC-32	BUS
33CB	EP	DC-31	BUS
33CB	EP	BC-31	BC
33CB	EP	BC-32	BC
33CB	EP	INV-31	INV
33CB	EP	INV-32	INV
33CB	EP	MCC39	MCC
33CB	EP	INV-33	INV
33CB	EP	INV-34	INV
55PAB	CVCS	CH-CH31	MDP
55PAB	CVCS	CH-CH32	MDP
55PAB	CVCS	CH-CH33	MDP
55PAB	CVCS	CH-BA31	MDP
55PAB	CVCS	CH-BA32	MDP
55PAB	CVCS	CH-278	XV
55PAB	CVCS	CH-230	XV
55PAB	CVCS	CH-283	XV
55PAB	CVCS	CH-235	XV
55PAB	CVCS	CH-284	XV
55PAB	CVCS	CH-236	XV
55PAB	CVCS	CH-364	XV
55PAB	CVCS	CH-360	XV
55PAB	CVCS	CH-366	XV
55PAB	CVCS	CH-267B	XV
55PAB	EP	MCC36A	MCC
55PAB	EP	MCC36B	MCC
55PAB	EP	MCC37	MCC
BAT31RM	EP	BATT31	BATT
BATRM32	EP	BATT32	BATT
CCWPMPRM	AC	CC-33	MDP

Table 4-2. Partial Listing of Components by Location at Indian Point 3 (continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
CCWPMPRM	AC	CC-32	MDP
CCWPMPRM	AC	CC-31	MDP
CR	EP	INST-BUS-31	BUS
CR	EP	INST-BUS-32	BUS
CR	EP	INST-BUS-33	BUS
CR	EP	INST-BUS-34	BUS
CST	AFW	AFW-6	XV
CST	AFW	AFW-CST	TANK
CWTRTK	AFW	AFW-CWTR	TANK
DGRM31	EP	DG-31	DG
DGRM31	EP	BATT33	BATT
DGRM32	EP	DG-32	DG
DGRM33	EP	DG-33	DG
ESWPLTF	SW	SW-37	MDP
ESWPLTF	SW	SW-38	MDP
ESWPLTF	SW	SW-39	MDP
INTK	SW	SW-22	MDP
INTK	SW	SW-31	MDP
INTK	SW	SW-33	MDP
INTK	SW	SW-34	MDP
INTK	SW	SW-35	MDP
INTK	SW	SW-36	MDP
PAB	AC	CC-HX31	HX
PAB	AC	CC-HX32	HX
PAB	CVCS	CH-142	HV
PAB	CVCS	CH-110B	NV
PAB	CVCS	CH-111A	NV
PAB	CVCS	CH-PW31	MDP
PAB	CVCS	CH-PW32	MDP
PAB	CVCS	CH-110A	NV

Table 4-2. Partial Listing of Components by Location at Indian Point 3 (continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
PAB	CVCS	CH-337	XV
PAB	CVCS	CH-BAT1	TANK
PAB	CVCS	CH-373	XV
PAB	CVCS	CH-BAT2	TANK
PAB	CVCS	CH-288	XV
PAB	CVCS	CH-112B	MOV
PAB	CVCS	CH-11	XV
PAB	CVCS	CH-16	XV
PAB	CVCS	CH-12	XV
PAB	CVCS	CH-15	XV
PAB	ECCS	SI-1852A	MOV
PAB	ECCS	SI-882	MOV
PAB	ECCS	SI-1852B	MOV
PAB	PAHRS	CS-866A	MOV
PAB	PAHRS	CS-31	MDP
PAB	PAHRS	CS-32	MDP
PAB	PAHRS	CS-866B	MOV
PAB	SW	CC-HX31	HX
PAB	SW	CC-HX31	HX
PAB	SW	CC-HX31	HX
PAB	SW	CC-HX32	HX
PAB	SW	CC-HX32	HX
PAB	SW	CC-HX32	HX
PIPETNL	AFW	AFW-49	XV
PPEN	AC	CC-822A	MOV
PPEN	AC	CC-822B	MOV
PPEN	ECCS	RH-744	MOV
PWST	CVCS	CH-PWST	TANK
RC	AC	RH-HX31	HX
RC	AC	RH-HX32	HX

Table 4-2. Partial Listing of Components by Location at Indian Point 3 (continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	CVCS	CH-204B	NV
RC	CVCS	CH-204A	NV
RC	ECCS	RCS-894A	MOV
RC	ECCS	RE-W1	TANK
RC	ECCS	RE-W2	TANK
RC	ECCS	RE-31	MDP
RC	ECCS	RE-32	MDP
RC	ECCS	RE-1802A	MOV
RC	ECCS	RE-1802B	MOV
RC	ECCS	SI-856A	MOV
RC	ECCS	SI-856B	MOV
RC	ECCS	RCS-VESSEL	RV
RC	ECCS	RH-745A	MOV
RC	ECCS	RH-745B	MOV
RC	ECCS	RCS-894B	MOV
RC	ECCS	RCS-894C	MOV
RC	ECCS	RCS894D	MOV
RC	ECCS	SI-856K	MOV
RC	ECCS	SI-856H	MOV
RC	ECCS	SI-856J	MOV
RC	ECCS	SI-1869B	MOV
RC	ECCS	SI-638	MOV
RC	ECCS	SI-899B	MOV
RC	ECCS	SI-747	MOV
RC	PAHRS	CS-889A	MOV
RC	PAHRS	CS-889B	MOV
RC	PAHRS	CRF-31	FCU
RC	PAHRS	CRF-31	FCU
RC	PAHRS	CRF-32	FCU
RC	PAHRS	CRF-33	FCU

Table 4-2. Partial Listing of Components by Location at Indian Point 3 (continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	PAHRS	CRF-34	FCU
RC	PAHRS	CRF-35	FCU
RC	PAHRS	CRF-32	FCU
RC	PAHRS	CRF-33	FCU
RC	PAHRS	CRF-34	FCU
RC	PAHRS	CRF-35	FCU
RC	RCS	RCS-VESSEL	RV
RC	RCS	RCS-730	MOV
RC	RCS	RCS-731	MOV
RC	RCS	RCS-536	MOV
RC	RCS	RCS-456	NV
RC	RCS	RCS-535	MOV
RC	RCS	RSC-455	NV
RHRPMPRM	ECCS	RH-31	MDP
RHRPMPRM	ECCS	RH-32	MDP
RWST	CVCS	SI-RWST	TANK
RWST	ECCS	SI-RWST	TANK
RWST	ECCS	SI-RWST	TANK
RWST	PAHRS	SI-RWST	TANK
RWST	PAHRS	SI-RWST	TANK
SERVWTRPIT	ECCS	RE-885A	MOV
SERVWTRPIT	ECCS	RE-885B	MOV
SIPMPRM	ECCS	SI-31	MDP
SIPMPRM	ECCS	SI-33	MDP
SIPMPRM	ECCS	SI-32	MDP
SIPMPRM	ECCS	SI-1810	MOV
SIPMPRM	ECCS	SI-887A	MOV
SIPMPRM	ECCS	SI-887B	MOV

5. BIBLIOGRAPHY FOR INDIAN POINT 3

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2. NUREG-0296, "Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 3," USNRC, August 1977.

3. NUREG-0611, "Generic Evaluation of Feedwater Transients and Small Break Loss of Coolant Accidents in Westinghouse-Designed Operating Plants," Appendix X.10, "Indian Point 3 Auxiliary Feedwater System," USNRC, January 1980.

4. NUREG/CR-2655, "Evaluation of the Prompt Alerting Systems at Four Nuclear Power Stations," Bolt, Beranck & Newman, Inc., September 1982.

5. NUREG/CR-2934, "Review and Evaluation of the Indian Point Probabilistic Safety Study," Sandia National Laboratories, December 1982.

6. NUREG/CR-3281, "Investigation of the Shell Cracking on the Steam Generators of Indian Point No. 3," Brookhaven National Laboratory, June 1983.

7. NUREG/CR-4179, "Diagraph Matrix Analysis for Systems Interactions at Indian Point Unit 3," Lawrence Livermore National Laboratory, January 1986 (5 volumes).

8. NUREG/CR-4207, "Fault Tree Application to the Study of Systems Interactions at Indian Point 3," Brookhaven National Laboratory, January 1986.

9. NUREG/CR-4565, "Probabilistic Safety Study Applications Program for Inspection of Indian Point Unit 3 Nuclear Power Plant," Brookhaven National Laboratory, March 1986.

10. GAO/RCED-83-158, "Response to Specific Questions on the Indian Point Probabilistic Safety Study," US General Accounting Office, May 24, 1983.

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)

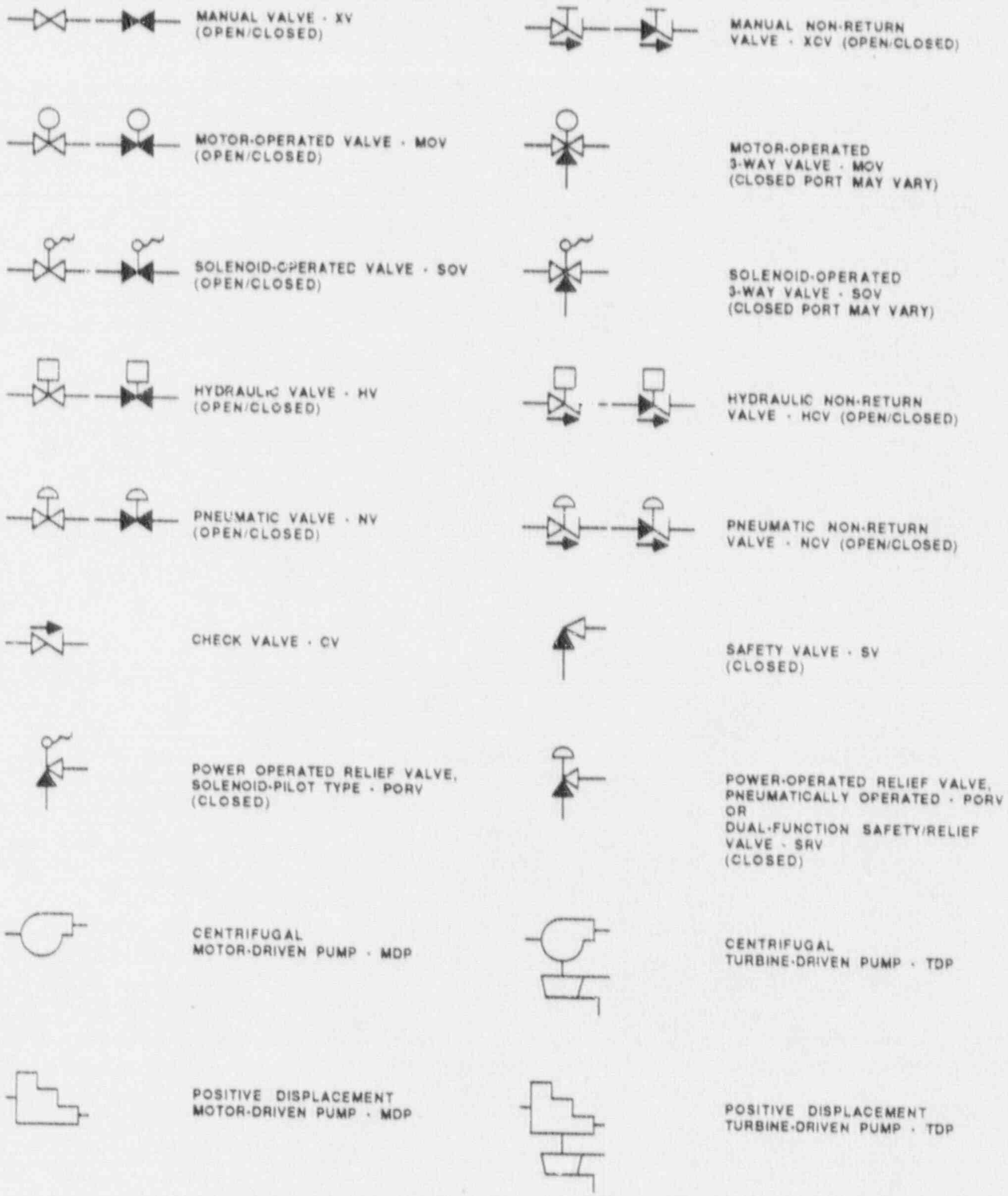

Figure A-1. Key To Symbols In Fluid System Drawings

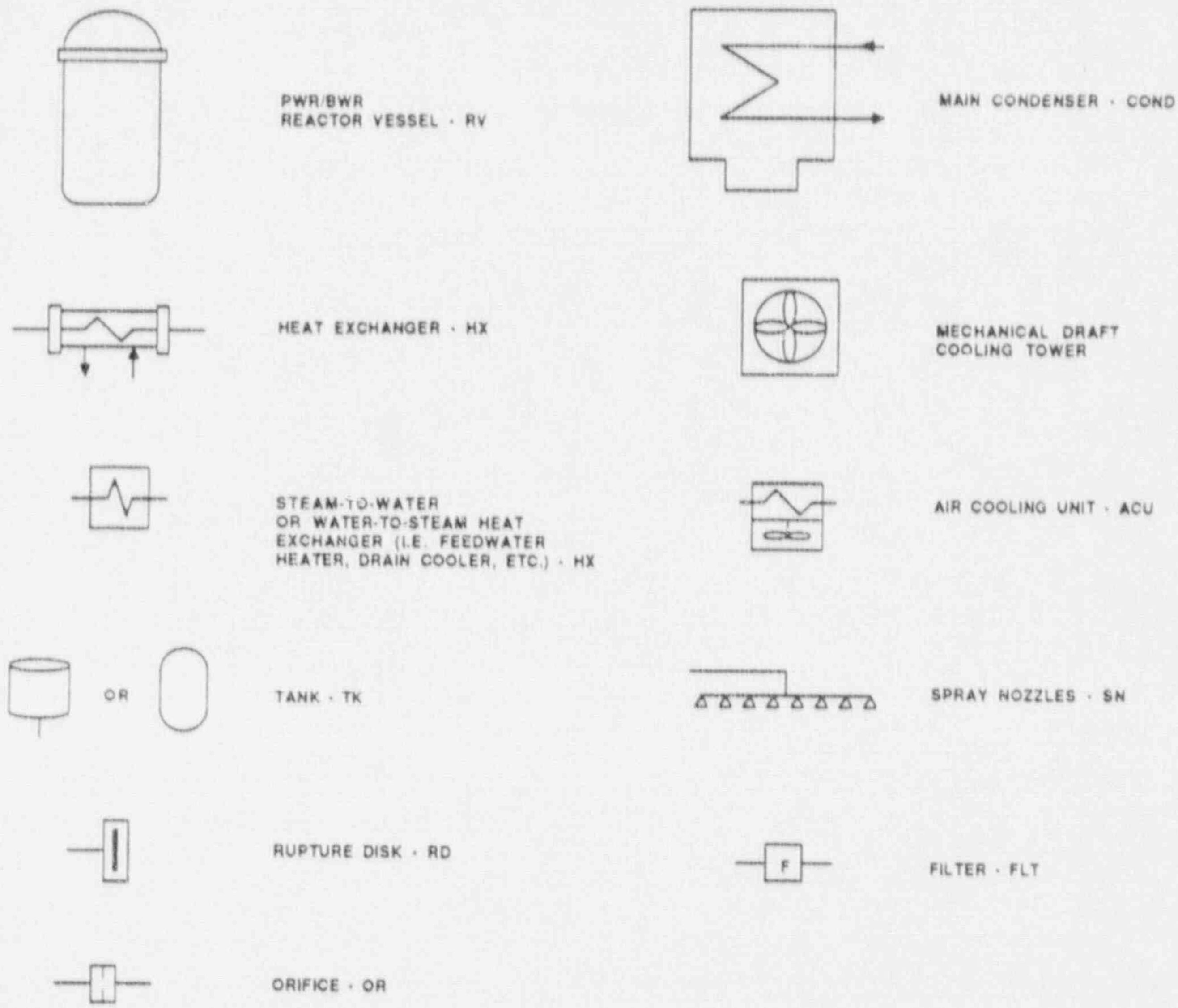

Figure A-1. Key To Symbols In Fluid System Drawings (Continued)

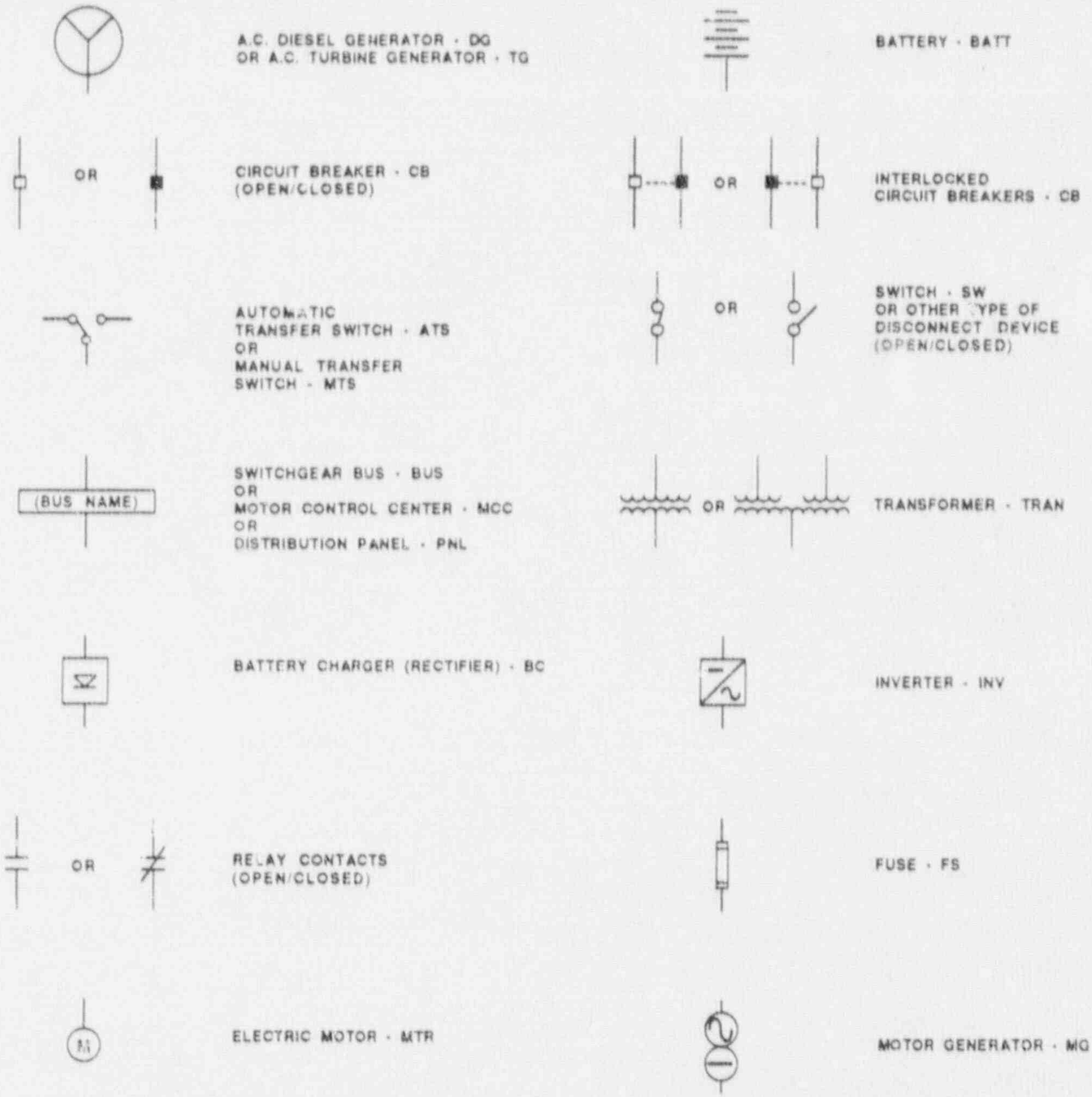

Figure A-2. Key To Symbols In Electrical System Drawings

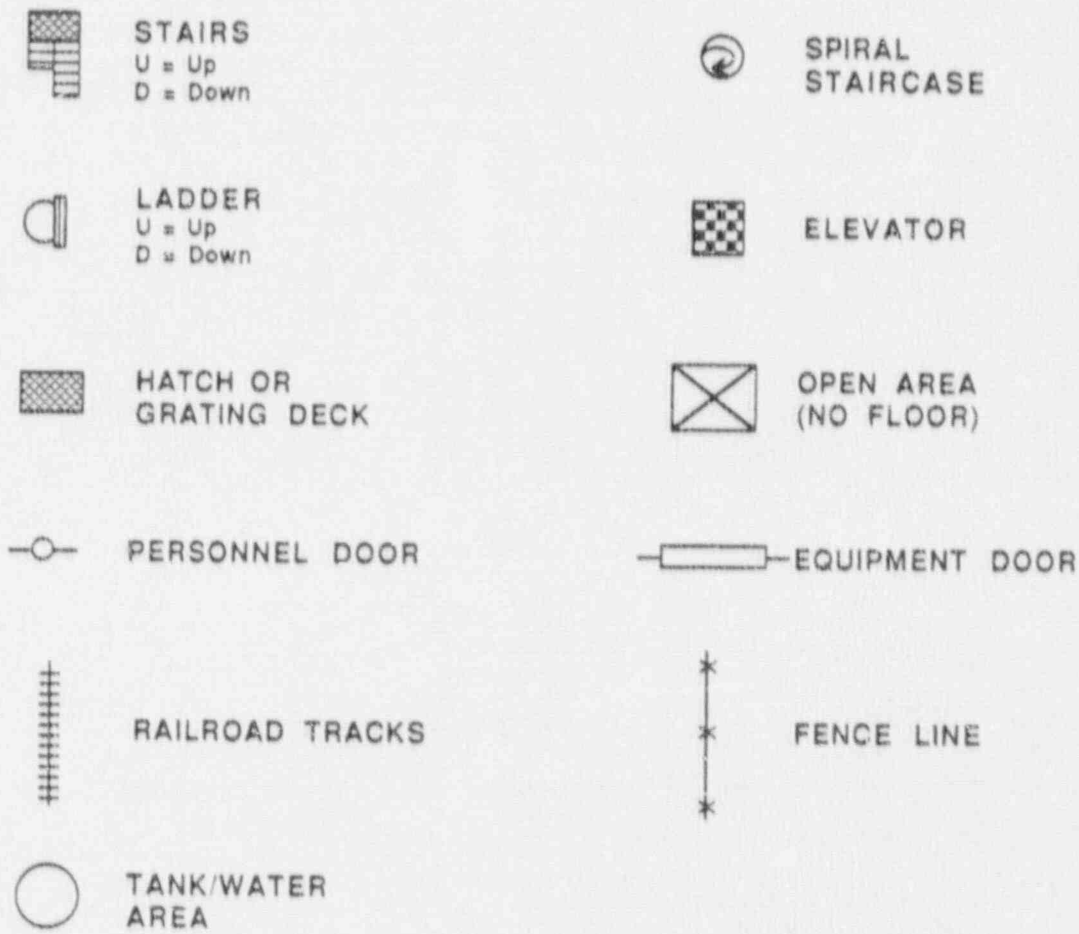

Figure A-3. Key To Symbols In Facility Layout Drawings

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
AFW	Auxiliary Feedwater System
ECCS	Emergency Core Cooling System (including HPSI and LPSI)
PAHRS	Post-Accident Heat Removal System
EP	Electric Power System
AC	Auxiliary Coolant Component Cooling Water System
SW	Service Water System
CVCS	Chemical and Volume Control System

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

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

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

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

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

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

TABLE B-1. COMPONENT TYPE CODES

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

TABLE B-1. COMPONENT TYPE CODES (Continued)

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