UNITED STATES NUCLEAR REGULATORY COMMISSION

NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

THREE MILE ISLAND 1

50-289

SAIC

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NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

THREE MILE ISLAND 1

50-289

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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.

THREE MILE ISLAND 1
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	9/89	Original report

THREE MILE ISLAND SYSTEM SOURCEBOOK

This sourcebook contains summary information on the Three Mile Island 1 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 Three Mile Island 1 nuclear power plant is listed below:

- Docket number	50-289
- Operator	GPU Nuclear Corp.
- Location	Pennsylvania, 10 southeast of Harrisburg
- Commercial operation date	9/2/74
- Reactor type	PWR
- NSSS vendor	Babcock & Wilcox
- Number of loops	2
- Power (MWt/MWe)	2535/792
- Architect-engineer	Gilbert Associates, Inc.
- Containment type	Reinforced concrete cylinder with steel liner, post-tensioned in three directions

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

The Three Mile Island 1 plant has a Babcock & Wilcox PWR two-loop nuclear steam supply system (NSSS). Other Babcock & Wilcox operating plants in the United States are:

- Arkansas Nuclear One, Unit 1
- Crystal River 3
- Davis Besse 1
- Oconee 1, 2, and 3
- Rancho Seco

In addition, the Bellefonte 1 and 2 plants are under construction as of 9/89.

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at Three Mile Island 1 in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at Three Mile Island 1 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 TMI-1 Systems Covered in this Report

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor Heat Removal Systems			
- Reactor Coolant System (RCS)	Same	3.1	4
- Auxiliary Feedwater (AFW) and Secondary Steam Relief (SSR) Systems	Emergency Feedwater System	3.2	10.6
- Emergency Core Cooling Systems (ECCS)	Same Subsystems	3.3	6.1
- High-Pressure Injection & Recirculation	High Pressure Injection (Makeup and Purification System) Core Flooding System		9.1
- Low-pressure Injection & Recirculation	Low Pressure Injection (Decay Heat Removal System) Recirculation (Decay Heat Removal System)		9.5
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Decay Heat Removal (DHR) System	3.3	6.1, 9.5
- Main Steam and Power Conversion Systems	Steam Supply Systems, Condensate System, Main Feedwater System, Condensate Circulating and River Water System	X	9.6.2.1, 10
- Other Heat Removal Systems	None identified	X	
Reactor Coolant Inventory Control Systems			
- Chemical and Volume Control System (CVCS) (Charging System)	Make-up and Purification System	3.3	6.1, 9.1
- ECCS	See ECCS, above	-	-

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Containment Systems			
- Containment	Same	X	5
- Containment Heat Removal Systems - Containment Spray System	Reactor Building Spray System	3.4	6.2
- Containment Fan Cooler System	Reactor Building Emergency Cooling System	3.4	5.6, 6.3
- Containment Normal Ventilation Systems	Reactor Building Ventilation System	X	5.6
- Combustible Gas Control Systems	Hydrogen Recombiner System, Reactor Building Purge Systems	X	5.6. 3.2, 6.5
Reactor and Reactivity Control Systems			
- Reactor Core	Same	X	3
- Control Rod System	Control Rod Drives	X	3.2.4.3, 7.2.2
- Boration Systems	See CVCS, above	-	-
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Same	3.5	7.1.2
- Engineered Safety Feature Actuation System (ESFAS)	Engineered Safeguards Actuation System	3.5	7.1.3
- Remote Shutdown System	Remote Shutdown Panel	X	7.4.6

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Instrumentation & Control (I&C) Systems (continued)			
- Other I&C Systems	Various systems	X	7.3, 7.4
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	8.2.3.1, 9.8.7
- Component Cooling Water (CCW) System	Nuclear Services Closed Cooling Water System,	3.7	9.6.2.3
	Decay Heat Closed Cycle Cooling Water System		9.6.2.5
- Service Water System (SWS)	River Water System	3.8	9.6
- Other Cooling Water Systems	Intermediate Cooling System, Spent Fuel Cooling System, Reactor Building Emergency Cooling Water System, Secondary Services Closed Cycle Cooling Water System	X	9.3, 9.4, 9.6
- Fire Protection Systems	Plant Fire Protection System	X	9.9
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Ventilation Systems	X	9.8
- Instrument and Service Air Systems	Instrument and Control Air System	X	9.10.1
- Refueling and Spent Fuel Systems	Fuel Handling System	X	9.7

2

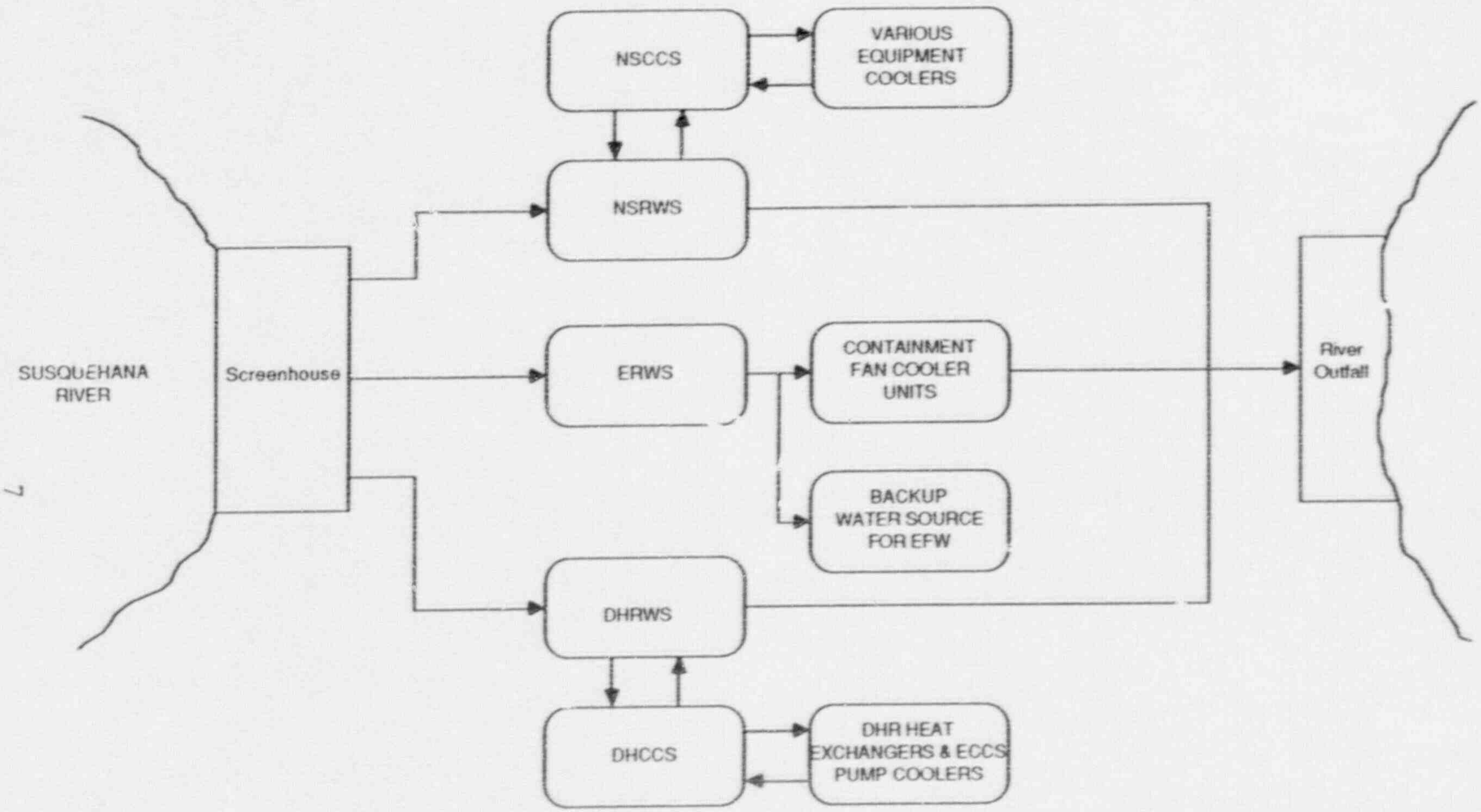
IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
- Radioactive Waste Systems	Radioactive Waste Disposal System	X	11.2
- Radiation Protection Systems	Radiation Shielding, Radiation Monitoring System	X	11.3, 11.4



EFW = Emergency Feedwater System
DHCCS = Decay Heat Closed Cooling Water System
DHRWS = Decay Heat River Water System
ERWS = Emergency River Water System
NSCCS = Nuclear Services Closed Cooling Water System
NSRWS = Nuclear Service River Water System

Figure 3-1. Cooling Water Systems Functional Diagram for Three Mile Island 1

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. Three Mile Island 1 has "lowered loop" RCS design that is shown in the elevation drawing in Figure 3.1-1. Simplified diagrams of the RCS and important system interfaces are shown in Figures 3.1-2 and 3.1-3. 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 two main coolant pumps in each of the two 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, 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 is one power-operated relief valve (electromatic valve) and two safety valves on the pressurizer. A continued inability to establish adequate heat transfer to the steam generators will result in a LOCA-like condition (i.e., continuing loss of reactor coolant through the pressurizer relief valves). Repeated cycling of these relief valves has resulted in valve failure (i.e., relief valve stuck open).

Following a small LOCA, reactor core heat is dumped to the containment or to a break site outside containment. If available, heat removal through the steam generators can aid in reducing RCS pressure and the rate of water loss from the small LOCA.

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 cooling systems operates 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: 11,500 ft^3, including pressurizer
2. Normal operating pressure: 2200 psia

B. Pressurizer
1. Volume: 1495 ft^3

C. Safety Valves (2)
1. Set pressure: 2500 psig
2. Relief capacity: 280,000 lb/hr each

D. Power-Operated Relief Valve ("Electromatic" valve)
1. Set pressure: 2300 psig
2. Relief capacity: 106,450 lb/hr each

E. Steam Generators
1. Type: once-through

3.1.6 Support Systems and Interfaces

A. Motive Power
1. The main coolant pumps are supplied from Non-Class 1E 6900 VAC switchgear.
2. Pressurizer heaters normally are supplied from a Non-Class 1E pressurizer heater control center. Manual actions are necessary to connect selected heaters to Class 1E 480 VAC buses 1P and/or 1S.

B. Main Coolant Pump Seal Injection Water System
The makeup and purification 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. Westinghouse main coolant pumps are used in the TMI-1 plant. (Ref. 1)

3.1.7 Section 3.1 References

1. NUREG-0560 "Staff Report on the Generic Assessment of Feedwater Transients in Pressurized Water Reactors Designed by the Babcock & Wilcox Company", USNRC, May 1979.

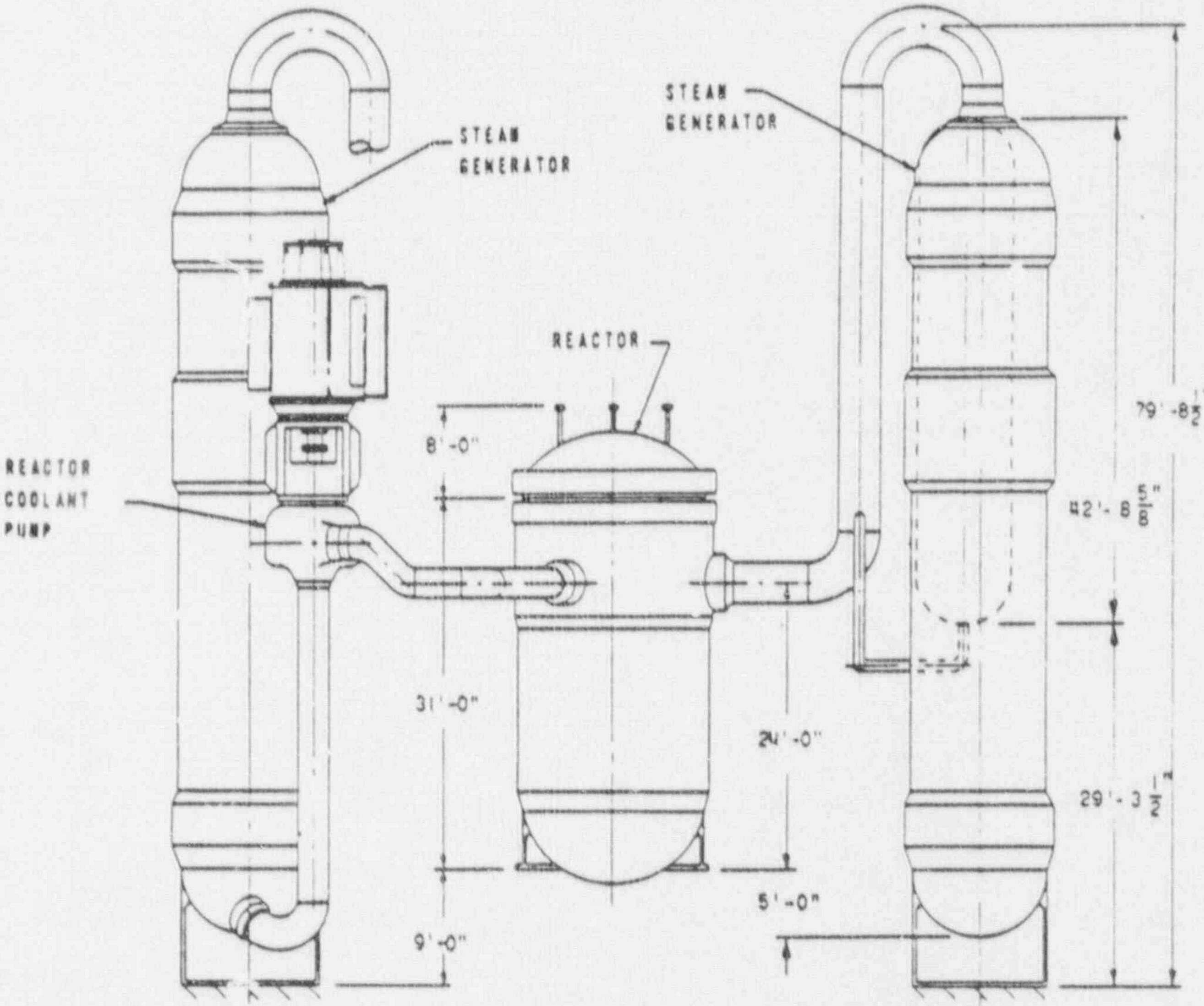


Figure 3.1-1. Simplified Elevation Drawing of Three Mile Island 1 Reactor Coolant System.

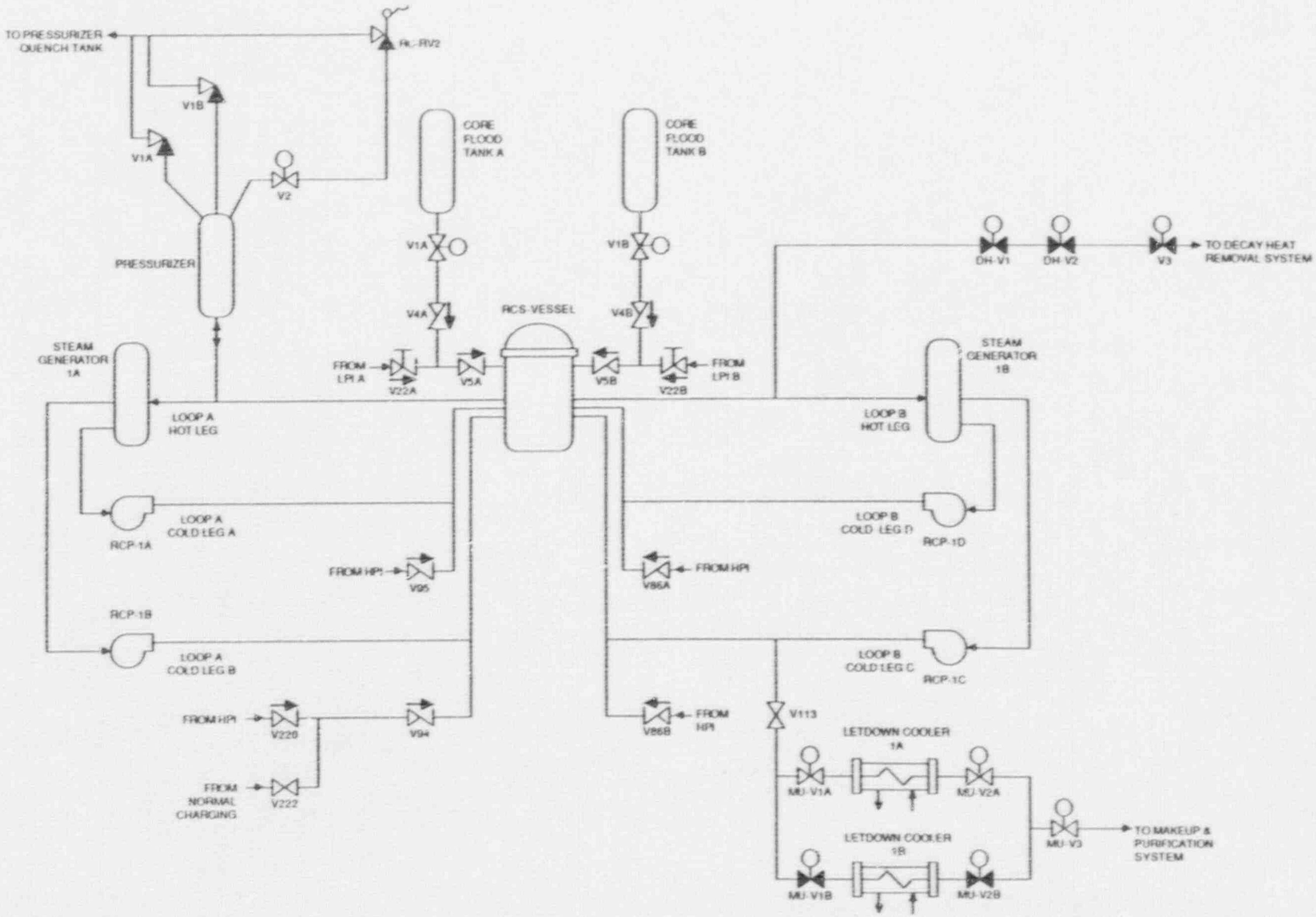


Figure 3.1-2. Three Mile Island 1 Reactor Coolant System

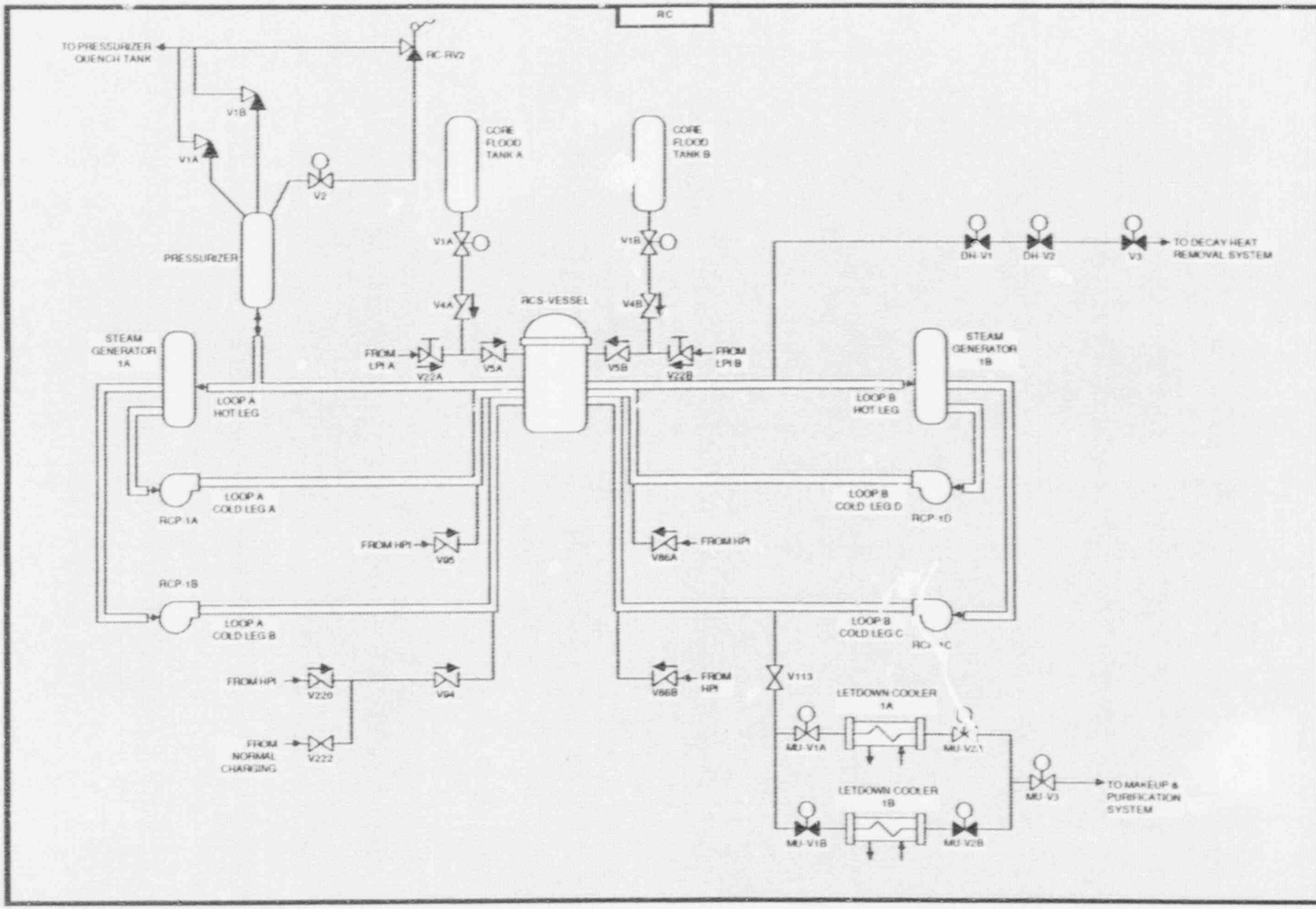


Figure 3.1-3. Three Mile Island 1 Reactor Coolant System Showing Component Locations

Table 3.1-1. Three Mile Island Reactor Coolant System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
DH-V1	MOV	RC	1CESVCC	480	1CESVCC	AC/C
DH-V2	MOV	RC	1CESVCC	480	1CESVCC	AC/C
DH-V3	MOV	281AB	1AESVCC	480	305AB	AC/A
MU-V1A	MOV	RC	1ARADWCC	480	305AB	AC/A
MU-V1B	MOV	RC	1BRADWCC	480	305AB	AC/B
MU-V2A	MOV	RC	1BESVCC	480	305AB	AC/B
MU-V2B	MOV	RC	1BESVCC	480	305AB	AC/B
RC-V2	MOV	RC	UNKNOWN			
RCS-RV2	NV	RC				

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

3.2.1 System Function

The AFW system (or Emergency Feedwater 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, that draw a suction on two condensate storage tanks (CST A and CST B) and supply water to both steam generators when needed. The AFW pump steam turbine drive is supplied from both steam generators and exhausts to atmosphere. All AFW pumps can be aligned to take a suction on the emergency river water system, which serves as a backup source for the AFW system.

The SSR system includes four or five safety valves on each of the four main steam headers (a total of 18 valves), and two power-operated atmospheric steam dump valves.

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

3.2.3 System Operation

During normal plant operation, the AFW system is in standby, and is automatically actuated when needed to maintain the secondary coolant inventory in the steam generators. This system also can be manually started from the main control room.

The three auxiliary feedwater pumps discharge into a common header from which separate lines deliver water to the two steam generators. The Integrated Control Systems (ICS) controls AFW flow once the system has been actuated.

The AFW control valves EF-V30A and EF-V30B are air operated and can be supplied from: (a) the main instrument air compressors, (b) the station service air compressors, (c) a two-hour bottled air supply system. These control valves fail open on loss of all control air. (Ref. 1)

CSTs A and B are the primary water source for the AFW system. Low water level in the CSTs will generate an alarm in the control room. It is necessary to open motor-operated valves in order to align the emergency river water system to supply water to the AFW pumps.

When the main condenser is not available as a heat sink, reactor core decay heat is rejected to an ultimate heat sink by venting steam to atmosphere via: (a) the safety valves on each main steam line, or (b) the atmospheric steam dump valves.

3.2.4 System Success Criteria

For the decay heat removal function to be successful, both the AFW and the SSR system must operate successfully. The success criteria for the AFW system are not clearly defined in the FSAR, however, the following is noted (Ref 1):

- The turbine-driven AFW pump can supply adequate flow.
- Each motor-driven AFW pump has half the flow rate of the turbine-driven pump.

The SSR system must operate to complete the decay heat transfer path to the environment. The number of atmospheric steam dump valves or safety valves which must open for this function is not known.

3.2.5 Component Information

A. Steam turbine-driven AFW pump P1
   1. Rated flow: 920 gpm @ 2700 ft head (1170 psid)
   2. Rated capacity: 100% (Ref. 2)

B. Motor-driven AFW pumps P2A and P2B
   1. Rated flow: 460 gpm @ 2700 ft head (1170 psid)
   2. Rated capacity: 50% (Ref. 2)

C. Condensate storage tanks (2)
   1. Capacity: 150,000 gallons each

D. Secondary steam relief valves
   1. Four or five safety valves per main steam line (total of 18)
   2. One power-operated atmospheric steam-dump valve per steam generator (MS-V4A and MS-V4B)
   3. One power-operated condenser steam dump valve per steam generator (MS-V8A and MS-V8B)

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) loss of both main feedwater pumps (low main feed pump differential pressure)
      b) loss of all four reactor coolant pumps

      Pump P2A and turbine-driven pump steam supply valve MS-V13A are actuated from Train A, and Pump P2B and steam supply valve MS-V13B are actuated from Train B. The Integrated Control System (ICS) automatically maintains steam generator level.

   2. Remote manual
      The AFW system can be actuated by remote manual means from the main control room. If the ICS is unavailable, the operator can take remote manual control of the AFW control valves. These controls are totally separate from the ICS, and are supplied by Class 1E power. Alternatively, steam generator level can be controlled by starting and stopping the AFW pumps as needed.

3. Local manual
   An auxiliary operator can take manual control of AFW control valves in the Intermediate Building if other means of control are unavailable.

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 valves MS-V10A and MS-V10B are redundant Class 1E DC loads that can be supplied from the station batteries as described in Section 3.6.

   3. The AFW turbine-driven pump is supplied from each main steam header, upstream of the main steam isolation valves.

C. Other
   1. Lubrication is provided locally for pumps, pump motors, and the turbine drive.
   2. A room ventilation system cooled by the nuclear service closed cooling water system (see Section 3.7) provides for AFW pump room cooling.

3.2.7 Section 3.2 References

1. TMI-1 Final Safety Analysis Report, Section 10.6.2.

2. Heddleson, F.A., "Summary Report on a Survey of Light Water Reactor Safety Systems," NUREG/CR-2069, Revised, Oak Ridge National Laboratory, April 1983.

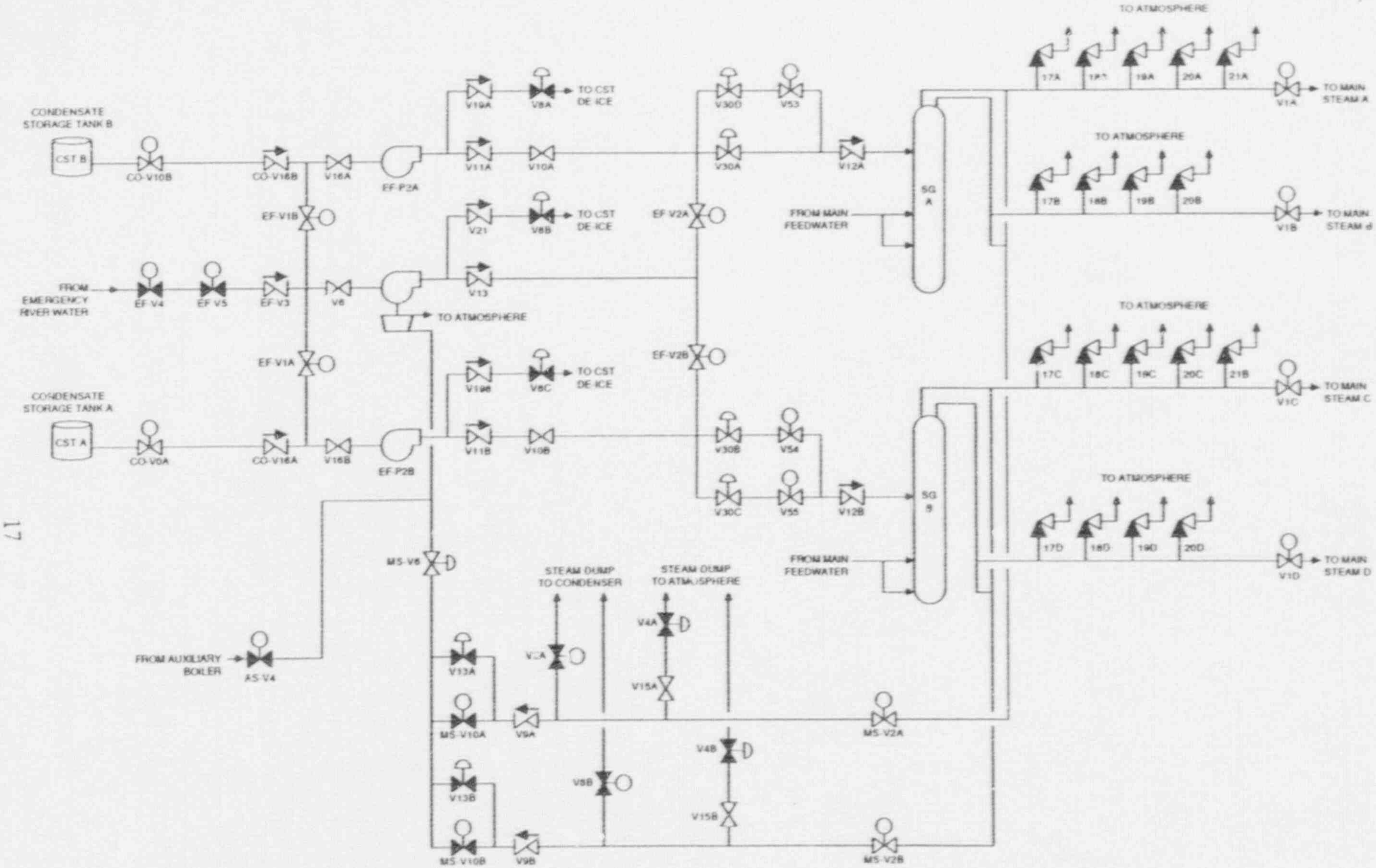


Figure 3.2-1 Three Mile Island 1 Auxiliary Feedwater and Secondary Steam Relief Systems

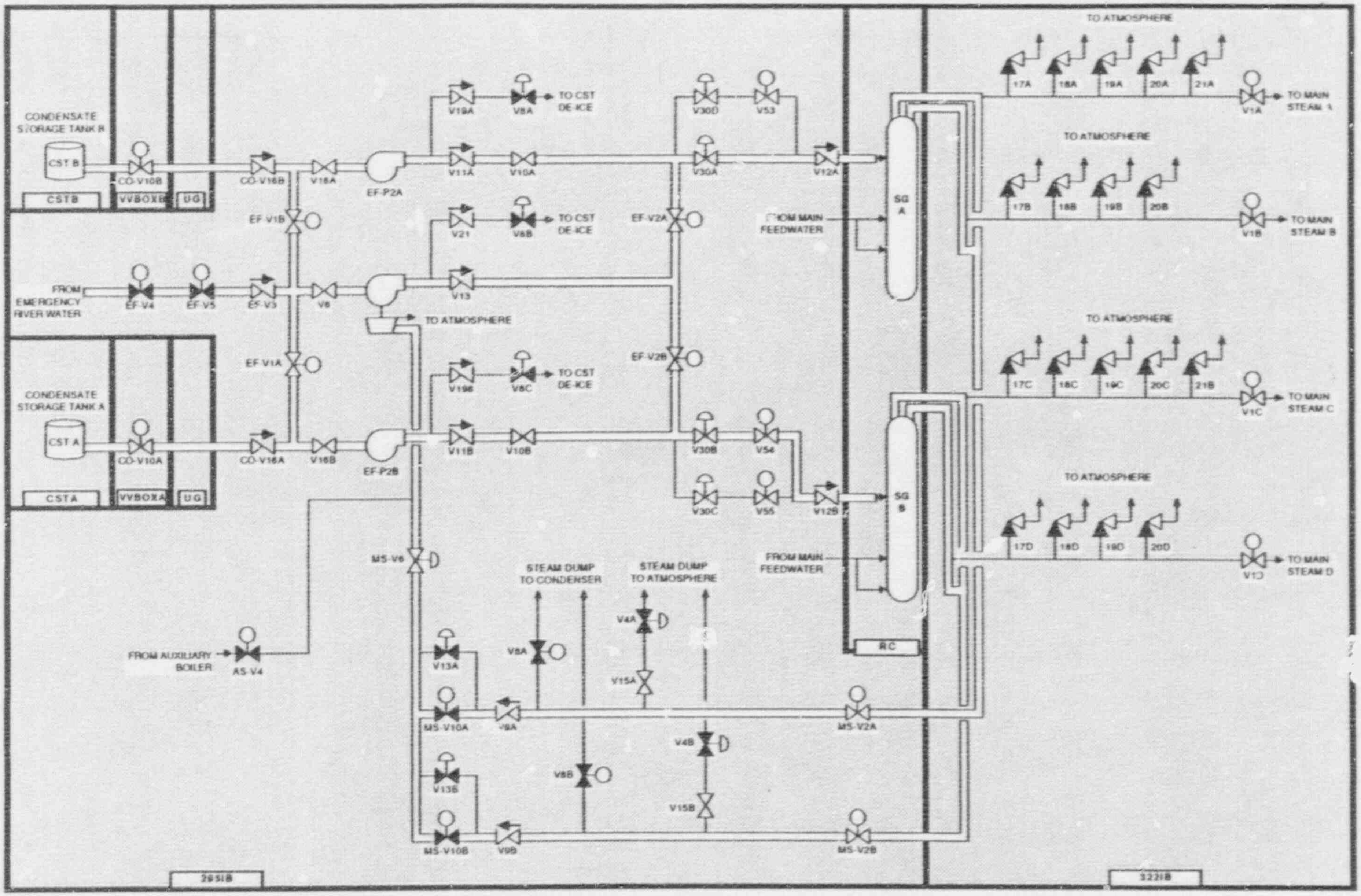


Figure 3.2-2 Three Mile Island 1 Auxiliary Feedwater and Secondary Steam Relief Systems Showing Component Locations

Table 3.2-1. Three Mile Island Auxiliary Feedwater System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CO-V10A	MOV	VVBOXA	1ATPCC	480	1ATPCC	AC/A
CO-V10B	MOV	VVBOXB	1ARADWCC	480	305AB	AC/A
CSTA	TANK	CSTA				
CSTB	TANK	CSTB				
EF-P1	TDP	295IB				
EF-P2A	MDP	295IB	BUS-1D	4160	BUS1D	AC/A
EF-P2B	MDP	295IB	BUS-1E	4160	BUS1E	AC/B
EF-V1A	MOV	295IB	1AESCC	480	SGRM1P	AC/A
EF-V1B	MOV	295IB	1BESCC	480	SGRM1S	AC/B
EF-V2A	MOV	295IB	1AESCC	480	SGRM1P	AC/A
EF-V2B	MOV	295IB	1BESCC	480	SGRM1S	AC/B
MS-V10A	MOV	295IB	DC-PNL-1C	125	BATPNLRMA	DC/A
MS-V10B	MOV	295IB	DC-PNL-1D	125	BATPNLRMB	DC/B
MS-V2A	MOV	295IB	1CESVCC	480	1CESVCC	AC/C
MS-V2B	MOV	295IB	1CESVCC	480	1CESVCC	AC/C
SG-A	SG	RC				
SG-B	SG	RC				

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 cooling systems (see Section 3.4).

3.3.2 System Definition

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

- Core flood tanks (Safety injection accumulators)
- High pressure injection (HPI) system
- Low pressure injection (LPI) system

At Three Mile Island 1, the makeup and purification (charging) system performs the high pressure injection function. The Borated Water Storage Tank (BWST) is the water source for the high and low pressure injection systems. The HPI system injects into the RCS cold legs, and the LPI system and core flood tanks inject directly into the reactor vessel.

The emergency coolant recirculation (ECR) function is performed after the ECI function has been successfully completed by realigning the LPI system to draw a suction on the reactor containment sump. Recirculation water is returned to the reactor vessel (low pressure recirculation) or to the RCS cold legs (high pressure recirculation).

Simplified drawings of the low pressure injection/recirculation system are shown in Figures 3.3-1 and 3.3-2. The high pressure injection (makeup and purification) 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 core flood tanks (accumulators), the ECCS injection and recirculation subsystems and the RCS are shown in Section 3.1.

3.3.3 System Operation

During normal operation, one makeup and purification (HPI) pump continuously supplies makeup to the RCS and seal water to each reactor coolant pump. Following a LOCA, two core flood tanks (accumulators) will supply borated water to the RCS as soon as RCS pressure drops below accumulator pressure (i.e., about 600 psig). An emergency safeguards initiation signal (ESIS) automatically starts the two low pressure injection pumps. In addition the makeup and purification system is automatically realigned to draw a suction from the BWST and two HPI pumps are actuated. The HPI pumps provide adequate coolant makeup following a small break which does not immediately depressurize the RCS to the core flood tank discharge pressure. HPI pump B can be powered and actuated from either load group or ESAS actuation train. It appears that this pump is intended to be an installed spare.

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 BWST water level drops to a prescribed low level setpoint, the low pressure injection pumps are realigned to draw a suction from the containment sump and deliver water to the RCS. If depressurization of the RCS proceeds slowly, high pressure recirculation can be accomplished by aligning the discharge of the LPI pumps to the suction of the HPI pumps.

3.3.4 System Success Criteria

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

- 2 of 2 core flood tanks provide makeup as RCS pressure drops below tank pressure, and
- At least one high pressure injection pump (charging pump) takes a suction on the BWST and injects into the cold legs, and
- One low pressure injection pump takes a suction on the BWST and injects into the RCS.

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

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

ECI success criteria for a small LOCA within containment is defined in the FSAR as (Ref. 1):

- One high pressure injection (charging) pump takes a suction on the BWST and injects into the RCS cold legs is sufficient for "those smaller leak sites which do not allow RCS pressure to decrease rapidly to the point at which low-pressure injection is inhibited".

ECI success criteria for a small LOCA within containment are defined in NUREG-0565 as (Ref. 2):

- Initial response requires one high pressure injection pump supplying water to the RCS.
- At higher decay heat levels, a second high pressure injection pump or the AFW system is required.

ECR success criteria for a small LOCA within containment requires that a high-pressure recirculation flow path be established with at least one low pressure injection pump aligned to take a suction on the containment sump and deliver water to the suction of one high pressure injection pump. The HPI pump completes the injection path to the RCS cold legs.

ECI success criteria for a small LOCA outside containment (makeup and purification system letdown LOCA) is as follows (Ref. 2):

- The letdown lines are 2-1/2" lines. A break of this size will result in the RCS stabilizing at a moderately high pressure (above core flood tank pressure). The HPI pumps are capable of providing adequate coolant make-up and "long term operation could continue in this state without heat removal through the steam generators and without uncovering the core" (Ref. 2).

- Based on the above, at least one HPI pump must take suction on the BWST and inject into the RCS cold legs.
- A source of injection water must be maintained until the LOCA is terminated or some other acceptable plant condition is established.

3.3.5 Component Information

A. Low pressure injection pumps P1A and P1B
   1. Rated flow: 2900 gpm @ 231 ft head (100 psid)
   2. Rated capacity: 100%
   3. Type: centrifugal

B. High pressure injection (makeup and purification) pumps P1A, P1B, and P1C
   1. Rated flow: 430 gpm @ 3990 ft head (1730 psid)
      350 gpm @ 5075 ft head (2200 psid)
   2. Rated capacity: 100%
   3. Type: centrifugal

C. Core flood tanks (2)
   1. Accumulator volume: 1410 ft^3
   2. Minimum water volume: 1010 ft^3
   3. Nominal operating pressure: 600 psig
   4. Minimum boron concentration: 2270 ppm

D. Borated water storage tank
   1. Capacity: 360,000 gallons
   2. Design Pressure: Atmospheric
   3. Nominal Boron Concentration: 2270 ppm

3.3.6 Support Systems and Interfaces

A. Control signals
   1. Automatic
      The ECCS injection subsystems are automatically actuated by an Emergency Safeguards Initiation Signal (ESIS). Conditions initiating an ESIS trip are:

      a. RCS low pressure
      b. Containment high pressure

   2. Remote manual
      An ESIS 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. Each HPI and LPI pump is cooled by component cooling water. HPI pumps P1A and P1C are provided with redundant cooling water supplies from the nuclear service closed cooling water system (NSCCS) and the decay heat closed cooling water system (DHCCS). Other pumps have a nonredundant cooling water supply (see Section 3.7).
2. Lubrication is provided locally for the HPI and LPI pumps and motors.
3. Ventilation is provided for each HPI and LPI pump room.

3.3.7 Section 3.3 References

1. TMI-1 Final Safety Analysis Report, Section 6.1.1.
2. NUREG-[illegible] "Generic Evaluation of Small Break Loss of Coolant Accident B[illegible]avior in Babcock and Wilcox Designed 177-FA", U. S. Nucle[illegible] Regulatory Commission, January 1980

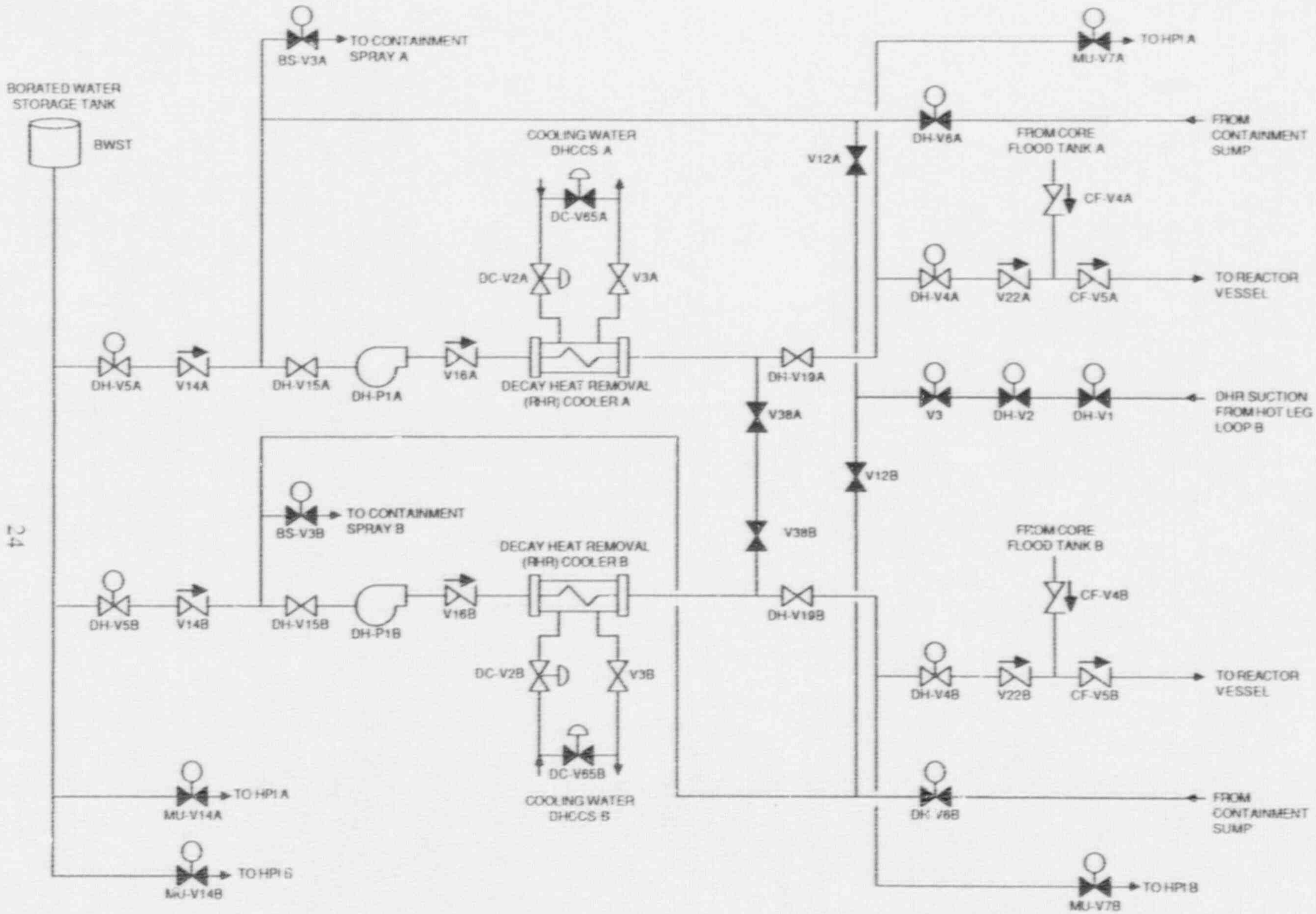


Figure 3.3-1 Three Mile Island 1 Low Pressure Safety Injection/Recirculation System

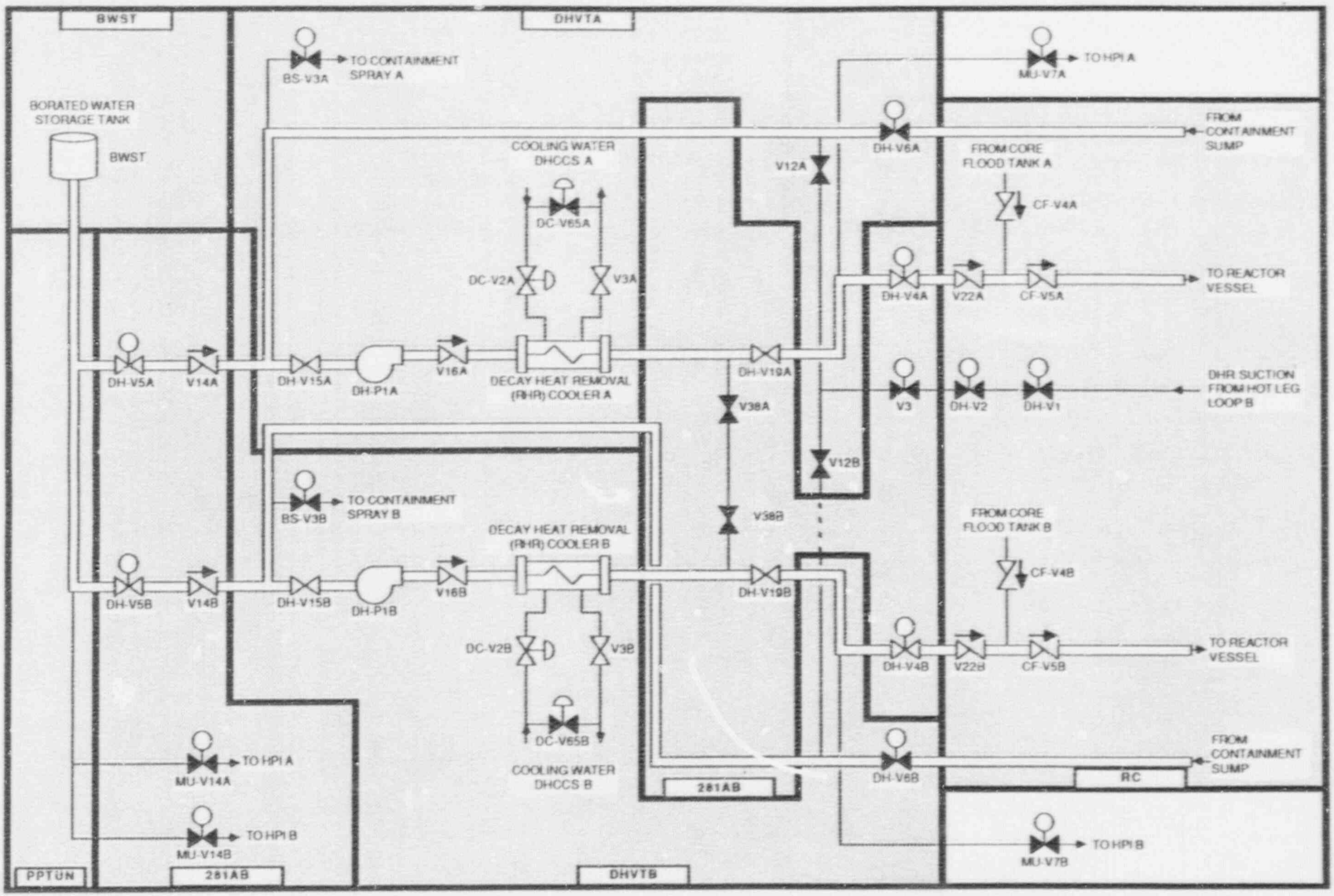


Figure 3.3-2 Three Mile Island 1 Low Pressure Safety Injection/Recirculation System Showing Component Locations

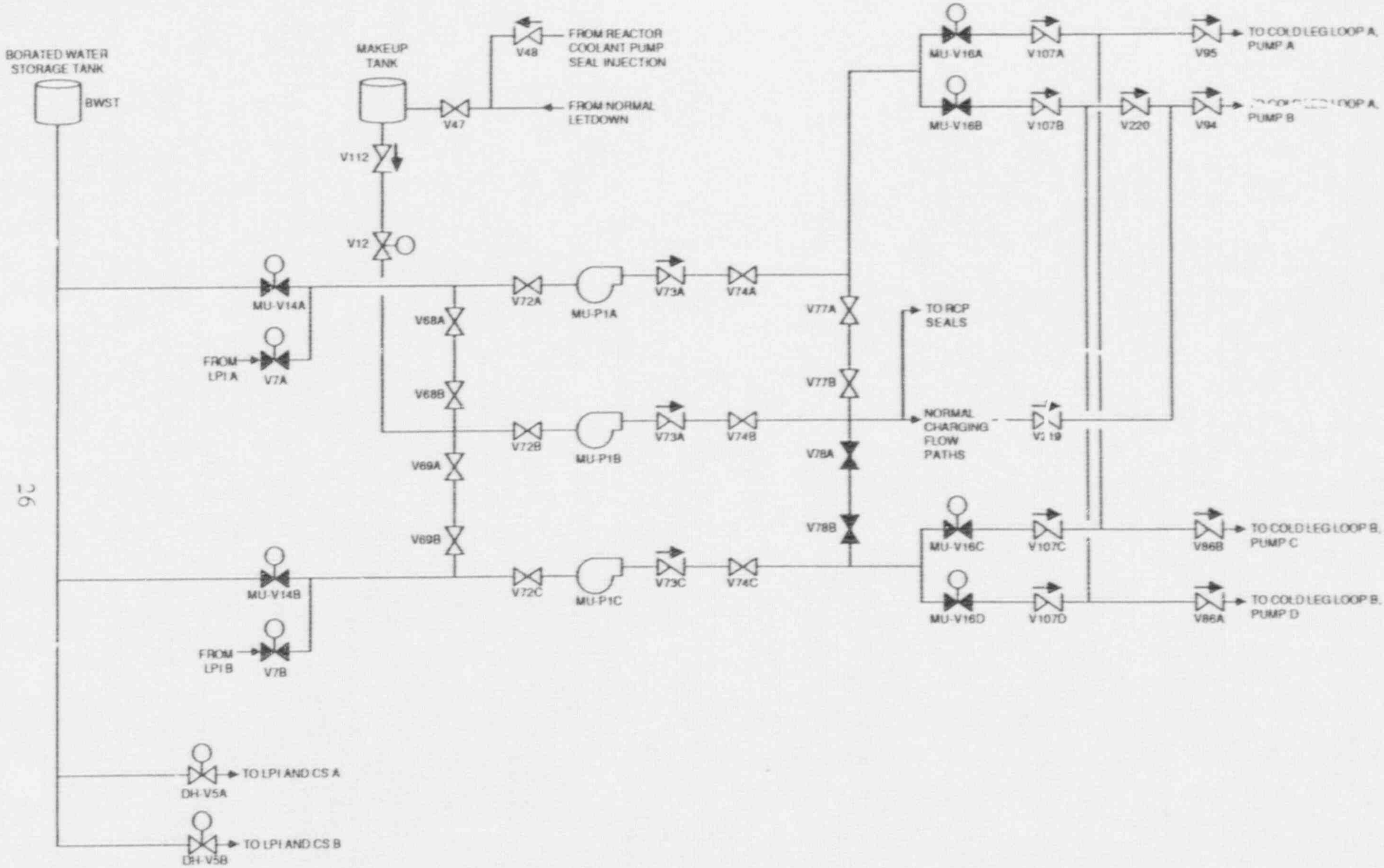


Figure 3.3-3 Three Mile Island 1 High Pressure Injection (Makeup) System

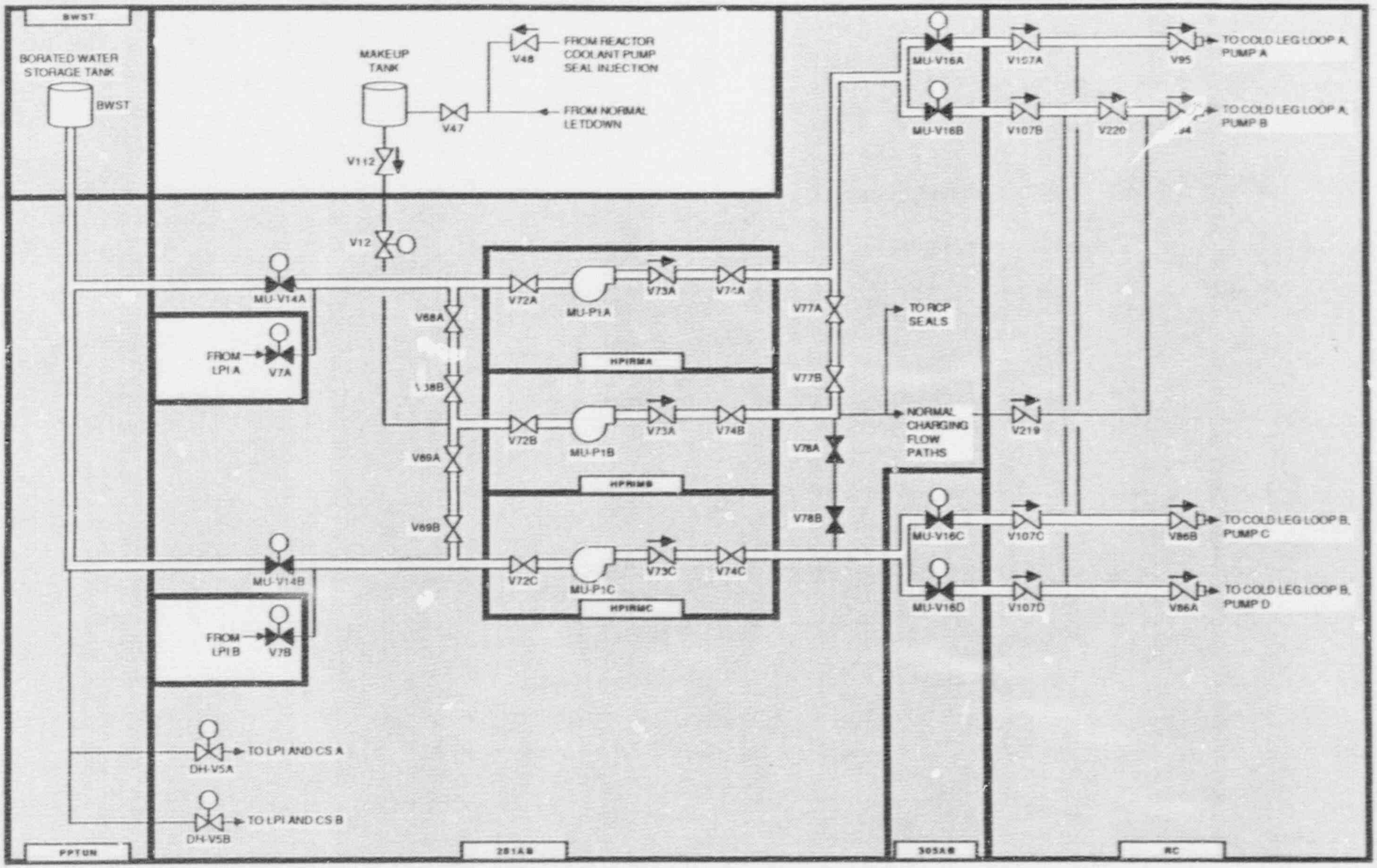


Figure 3.3-4 Three Mile Island 1 High Pressure Injection (Makeup) System Showing Component Locations

Table 3.3-1. Three Mile Island Emergency Core Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
BWST	TANK	BWST				
CFS-T1A	TANK	RC				
CFS-T1B	TANK	RC				
CFS-V1A	MOV	RC	1CESVCC	480	1CESVCC	AC/C
CFS-V1B	MOV	RC	1CESVCC	480	1CESVCC	AC/C
DH-HX1A	HX	DHVTA				
DH-HX1B	HX	DHVTB				
DH-P1A	MDP	DHVTA	BUS-1D	4160	BUS1D	AC/A
DH-P1B	MDP	DHVTB	BUS-1E	4160	BUS1E	AC/B
DH-V15A	XV	DHVTA				
DH-V15B	XV	DHVTB				
DH-V1[illegible]	XV	281AB				
DH-V4[illegible]	MOV	281AB	1AESVCC	480	305AB	AC/A
DH-V4B	MOV	281AB	1BESVCC	480	305AB	AC/B
DH-V5A	MOV	281AB	1AESVCC	480	305AB	AC/A
DH-V5B	MOV	281AB	1BESVCC	480	305AB	AC/B
DH-V6A	MOV	DHVTA	1AESVCC	480	305AB	AC/A
DH-V6B	MOV	DHVTB	1BESVCC	480	305AB	AC/B
MU-P1A	MDP	HPIRMA	BUS-1D	4160	BUS1D	AC/A
MU-P1B	MDP	HPIRMB	BUS-1D/1E	4160	BUS1D/BUS1E	AC/A/B
MU-P1C	MDP	HPIRMC	BUS-1E	4160	BUS1E	AC/B
MU-V14A	MOV	281AB	1AESVCC	480	305AB	AC/A
MU-V14B	MOV	281AB	1BESVCC	480	305AB	AC/B
MU-V16A	MOV	281AB	1AESVCC	480	305AB	AC/A
MU-V16B	MOV	281AB	1AESVCC	480	305AB	AC/A
MU-V16C	MOV	305AB	1BESVCC	480	305AB	AC/B
MU-V16D	MOV	305AB	1BESVCC	480	305AB	AC/B

3.4 CONTAINMENT COOLING SYSTEMS

3.4.1 System Function

The containment cooling system is an integrated set of subsystems that perform the functions of containment heat removal and containment pressure control following a loss of coolant accident. In conjunction with the ECCS, the Reactor Building Spray system completes the post-LOCA heat transfer path from the reactor core to the ultimate heat sink.

3.4.2 System Definition

There are two diverse containment cooling systems at Three Mile Island 1. The reactor building spray system operates in a once-through injection mode by taking a suction on the BWST and discharging directly to spray headers inside containment. This system can be realigned to operate in a recirculation mode for long-term operation. A diverse containment cooling capability is provided by a set of three fan cooler units (FCUs) inside containment. Each FCU consists of a two-speed fan, a normal and emergency cooling coil and associated ductwork.

Simplified drawings of the reactor building spray system are shown in Figure 3.4-1 and 3.4-2. The containment fan coolers are shown in Section 3.8 as a heat load for the emergency river water system. A summary of data on selected containment cooling system components is presented in Table 3.4-1.

3.4.3 System Operation

During normal operation, the reactor building spray system is in standby. When actuated, the two reactor building spray pumps take a suction on the Borated Water Storage Tank (BWST) and discharge to separate sets of spray headers inside containment. Sodium hydroxide is added to the spray water for iodine removal and pH control. After water in BWST reaches a low level, the spray pumps are realigned to recirculate water from the containment sump to the spray headers. The suction paths from the containment sump are shared by the spray pumps and the low-pressure ECCS pumps.

The containment fan cooler units perform both normal and emergency containment cooling functions. For emergency cooling, the fan operates at reduced speed and is supplied with cooling water from the emergency river water system (ERWS). The normal cooling water coil is isolated.

3.4.4 System Success Criteria

Containment cooling success criteria for a LOCA (reactor building spray plus fan cooler units) are any one of the following combinations (Ref.1):

- Both spray loops operating.
- One spray loop and one FCU operating.
- Three FCUs operating.

3.4.5 Component Information

A. Reactor Building Spray Pumps (2)
   1. Rated flow: 1500 gpm @ 450 ft head (approximate) (195 psid)
   2. Type: centrifugal

B. Containment Fan Cooler Units (3)
   1. Type: finned tube
   2. Design duty: 92.9×10^6 Btu/hr

3.4.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      a. Reactor building spray system.
         At a containment pressure of 4 psig, all motor-operated valves open. The system is actuated at a containment pressure of 30 psig by the ESAS (see Section 3.5).
      b. Containment fan cooler units.
         All FCUs are aligned for low-speed operation with cooling water from the ERWS upon:
         - a containment pressure of 4 psig
         - low RCS pressure
   2. Remote manual
      All containment cooling subsystems can be actuated by remote manual means from the central control room.

B. Motive Power
   1. The reactor building spray pumps and motor-operated valves and the fan cooler units 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. Note that FCU "C" can be powered from either AC load group.

C. Cooling Water
   1. Each reactor building spray pump is cooled by the decay heat closed cooling water system (DHCCS see Section 3.7).
   2. The emergency river water system provides cooling water to the containment fan cooler units (see Section 3.8)

D. Other
   1. Lubrication is provided locally for all reactor building spray pumps and FCUs.

3.4.7 Section 3.4 References

1. TMI-1 Final Safety Analysis Report, Section 6.2.3.

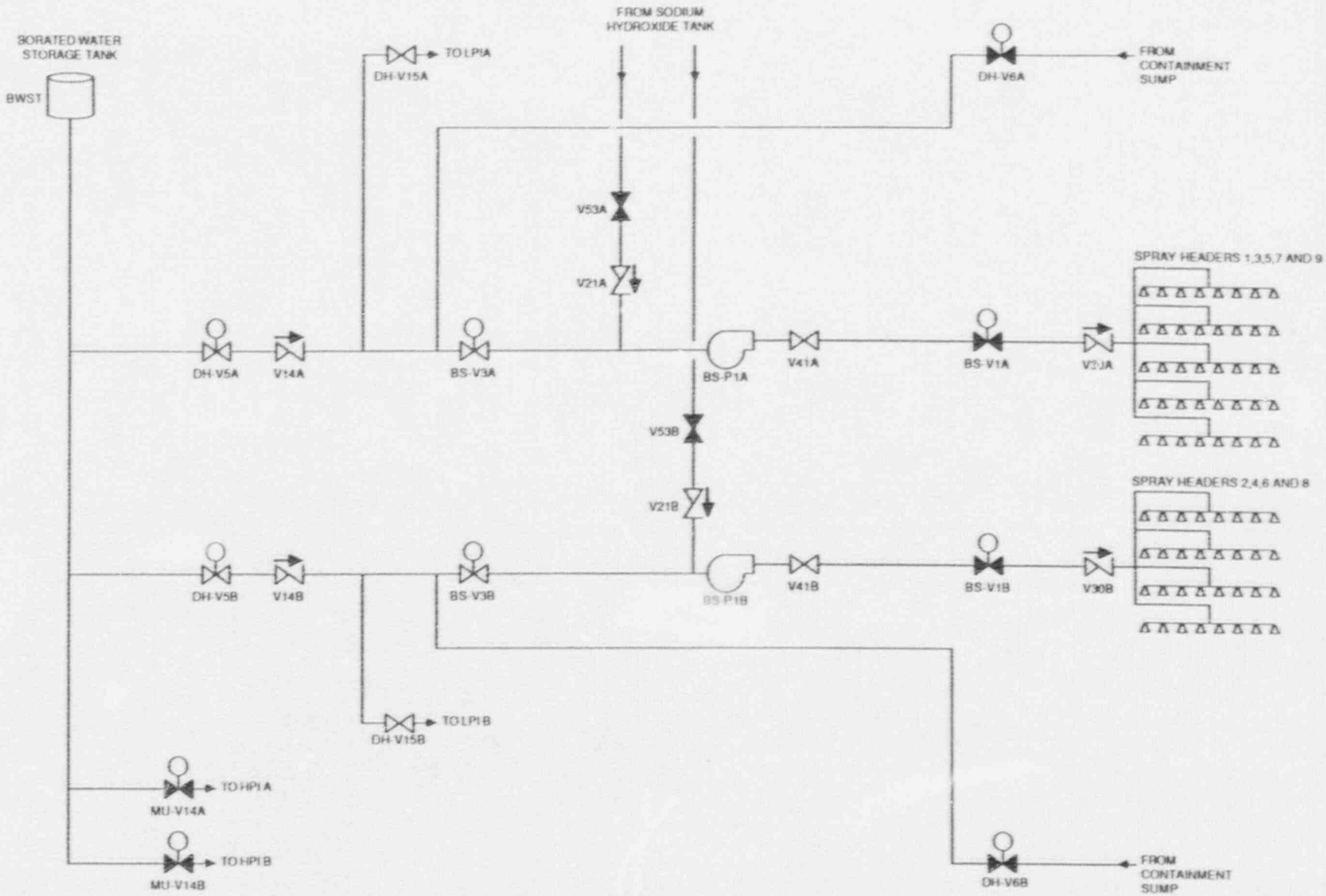


Figure 3.4-1 Three Mile Island 1 Reactor Building Spray System

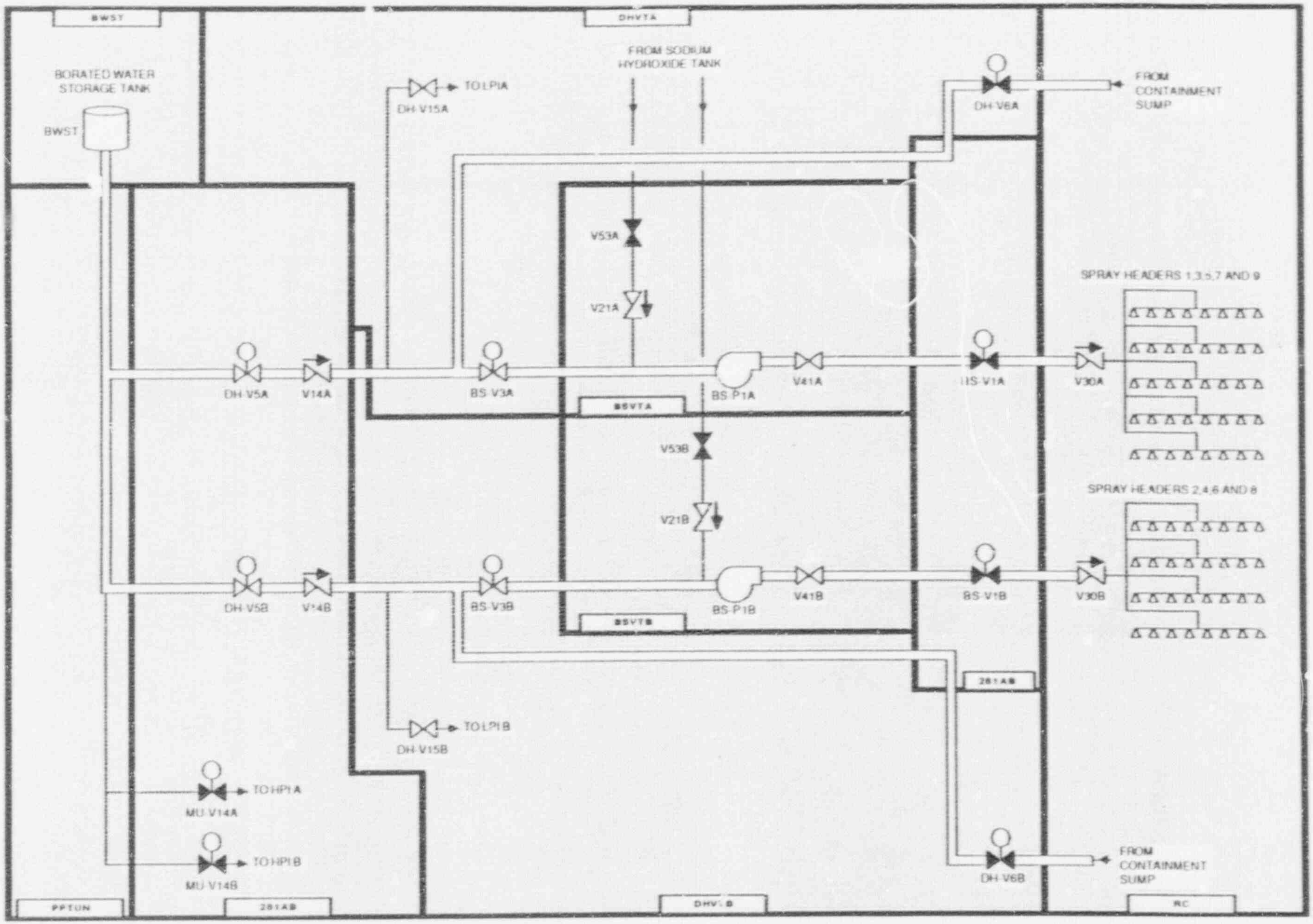


Figure 3.4-2 Three Mile Island 1 Reactor Building Spray System Showing Component Locations

Table 3.4-1. Three Mile Island Containment Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
BS-P1A	MDP	BSVT[illegible]	BUS-1D	4160	BUS1D	AC/A
BS-P1B	MDP	BSVTB	BUS-1E	4160	BUS1E	AC/B
BS-V1A	MOV	281AB	1AESVCC	480	305AB	AC/A
BS-V1B	MOV	281AB	1BESVCC	480	305AB	AC/B
BS-V3A	MOV	DHVTA	1AESVCC	480	305AB	AC/A
BS-V3B	MOV	DHVTB	1BESVCC	480	305AB	AC/B
BS-V41A	XV	BSVTA				
BS-V41B	XV	BSVTB				
FCU-A	FCU	RC	BUS-1D	4160	BUS1D	AC/A
FCU-B	FCU	RC	BUS-1E	4160	BUS1E	AC/B
FCU-C	FCU	RC	BUS-1D/1E	4160	BUS1D/BUS1E	AC/A/B
RX BLDG	BLDG	RC				
SUMP	TANK	RC				

3.5 INSTRUMENTATION AND CONTROL (I&C) SYSTEMS

3.5.1 System Function

The instrumentation and control systems include the Reactor Protection System (RPS), the Engineered Safeguards Actuation Systems (ESAS), and systems for the display of plant information to the operators. A remote shutdown capability is provided to ensure that the reactor can be placed in a safe condition in the event that the main control room must be evacuated.

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 ESAS and other actuation systems 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 these systems. The remote shutdown capability is provided by the Remote Shutdown Panel in conjunction with normal automatic systems and local controls outside the main control room.

3.5.3 System Operation

A. RPS

The B&W RPS has four input instrument channels (1, 2, 3, and 4), each terminating in a channel trip relay that provides an input to four reactor trip modules. Each reactor trip module is a 2-out-of-4 logic unit that is controlled by the four input instrument channels. A trip of any two of the four input channels should trip all four reactor trip modules. The scram breaker contacts are arranged in what is effectively a 1-out-of-2-taken-twice logic. RPS trips are listed below:

- Manual
- High neutron flux (power range)
- High neutron flux (flow-biased limit)
- High neutron flux for number and combination of coolant pumps in operation
- High reactor outlet temperature
- RCS pressure-temperature relationship out of range
- Low RCS pressure
- High RCS pressure
- High containment pressure
- Loss of both main feedwater pumps
- Main Turbine Trip

The manual scram circuit bypasses the RPS logic trains and directly deenergizes the undervoltage coils in the scram breakers, causing these breakers to open.

B. ESAS

The ESAS has two output actuation trains. In general, the ESAS "A" train controls equipment powered from Class 1E AC electrical Division A and the ESAS "B" train controls redundant equipment powered from Division B. An individual component usually receives an actuation signal from only one ESAS train. The ESAS generates the following signals: (a) high pressure injection actuation, (b) low pressure injection actuation, (c) containment isolation, (d) containment spray actuation (e) containment fan cooler actuation, and (f) diesel generator and load sequencer actuation. A separate actuation logic subsystem is provided for actuating the auxiliary feedwater system. The control room operators can manually trip the ESAS and Auxiliary Feedwater Actuation logic subsystems. Details regarding actuation logic are included in the system description for the actuated system.

C. Remote Shutdown
The Remote Shutdown Panel (RSP) provides the ability to monitor key process variables required to achieve a cold safe shutdown from outside the control room. Provisions are also provided to control both main steam atmospheric relief valves (4A & 4B) and emergency feedwater valves (30A & 30B). The design is comprised of two redundant Class 1E nuclear safety related equipment trains. Each train has sensors, a signal conditioning cabinet, a shutdown indication and control panel, and transfer switches which allow control of the valves separate from the control room. The transfer switches must be actuated before control can be achieved from the Remote Shutdown Panel. Except for the controls listed in Table 3.5-1, all other controls to shut the plant down will require the operator(s) to actuate the local control for the respective components. (i.e. circuit breaker, valve handwheel, etc.). The RSP and associated equipment consists of two physically separate, independent and redundant safety grade panels. The panels are located in the Patch Panel Room at Elevation 322' of the Control Building.

The manual loading stations for valves 4A and 4B and valves 30A and 30B can be used to control the valves provided the associated Train "A" and "B" transfer switch has been activated. The transfer switch for Train "A" is located near the signal conditioning cabinets of Train "A" at Elev. 338 of the Control Building. The transfer switch for Train "B" is located near the Remote Shutdown Panels. When the switches are activated by an administratively controlled "Key", control of the valves is transferred from the control room to the Remote Shutdown Panels. The Train "A" is associated with the flow loop "A" and Train "B" is associated with flow loop "B".

3.5.4 Support Systems and Interfaces

A. Control Power
1. RPS
The RPS is powered from 120 VAC vital instrumentation distribution panels VBA, VBB, VBC and VBD as defined in Section 3.6.
2. ESAS
The ESAS input instrument channels most likely are powered from 120 VAC vital instrumentation distribution panels VBA to VBD. The output logic most likely is powered from 120 VDC distribution panels 1E (Train A) and 1F (Train B).
3. Diesel Generator Control Power
The diesel generators receive control power from 125 VDC distribution panels 1P (diesel A) and 1Q (diesel B).
4. Auxiliary Feedwater (Emergency Feedwater) Actuation
AFW actuation output logic is powered from 125 VDC distribution panels 1C (Train A) and 1D (Train B).

3.5.5 Section 3.5 References

1. TMI-1 Final Safety Analysis Report, Section 7.4.6.

Table 3.5-1. TMI-1 Equipment With Local Control Capabilities

- Emergency feedwater pumps
- Emergency feedwater valves
- Steam generator level control
- Atmospheric relief valves
- Pressurizer spray valve
- Pressurizer relief valve
- Makeup pumps
- Makeup valves
- Decay heat pump
- Decay heat primary coolant valves
- Decay heat closed cooling pumps
- Decay heat river water pumps
- Decay heat river water valves
- Nuclear service river water
- Nuclear service closed cooling pumps
- Nuclear service river water discharge valves
- Reactor building fan cooling pumps
- Reactor building fan coolers
- ES high-pressure injection bypass
- ES low-pressure injection bypass
- Core flooding tank valves
- All safeguards and reactor bus feeder breakers
- Emergency generator breakers
  (Emergency generators start automatically)
- Paging and telephone systems

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 two major 4160/480 VAC load groups, or divisions, and four 125 VDC/120 VAC load groups. Each 4160/480 VAC load group consists of a diesel generator and distribution equipment needed to supply key AC electrical loads. Each 125 VAC/120 VAC load group includes a battery, battery chargers, inverter and distribution equipment needed to supply DC and instrument loads. A simplified one-line diagram of the Class 1E AC electric power system is shown in Figure 3.6-1. The 125VDC and 120VAC portions of the Class 1E system are shown in Figure 3.6-2. 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 230kV switchyard. The automatic transfer from this preferred power source to 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 25 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 capacity of each of the two redundant batteries is sufficient to feed its connected essential loads for two hours including three complete cycles of safeguards circuit breaker closure and tripping.

The 120 VAC vital buses normally receive power from motor control centers 1AESCC and 1BESCC. The corresponding battery and battery charger are not required under this condition. The batteries will supply the vital bus inverters on loss of AC power.

The Class 1E electrical system contains a total of four divisions that are color-coded.

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
- One diesel generator may also be lost

3.6.5 Component Information

A. Standby diesel generators (2)
   1. Maximum continuous rating: 2600 kW
   2. 30-minute rating: 3300 kW
   3. Rated voltage: 4160 VAC
   4. Manufacturer: Colt-Pielstick

B. Batteries (5)
   1. Type: Lead-acid

3.6.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      a. The standby diesel generators are automatically started based on:
         - Loss of voltage or undervoltage on the respective 4160 VAC Class 1E bus
         - Safety injection signal (ESIS, see Section 3.3)
         - Containment high pressure
      b. Automatic sequential loading of each diesel generator is accomplished in five blocks. The loading sequence is automatically changed based on the initiating trip.
   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
      A jacket water system and a water-to-air radiator provide for diesel cooling.
   2. Diesel Starting System
      The air starting system for each diesel is capable of multiple start attempts without requiring AC power to recharge the starting air accumulators.
   3. Diesel Fuel Oil Transfer and Storage System
      A "day tank" supplies the relatively short-term fuel needs of the diesel (approximately 3 hours). The day tank must be replenished from storage tanks to maintain an uninterrupted supply of fuel to the diesel.
   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, controls and switchgear have been qualified. This system may be needed for long-term operation of the diesel generator.

C. Switchgear Room Ventilation System
   This system maintains acceptable environmental conditions in the switchgear rooms, and may be needed for long-term operation of the switchgear.

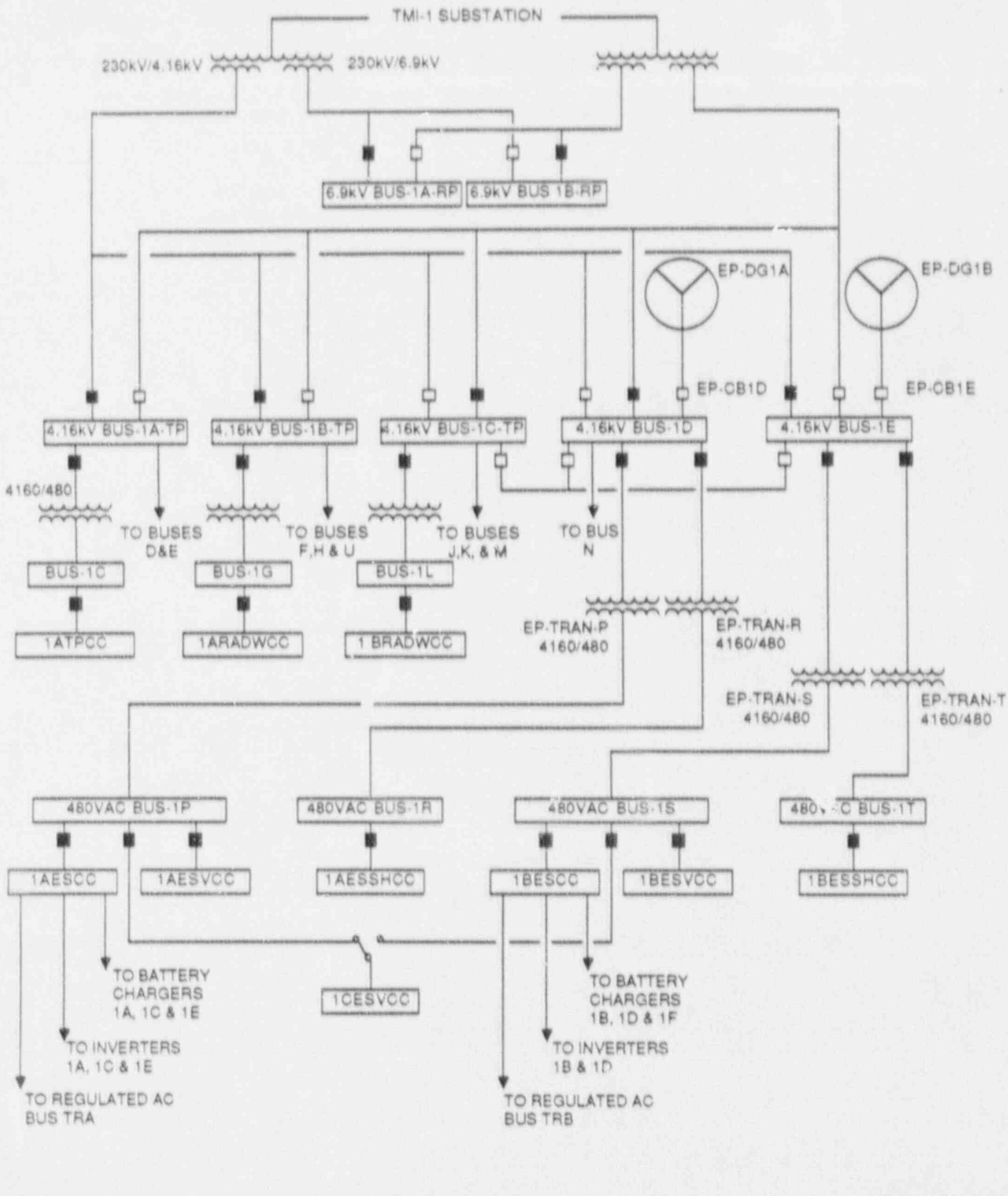


Figure 3.6-1 Three Mile Island 1 6900/4160/480 VAC Electric Power Distribution System

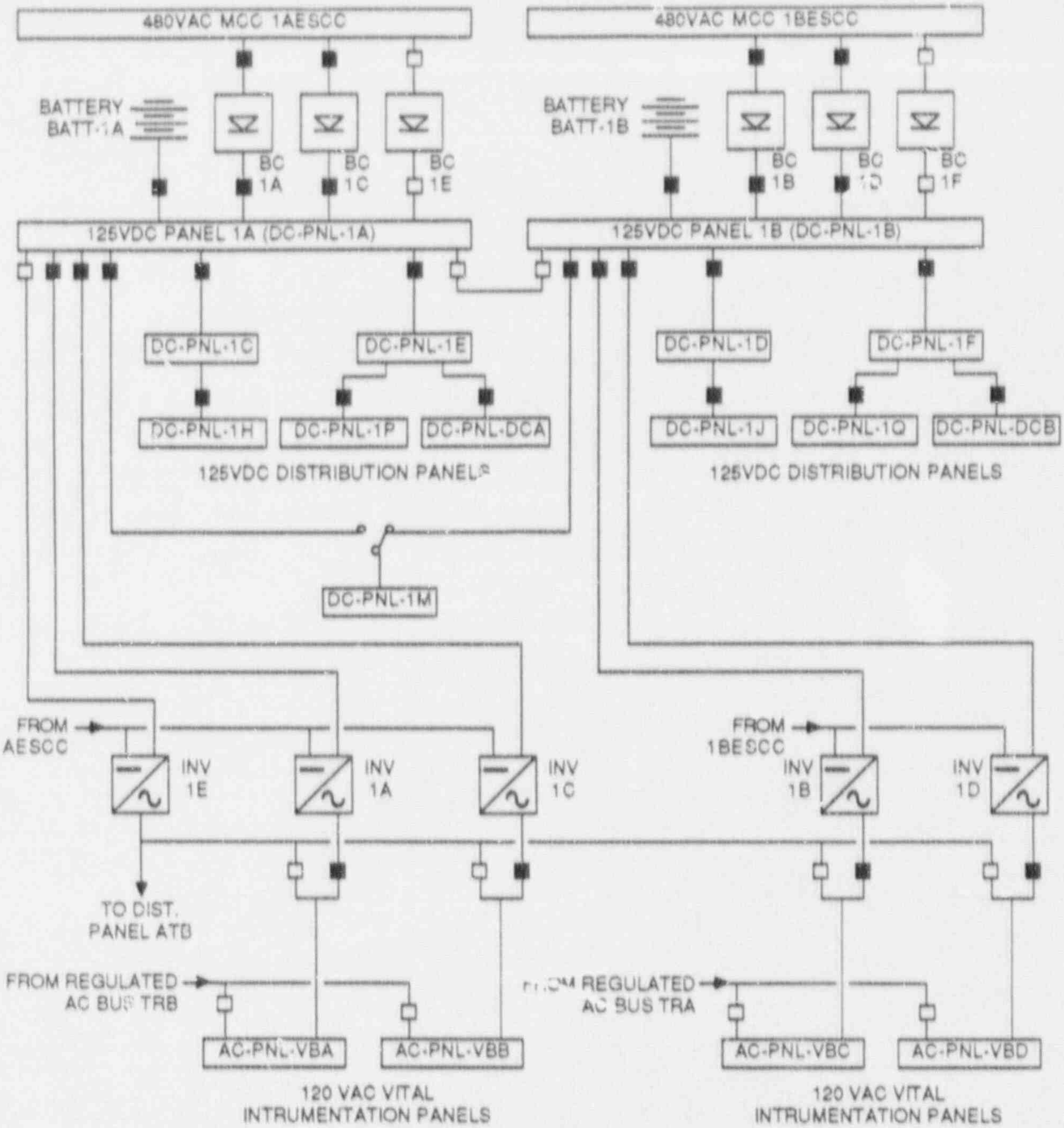


Figure 3.6-2 Three Mile Island 1 125VDC/120VAC Electric Power Distribution System

Table 3.6-1. Three Mile Island Electric Power System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
1AESCC	MCC	SGRM1P	BUS-1P	480	SGRM1P	AC/A
1AESSHCC	MCC	SCREENHS	BUS-1R	480	SCREENHS	AC/A
1AESVCC	MCC	1AESVCC	BUS-1P	480	SGRM1P	AC/A
1ARADWCC	MCC	1ARADWCC	BUS-1G	480	UNKNOWN	NON-1E
1ATPCC	MCC	1ATPCC	BUS-1C	480	UNKNOWN	NON-1E
1BESCC	MCC	SGRM1S	BUS-1S	480	SGRM1S	AC/B
1BESSHCC	MCC	SCREENHS	BUS-1T	480	SCREENHS	AC/B
1BESVCC	MCC	1BESVCC	BUS-1S	480	SGRM1S	AC/B
1BRADWCC	MCC	1BRADWCC	BUS-1L	480	UNKNOWN	NON-1E
1CESVCC	MCC	1CESVCC	ATS-CESVCC	480	EEQUIPRM	AC/C
AC-PNL-VBA	BUS	BATPNLRMA	INVERTER-1A	120	BATPNLRMA	AC/A
AC-PNL-VBB	BUS	BATPNLRMB	INVERTER-1B	120	BATPNLRMB	AC/B
AC-PNL-VBC	BUS	BATPNLRMA	INVERTER-1C	120	BATPNLRMA	AC/C
AC-PNL-VBD	BUS	BATPNLRMB	INVERTER-1D	120	BATPNLRMB	AC/D
ATS-1CESVCC	ATS	EEQUIPRM	BUS-1P/1S	480	SGRM1P/1S	AC/C
BATT-1A	BATT	BATRMA		125		DC/A
BATT-1B	BATT	BATRMB		125		DC/B
BUS-1A-TP	BUS	UNKNOWN	OFF-SITE			NON-1E
BUS-1B-TP	BUS	UNKNOWN	OFF-SITE			NON-1E
BUS-1C	BUS	UNKNOWN	EP-TRAN-C	480	UNKNOWN	NON-1E
BUS-1C-TP	BUS	UNKNOWN	OFF-SITE			NON-1E
BUS-1D	BUS	BUS1D	EP-DG1A	4160	DGRMA	AC/A
BUS-1E	BUS	BUS1E	EP-DG1B	4160	DGRMB	AC/B
BUS-1G	BUS	UNKNOWN	EP-TRAN-G	480	UNKNOWN	NON-1E
BUS-1L	BUS	UNKNOWN	EP-TRAN-L	480	UNKNOWN	NON-1E
BUS-1P	BUS	SGRM1P	EP-TRAN-P	480	SGRM1P	AC/A
BUS-1R	BUS	SCREENHS	EP-TRAN-R	480	SCREENHS	AC/A
BUS-1S	BUS	SGRM1S	EP-TRAN-S	480	SGRM1S	AC/B
BUS-1T	BUS	SCREENHS	EP-TRAN-T	480	SCREENHS	AC/B

Table 3.6-1. Three Mile Island Electric Power System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
DC-ATS-1M	ATS	EEQUIPRM	DC-BUS-1A/1B	125	BATPNLRMA/B	DC/C
DC-PNL-1A	BUS	BATPNLRMA	BATT-PNL-1A	125	BATRMA	DC/A
DC-PNL-1B	BUS	BATPNLRMB	BATT-1B	125	BATRMB	DC/B
DC-PNL-1C	BUS	BATPNLRMA	DC-PNL-1A	125	BATPNLRMA	DC/A
DC-PNL-1D	BUS	BATPNLRMB	DC-PNL-1B	125	BATPNLRMB	DC/B
DC-PNL-1E	BUS	BATPNLRMA	DC-PNL-1A	125	BATPNLRMA	DC/A
DC-PNL-1F	BUS	BATPNLRMB	DC-PNL-1B	125	BATPNLRMB	DC/B
DC-PNL-1H	BUS	BATPNLRMA	DC-PNL-1C	125	BATPNLRMA	DC/A
DC-PNL-1J	BUS	BATPNLRMB	DC-PNL-1D	125	BATPNLRMB	DC/B
DC-PNL-1M	BUS	EEQUIPRM	DC-ATS-1M	125	EEQUIPRM	DC/C
DC-PNL-1P	BUS	305HLA	DC-PNL-1E	125	BATPNLRMA	DC/A
DC-PNL-1Q	BUS	305HLB	DC-PNL-1F	125	BATPNLRMB	DC/B
DC-PNL-DCA	BUS	BATPNLRMA	DC-PNL-1E	125	BATPNLRMA	DC/A
DC-PNL-DCB	BUS	BATPNLRMB	DC-PNL-1F	125	BATPNLRMB	DC/B
EP-CB1D	CB	BUS1D				
EP-CB1E	CB	BUS1E				AC/B
EP-DG1A	DG	DGRMA		4160		AC/A
EP-DG1B	DG	DGRMB		4160		AC/B
EP-TRAN-C	TRAN	UNKNOWN	BUS-1A-TP	4160	UNKNOWN	NON-1E
EP-TRAN-G	TRAN	UNKNOWN	BUS-1B-TP	4160	UNKNOWN	NON-1E
EP-TRAN-L	TRAN	UNKNOWN	BUS-1C-TP	4160	UNKNOWN	NON-1E
EP-TRAN-P	TRAN	SGRM1P	BUS-1D	4160	BUS1D	AC/A
EP-TRAN-R	TRAN	SCREENHS	BUS-1D	4160	BUS1D	AC/A
EP-TRAN-S	TRAN	SGRM1S	BUS-1E	4160	BUS1E	AC/B
EP-TRAN-T	TRAN	SCREENHS	BUS-1E	4160	BUS1E	AC/B
INVERTER-1A	INV	BATPNLRMA	DC-PNL-1A	125	BATPNLRMA	AC/A
INVERTER-1B	INV	BATPNLRMB	DC-PNL-1B	125	BATPNLRMB	AC/B
INVERTER-1C	INV	BATPNLRMA	DC-PNL-1A	125	BATPNLRMA	AC/C
INVERTER-1D	INV	BATPNLRMB	DC-PNL-1B	125	BATPNLRMB	AC/D

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Three Mile Island 1

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
1AESCC	480	AC/A	SGRM1P	AFW	EF-V1A	MOV	295IB
1AESCC	480	AC/A	SGRM1P	AFW	EF-V2A	MOV	295IB
1AESCC	480	AC/A	SGRM1P	RW	RR-V3A	MOV	PPCHN
1AESCC	480	AC/A	SGRM1P	RW	RR-V4A	MOV	PPCHN
1AESCC	480	AC/A	SGRM1P	RW	RR-V4C	MOV	PPCHN
1AESSHCC	480	AC/A	SCREENHS	RW	DR-V1A	MOV	SCREENHS
1AESSHCC	480	AC/A	SCREENHS	RW	NR-V1A	MOV	SCREENHS
1AESSHCC	480	AC/A	SCREENHS	RW	NR-V2	MOV	SCREENHS
1AESSHCC	480	AC/A	SCREENHS	RW	NR-V3	MOV	SCREENHS
1AESSHCC	480	AC/A	SCREENHS	RW	RR-V1A	MOV	SCREENHS
1AESVCC	480	AC/A	305AB	ECCS	DH-V4A	MOV	281AB
1AESVCC	480	AC/A	305AB	ECCS	DH-V4A	MOV	281AB
1AESVCC	480	AC/A	305AB	ECCS	DH-V5A	MOV	281AB
1AESVCC	480	AC/A	305AB	ECCS	DH-V6A	MOV	DHVTA
1AESVCC	480	AC/A	305AB	ECCS	MU-V14A	MOV	281AB
1AESVCC	480	AC/A	305AB	ECCS	MU-V16A	MOV	281AB
1AESVCC	480	AC/A	305AB	ECCS	MU-V16B	MOV	281AB
1AESVCC	480	AC/A	305AB	PAHR	BS-V1A	MOV	281AB
1AESVCC	480	AC/A	305AB	PAHR	BS-V3A	MOV	DHVTA
1AESVCC	480	AC/A	305AB	PAHR	DH-V5A	MOV	281AB
1AESVCC	480	AC/A	305AB	PAHR	DH-V6A	MOV	DHVTA
1AESVCC	480	AC/A	305AB	RCS	DH-V3	MOV	281AB
1AESVCC	480	AC/A	305AB	RW	NR-V16A	MOV	HXVT
1AESVCC	480	AC/A	305AB	RW	NR-V16B	MOV	HXVT
1AESVCC	480	AC/A	305AB	RW	NR-V5	MOV	HXVT
1AESVCC	430	AC/A	305AB	RW	NR-V8A	MOV	HXVT
1AESVCC	480	AC/A	305AB	RW	NR-V8B	MOV	HXVT
1ARADWCC	480	AC/A	305AB	AFW	CO-V10B	MOV	VVBOXB
1ARADWCC	480	AC/A	305AB	RCS	MU-V1A	MOV	RC
1ATPCC	480	AC/A	1ATPCC	AFW	CO-V10A	MOV	VVBOXA
1BESCC	480	AC/B	SGRM1S	AFW	EF-V1B	MOV	295IB

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Three Mile Island 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
1BESCC	480	AC/B	SGRM1S	AFW	EF-V2B	MOV	295IB
1BESCC	480	AC/B	SGRM1S	RW	RR-V3B	MOV	PPCHN
1BESCC	480	AC/B	SGRM1S	RW	RR-V4B	MOV	PPCHN
1BESSHCC	480	AC/B	SCREENHS	RW	DR-V1B	MOV	SCREENHS
1BESSHCC	480	AC/B	SCREENHS	RW	NR-V7	MOV	SCREENHS
1BESSHCC	480	AC/B	SCREENHS	RW	RR-V1B	MOV	SCREENHS
1BESSHCC	480	AC/B	SCREENHS	RW	NR-V1C	MOV	SCREENHS
1BESVCC	480	AC/B	305AB	ECCS	DH-V4B	MOV	281AB
1BESVCC	480	AC/B	305AB	ECCS	DH-V4B	MOV	281AB
1BESVCC	480	AC/B	305AB	ECCS	DH-V5B	MOV	281AB
1BESVCC	480	AC/B	305AB	ECCS	DH-V6B	MOV	DHVTB
1BESVCC	480	AC/B	305AB	ECCS	MU-V14B	MOV	281AB
1BESVCC	480	AC/B	305AB	ECCS	MU-V16C	MOV	305AB
1BESVCC	480	AC/B	305AB	ECCS	MU-V16D	MOV	305AB
1BESVCC	480	AC/B	305AB	PAHR	BS-V1B	MOV	281AB
1BESVCC	480	AC/B	305AB	PAHR	BS-V3B	MOV	DHVTB
1BESVCC	480	AC/B	305AB	PAHR	DH-V5B	MOV	281AB
1BESVCC	480	AC/B	305AB	PAHR	DH-V6B	MOV	DHVTB
1BESVCC	480	AC/B	305AB	RCS	MU-V2A	MOV	RC
1BESVCC	480	AC/B	305AB	RCS	MU-V2B	MOV	RC
1BESVCC	480	AC/B	305AB	RW	NR-V16C	MOV	HXVT
1BESVCC	480	AC/B	305AB	RW	NR-V16D	MOV	HXVT
1BESVCC	480	AC/B	305AB	RW	NR-V6	MOV	HXVT
1BESVCC	480	AC/B	305AB	RW	NR-V8C	MOV	HXVT
1BRADWCC	480	AC/B	305AB	RCS	MU-V1B	MOV	RC
1CESVCC	480	AC/C	1CESVCC	AFW	MS-V2A	MOV	295IB
1CESVCC	480	AC/C	1CESVCC	AFW	MS-V2B	MOV	295IB
1CESVCC	480	AC/C	1CESVCC	ECCS	CFS-V1A	MOV	RC
1CESVCC	480	AC/C	1CESVCC	ECCS	CFS-V1B	MOV	RC
1CESVCC	480	AC/C	1CESVCC	RCS	DH-V1	MOV	RC
1CESVCC	480	AC/C	1CESVCC	RCS	DH-V2	MOV	RC

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Three Mile Island 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
1CESVCC	480	AC/C	1CESVCC	RW	EF-V4	MOV	295IB
1CESVCC	480	AC/C	1CESVCC	RW	EF-V5	MOV	295IB
1CESVCC	480	AC/C	1CESVCC	RW	NR-V18	MOV	HXVT
1CESVCC	480	AC/C	1CESVCC	RW	NR-V19	MOV	HXVT
1CESVCC	480	AC/C	1CESVCC	RW	NR-V1B	MOV	SCREENHS
1CESVCC	480	AC/C	1CESVCC	RW	RR-V3C	MOV	PPCHN
ATS-CESVCC	480	AC/C	EEQUIPRM	EP	1CESVCC	MCC	1CESVCC
BATT-1B	125	DC/B	BATRMB	EP	DC-PNL-1B	BUS	BATPNLRMB
BATT-PNL-1A	125	DC/A	BATRMA	EP	DC-PNL-1A	BUS	BATPNLRMA
BUS-1A-TP	4160	NON-1E	UNKNOWN	EP	EP-TRAN-C	TRAN	UNKNOWN
BUS-1B-TP	4160	NON-1E	UNKNOWN	EP	EP-TRAN-G	TRAN	UNKNOWN
BUS-1C	480	NON-1E	UNKNOWN	EP	1ATPCC	MCC	1ATPCC
BUS-1C-TP	4160	NON-1E	UNKNOWN	EP	EP-TRAN-L	TRAN	UNKNOWN
BUS-1D	4160	AC/A	BUS1D	AFW	EF-P2A	MDP	295IB
BUS-1D	4160	AC/A	BUS1D	ECCS	DH-P1A	MDP	DHVTA
BUS-1D	4160	AC/A	BUS1D	ECCS	DH-P1A	MDP	DHVTA
BUS-1D	4160	AC/A	BUS1D	ECCS	MU-P1A	MDP	HPIRMA
BUS-1D	4160	AC/A	BUS1D	EP	EP-TRAN-P	TRAN	SGRM1P
BUS-1D	4160	AC/A	BUS1D	EP	EP-TRAN-R	TRAN	SCREENHS
BUS-1D	4160	AC/A	BUS1D	PAHR	BS-P1A	MDP	BSVTA
BUS-1D	4160	AC/A	BUS1D	PAHR	FCU-A	FCU	RC
BUS-1D	4160	AC/A	BUS1D	RW	RR-P1A	MDP	SCREENHS
BUS-1D/1E	4160	AC/A/B	BUS1D/BUS1E	ECCS	MU-P1B	MDP	HPIRMB
BUS-1D/1E	4160	AC/A/B	BUS1D/BUS1E	PAHR	FCU-C	FCU	RC
BUS-1E	4160	AC/B	BUS1E	AFW	EF-P2B	MDP	295IB
BUS-1E	4160	AC/B	BUS1E	ECCS	DH-P1B	MDP	DHVTB
BUS-1E	4160	AC/B	BUS1E	ECCS	DH-P1B	MDP	DHVTB
BUS-1E	4160	AC/B	BUS1E	ECCS	MU-P1C	MDP	HPIRMC
BUS-1E	4160	AC/B	BUS1E	EP	EP-TRAN-S	TRAN	SGRM1S
BUS-1E	4160	AC/B	BUS1E	EP	EP-TRAN-T	TRAN	SCREENHS
BUS-1E	4160	AC/B	BUS1E	PAHR	BS-P1B	MDP	BSVTB

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Three Mile Island 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS-1E	4160	AC/B	BUS1E	PAHR	FCU-B	FCU	RC
BUS-1E	4160	AC/B	BUS1E	RW	RR-P1B	MDP	SCREENHS
BUS-1G	480	NON-1E	UNKNOWN	EP	1ARADWCC	MCC	1ARADWCC
BUS-1L	480	NON-1E	UNKNOWN	EP	1BRADWCC	MCC	1BRADWCC
BUS-1P	480V	AC/A	SGRM1P	CCW	DC-P1A	MDP	305AB
BUS-1P	480	AC/A	SGRM1P	CCW	NS-P1A	MDP	305AB
BUS-1P	480	AC/A	SGRM1P	EP	1AESCC	MCC	SGRM1P
BUS-1P	480	AC/A	SGRM1P	EP	1AESVCC	MCC	1AESVCC
BUS-1P/1S	480	AC/C	SGRM1P/1S	EP	ATS-1CESVCC	ATS	EEQUIPRM
BUS-1R	480	AC/A	SCREENHS	EP	1AESSHCC	MCC	SCREENHS
BUS-1R	480	AC/A	SCREENHS	RW	DR-P1A	MDP	SCREENHS
BUS-1R	480	AC/A	SCREENHS	RW	NR-P1A	MDP	SCREENHS
BUS-1S	480V	AC/B	SGRM1S	CCW	DC-P1B	MDP	305AB
BUS-1S	480	AC/B	SGRM1S	CCW	NS-P1B	MDP	305AB
BUS-1S	480	AC/B	SGRM1S	CCW	NS-P1C	MDP	305AB
BUS-1S	480	AC/B	SGRM1S	EP	1BESCC	MCC	SGRM1S
BUS-1S	480	AC/B	SGRM1S	EP	1BESVCC	MCC	1BESVCC
BUS-1T	480	AC/B	SCREENHS	EP	1BESSHCC	MCC	SCREENHS
BUS-1T	480	AC/B	SCREENHS	RW	DR-P1B	MDP	SCREENHS
BUS-1T	480	AC/B	SCREENHS	RW	NR-P1B	MDP	SCREENHS
BUS-1T	480	AC/B	SCREENHS	RW	NR-P1C	MDP	SCREENHS
DC-ATS-1M	125	DC/C	EEQUIPRM	EP	DC-PNL-1M	BUS	EEQUIPRM
DC-BUS-1A/1B	125	DC/C	BATPNLRMA/B	EP	DC-ATS-1M	ATS	EEQUIPRM
DC-PNL-1A	125	DC/A	BATPNLRMA	EP	DC-PNL-1C	BUS	BATPNLRMA
DC-PNL-1A	125	DC/A	BATPNLRMA	EP	DC-PNL-1E	BUS	BATPNLRMA
DC-PNL-1A	125	AC/A	BATPNLRMA	EP	INVERTER-1A	INV	BATPNLRMA
DC-PNL-1A	125	AC/C	BATPNLRMA	EP	INVERTER-1C	INV	BATPNLRMA
DC-PNL-1B	125	DC/B	BATPNLRMB	EP	DC-PNL-1D	BUS	BATPNLRMB
DC-PNL-1B	125	DC/B	BATPNLRMB	EP	DC-PNL-1F	BUS	BATPNLRMB
DC-PNL-1B	125	AC/B	BATPNLRMB	EP	INVERTER-1B	INV	BATPNLRMB
DC-PNL-1B	125	AC/D	BATPNLRMB	EP	INVERTER-1D	INV	BATPNLRMB

Table 3.6-2. Partial Listing of Electrical Sources and Loads at Three Mile Island 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
DC-PNL-1C	125	DC/A	BATPNLRMA	AFW	MS-V10A	MOV	295IB
DC-PNL-1C	125	DC/A	BATPNLRMA	EP	DC-PNL-1H	BUS	BATPNLRMA
DC-PNL-1D	125	DC/B	BATPNLRMB	AFW	MS-V10B	MOV	295IB
DC-PNL-1D	125	DC/B	BATPNLRMB	EP	DC-PNL-1J	BUS	BATPNLRMB
DC-PNL-1E	125	DC/A	BATPNLRMA	EP	DC-PNL-1P	BUS	305HLA
DC-PNL-1E	125	DC/A	BATPNLRMA	EP	DC-PNL-DCA	BUS	BATPNLRMA
DC-PNL-1F	125	DC/B	BATPNLRMB	EP	DC-PNL-1Q	BUS	305HLB
DC-PNL-1F	125	DC/B	BATPNLRMB	EP	DC-PNL-DCB	BUS	BATPNLRMB
EP-DG1A	4160	AC/A	DGRMA	EP	BUS-1D	BUS	BUS1D
EP-DG1B	4160	AC/B	DGRMB	EP	BUS-1E	BUS	BUS1E
EP-TRAN-C	480	NON-1E	UNKNOWN	EP	BUS-1C	BUS	UNKNOWN
EP-TRAN-G	480	NON-1E	UNKNOWN	EP	BUS-1G	BUS	UNKNOWN
EP-TRAN-L	480	NON-1E	UNKNOWN	EP	BUS-1L	BUS	UNKNOWN
EP-TRAN-P	480	AC/A	SGRM1P	EP	BUS-1P	BUS	SGRM1P
EP-TRAN-R	480	AC/A	SCREENHS	EP	BUS-1R	BUS	SCREENHS
EP-TRAN-S	480	AC/B	SGRM1S	EP	BUS-1S	BUS	SGRM1S
EP-TRAN-T	480	AC/B	SCREENHS	EP	BUS-1T	BUS	SCREENHS
INVERTER-1A	120	AC/A	BATPNLRMA	EP	AC-PNL-VBA	BUS	BATPNLRMA
INVERTER-1B	120	AC/B	BATPNLRMB	EP	AC-PNL-VBB	BUS	BATPNLRMB
INVERTER-1C	120	AC/C	BATPNLRMA	EP	AC-PNL-VBC	BUS	BATPNLRMA
INVERTER-1D	120	AC/D	BATPNLRMB	EP	AC-PNL-VBD	BUS	BATPNLRMB
OFF-SITE		NON-1E		EP	BUS-1A-TP	BUS	UNKNOWN
OFF-SITE		NON-1E		EP	BUS-1B-TP	BUS	UNKNOWN
OFF-SITE		NON-1E		EP	BUS-1C-TP	BUS	UNKNOWN
UNKNOWN				RCS	RC-V2	MOV	RC

3.7 COMPONENT COOLING WATER SYSTEMS

3.7.1 System Function

The component cooling water systems support normal operation and cooldown requirements of the plant and provide adequate cooling to essential systems and components following a design basis accident. These systems form closed, intermediate coolant loops between heat sources and river water systems which are required to complete the heat transfer path to the ultimate heat sink.

3.7.2 System Definition

The following two closed-loop cooling water systems are described in this section:

- Nuclear Services Closed Cooling Water System (NSCCS)
- Decay Heat Closed Cooling Water System (DHCCS)

Each system consists of pumps and distribution valves and piping that serve various heat loads. Surge tanks maintain the coolant inventory and pressure in each system.

Simplified drawings of the NSCCS are shown in Figure 3.7-1 and 3.7-2. DHCCS Loop A is shown in Figures 3.7-3 and 3.7-4 and the similar DHCCS Loop B is shown in Figures 3.7-5 and 3.7-6. A summary of the data on selected NSCCS and DHCCS components is presented in Table 3.7-1.

3.7.3 System Operation

A. NSCCS

The NSCCS normally is in operation. This system, along with the intermediate cooling system, satisfies the cooling requirements of all nuclear-oriented services other than decay heat and containment emergency cooling. In the event of a LOCA, all nonessential heat loads are isolated. The following key heat load are supported by this system:

- Makeup and purification (HPI) pumps 1A, 1B and 1C
- AFW pump room coolers
- Nuclear services and decay heat pump area coolers
- Control building air conditioning

Other components served by this system include reactor coolant pump air, oil and seal coolers. The nuclear services river water system (NSRWS) completes the heat transfer path to the ultimate heat sink (see Section 3.8).

B. DHCCS

The DHCCS Loops A and B normally are in standby and are automatically actuated by an ESAS signal (see Section 3.5). The following key heat loads are supported by this system.

Heat Load	DHCCS A	DHCCS B
Makeup and Purification (HPI) pump	1A	1C
Containment Spray pump	1A	1B
Decay heat removal (LPI) pump	1A	1B
Decay heat removal cooler	A	B

Note that HPI pumps 1A and 1C can be cooled by both NSCCS and DHCCS. The decay heat river water system (DHRWS) completes the heat transfer path to the ultimate heat sink (see Section 3.8)

3.7.4 System Success Criteria

A. NSCCS
- One NSCCS pump operating in conjunction with two effective heat exchangers. (Ref. 1)

B. DHCCS
- An individual DHCCS loop is successful with one of two pumps operating in the loop, and one of two heat exchangers in the loop is functioning. (Ref. 2)

3.7.5 Component Information

A. NSCCS pumps (3)
1. Rated flow: 2800 gpm @ 136 ft. head (59 psid)
2. Rated capacity: 50%
3. Type: centrifugal

B. NSCCS heat exchangers (4)
1. Type: shell and tube
2. Design capacity: 19.33×10^6 Btu/hr
3. Rated capacity: 33.3%

C. NSCCS surge tank
1. Capacity: 1470 gal.

D. DHCCS pumps (2)
1. Rated flow: 3900 gpm @ 75 ft. head (33 psid)
2. Rated capacity: 100%
3. Type: centrifugal

E. DHCCS heat exchangers (2)
1. Type: shell and tube
2. Design capacity: 135×10^6 Btu/hr
3. Rated capacity: 100%

F. DHCCS surge tanks (2)
1. Capacity: 375 gal.

3.7.6 Support Systems and Interfaces

A. Control Signals
1. Automatic
   a. The DHCCS and associated DHRWS pumps are started by the ESAS (see Section 3.5)
   b. NSCCS nonessential heat loads are automatically isolated by the ESAS.

2. Remote manual
   a. NSCCS and DHCCS pumps and valves can be operated from the main control room.

B. Motive Power

1. The NSCCS and DHCCS pumps and valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.6.

C. Other

1. Lubrication and seal cooling is provided locally for each pump.

3.7.7 Section 3.7 References

1. TMI-1 Final Safety Analysis Report, Section 9.6.2.3.
2. TMI-1 Final Safety Analysis Report, Section 9.6.2.5.

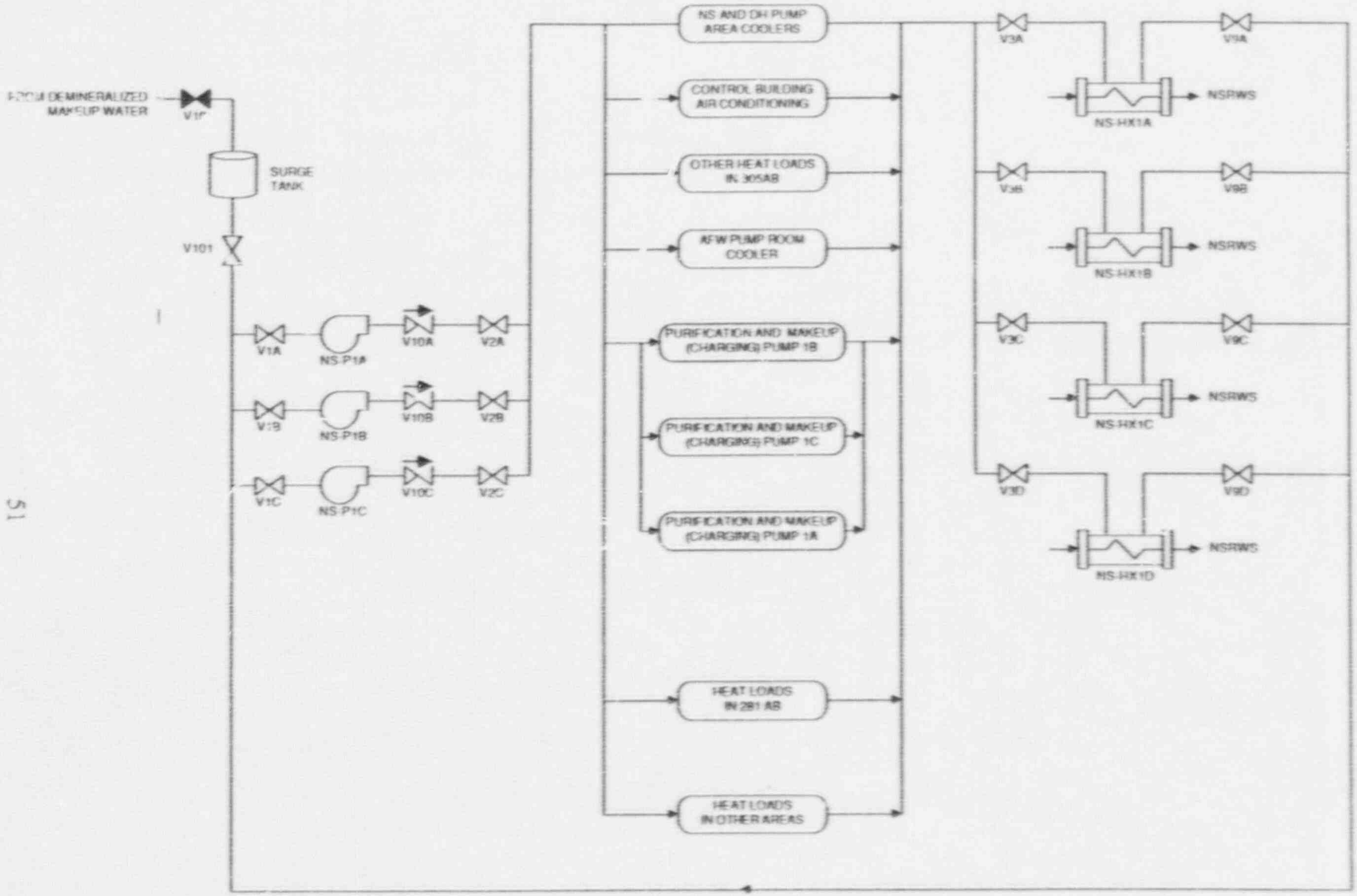


Figure 3.7-1 Three Mile Island 1 Nuclear Service Closed Cooling Water System

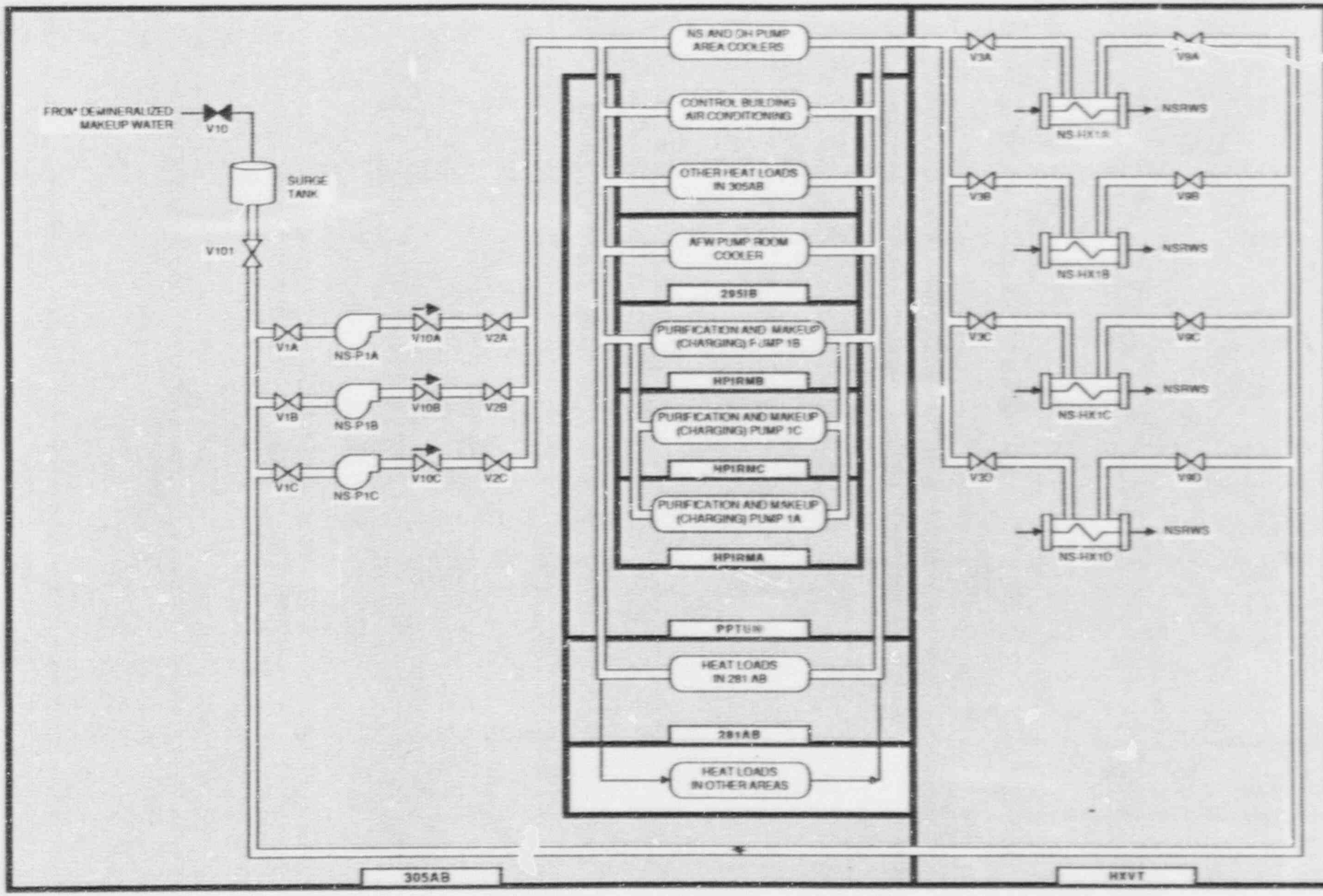


Figure 3.7-2 Three Mile Island 1 Nuclear Service Closed Cooling Water System Showing Component Locations

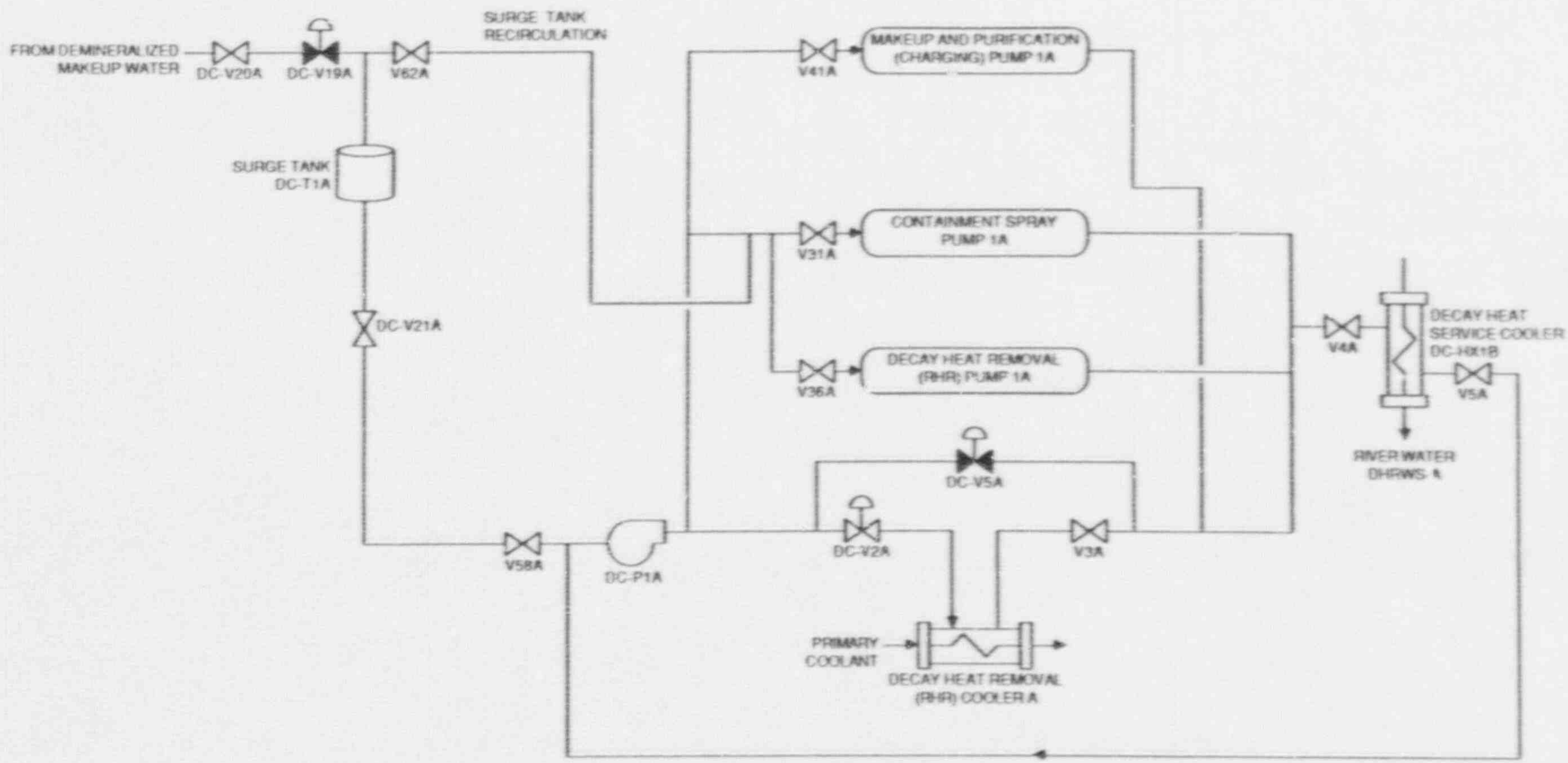


Figure 3.7-3 Three Mile Island 1 Decay Heat Closed Cooling Water System, Loop A

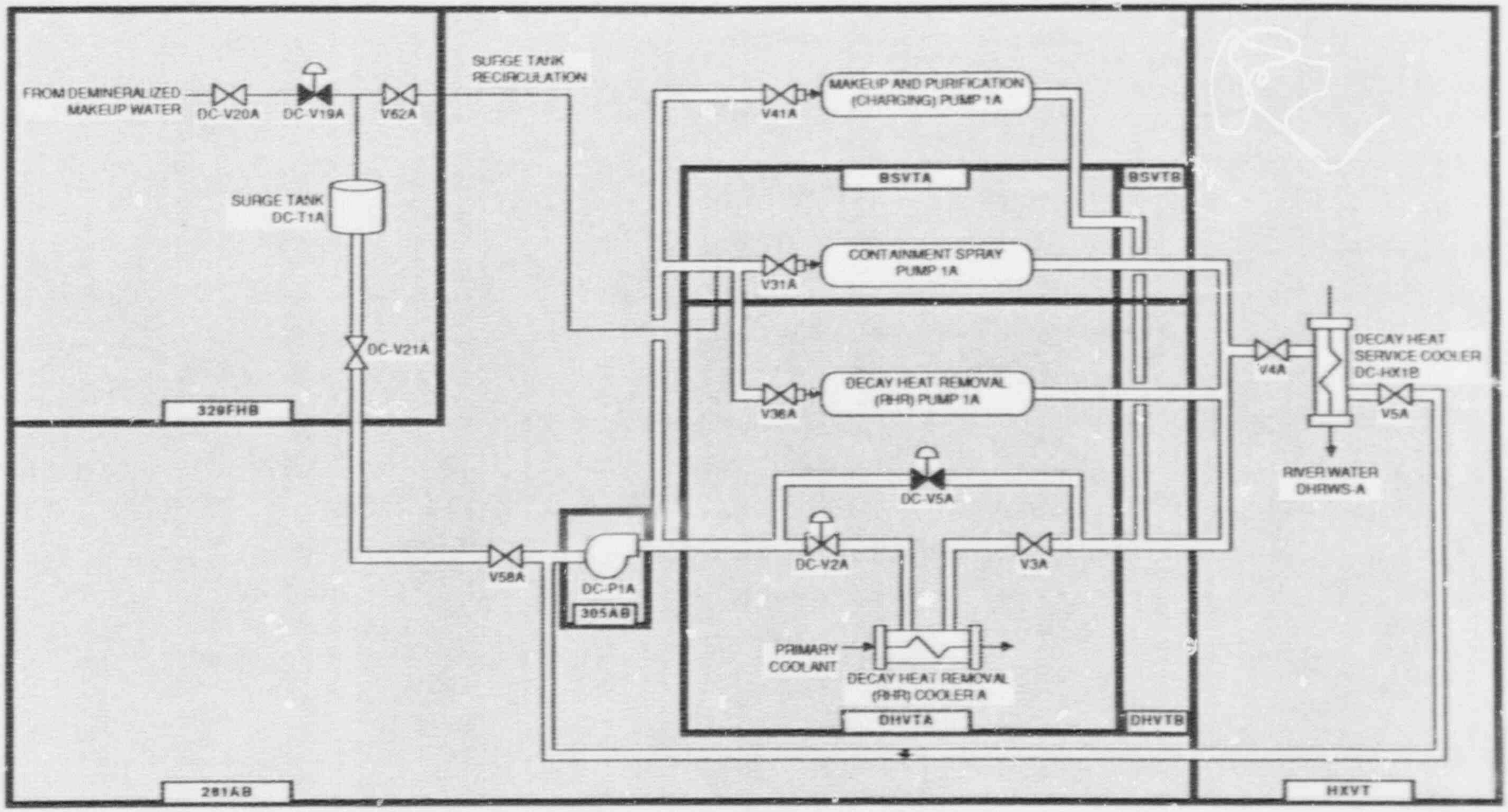


Figure 3.7-4 Three Mile Island 1 Decay Heat Closed Cooling Water System, Loop A, Showing Component Locations

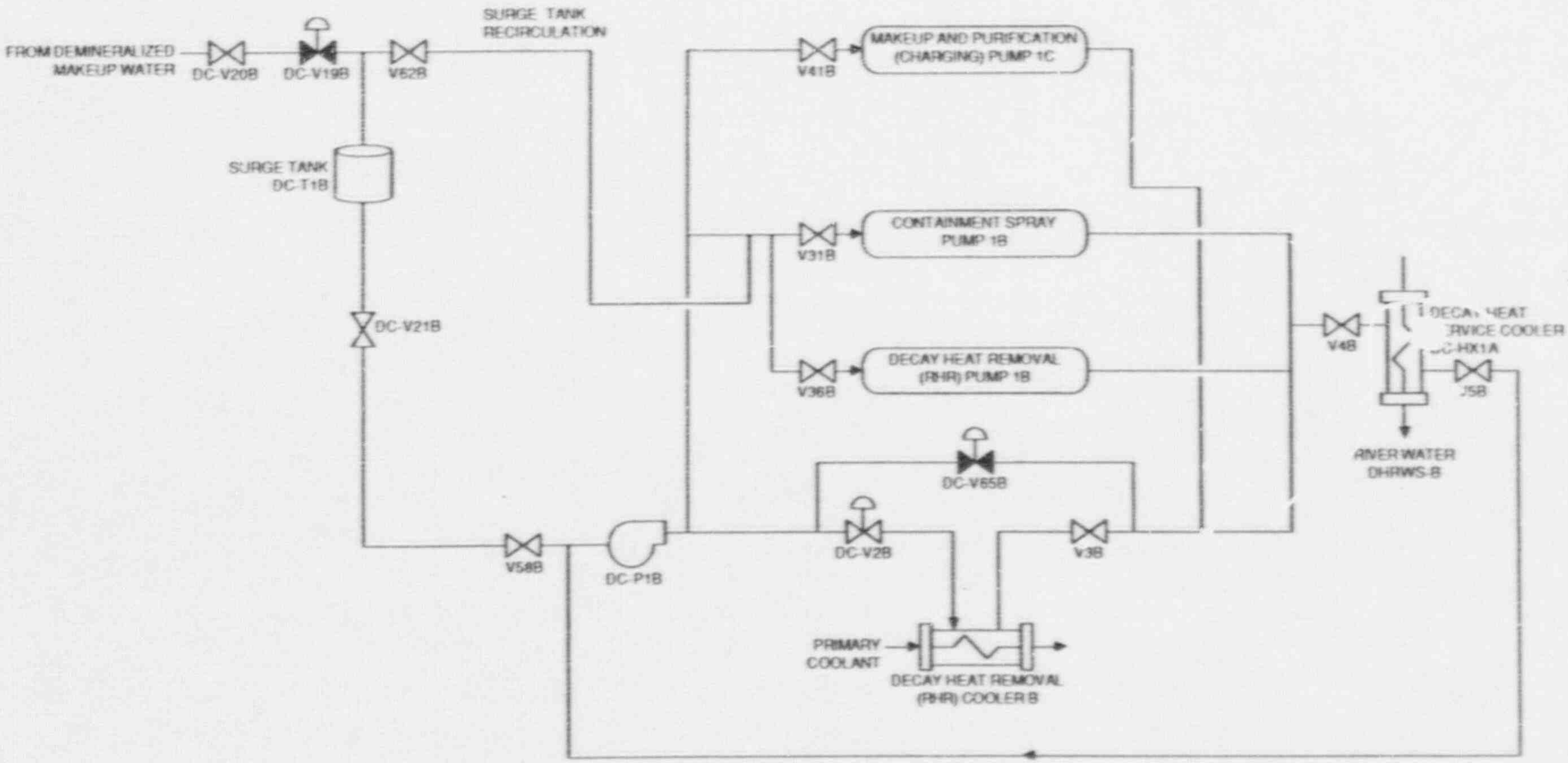


Figure 3.7-5 Three Mile Island 1 Decay Heat Closed Cooling Water System, Loop B

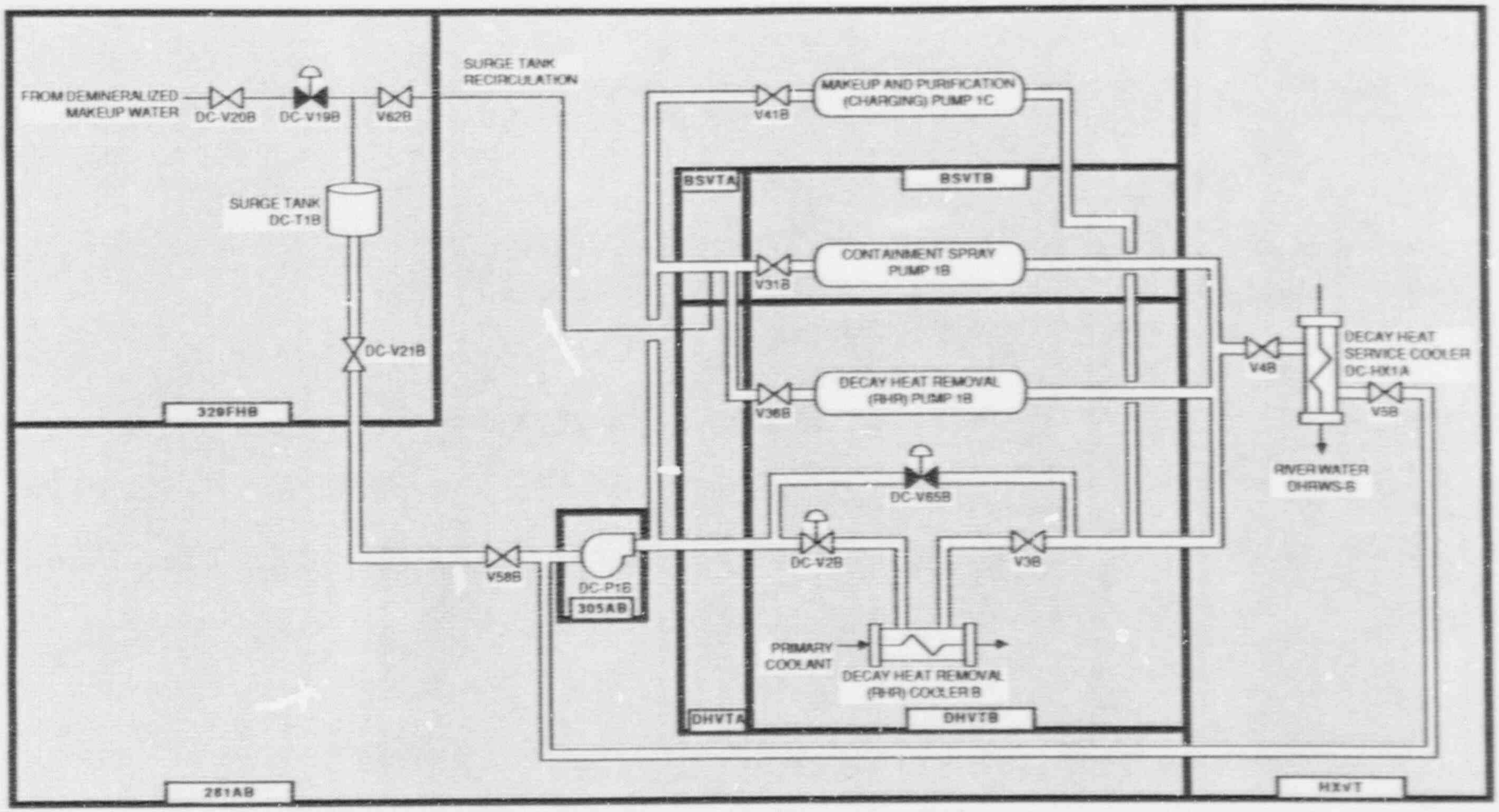


Figure 3.7-6 Three Mile Island 1 Decay Heat Closed Cooling Water System, Loop B, Showing Component Locations

Table 3.7-1. Three Mile Island Component Cooling Water Systems Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
DC-HXA	HX	HXVT				
DC-HXB	HX	HXVT				
DC-P1A	MDP	305AB	BUS-1P	480V	SGRM1P	AC/A
DC-P1B	MDP	305AB	BUS-1S	480V	SGRM1S	AC/B
DC-T1A	TANK	329FHB				
DC-T1B	TANK	329FHB				
DC-V19A	NV	329FHB				
DC-V19B	NV	329FHB				
DC-V20A	XV	329FHB				
DC-V20B	XV	329FHB				
DC-V21A	XV	329FHB				
DC-V21B	XV	329FHB				
DC-V2A	NV	DHVTA				
DC-V2B	NV	DHVTB				
DC-V65A	NV	DHVTA				
DC-V65B	NV	DHVTB				
NS-HX1A	HX	HXVT				
NS-HX1B	HX	HXVT				
NS-HX1C	HX	HXVT				
NS-HX1D	HX	HXVT				
NS-P1A	MDP	305AB	BUS-1P	480	SGRM1P	AC/A
NS-P1B	MDP	305AB	BUS-1S	480	SGRM1S	AC/B
NS-P1C	MDP	305AB	BUS-1S	480	SGRM1S	AC/B

3.8 RIVER WATER SYSTEM

3.8.1 System Function

The river water (RW) system supports normal operation and cooldown requirements of the plant and provides adequate cooling to essential systems and components following a design basis accident. This system completes the heat transfer path from key components to the ultimate heat sink.

3.8.2 System Definition

The river water system is comprised of several subsystems that share the intake structure and pumphouse on the Susquehanna River. Each subsystem includes river water pumps, supply headers, effluent headers, and associated distribution control and isolation valves. The subsystems of interest are:

- Emergency river water system (ERWS)
- Nuclear services cooling river water system (NSRWS)
- Decay heat river water system (DHRWS)

Simplified drawings of the RW subsystems are shown in Figure 3.8-1 and 3.8-6. A summary of data on selected river water system components is presented in Table 3.8-1.

3.8.3 System Operation

A. ERWS

The two ERWS pumps normally are in standby and isolation valves in the flow paths to the containment fan cooler units (FCUs) and the auxiliary feedwater system are normally closed. The ERWS pumps are started and FCU isolation valves are opened automatically by signals from the Engineered Safeguards Actuation System (ESAS, see Section 3.5). Remote manual actions are required to start and align this system as a backup water source for the auxiliary feedwater system (see Section 3.2).

B. NSRWS

One or more NSRWS pumps normally are in operation. These pumps are sized to cool the NSCCS heat exchangers and also the intermediate service coolers. In an emergency, flow to the intermediate coolers can be isolated. The NSRWS can be supplemented by manually aligning secondary service river water pumps to supply NSRWS heat loads.

C. DHRWS

The DHRWS pumps normally are in standby. This system is required for cooling the DHCCS heat exhangers during normal cooldown or following an accident. The "A" DHRWS pump supports operation of DHCCS Loop A. Similarly, the "B" DHRWS pump supports DHCCS Loop B.

D. River water effluent return

The ERWS, NSRWS and DHRWS all discharge to a common return header which directs water to a river outfall via valve V69. An alternate discharge path to the screen wash spray header is available for the NSRWS via valve NR-V19.

3.8.4 System Success Criteria

A. ERWS
- One of two pumps operating at its rated flow supplying the containment fan cooler units or the AFW system (Ref. 1).

B. NSRWS
- One pump operating at rated flow and supplying at least two of the four NSCCS heat exchangers (Ref. 2).

C. DHRWS
- One of two pumps operating at rated flow and supplying one of two coolers. (Ref. 3)

3.8.5 Component Information

A. ERWS pumps (2)
1. Rated flow: 5400 gpm @ 242 ft head (105 psid)
2. Rated capacity: 100%

B. NSRWS pumps (3)
1. Rated flow: 6000 gpm @ 77 ft head (33 psid)
2. Rated capacity: 50%

C. DHRWS pumps (2)
1. Rate flow: 7900 gpm @ 68 ft head (29 psid)
2. Rated capacity: 100%

3.8.6 Support Systems and Interfaces

A. Control Signals
1. Automatic
    a. The ERWS pumps are started and isolation valves serving the containment fan coolers are opened by the ESAS (see Section 3.5).
    b. All NSRWS pumps receive a start signal from the ESAS, and valves NR-V4A and NR-V4B in a recirculation flow line are shut.
    c. The DHRWS and associated DHCCS pumps are started by the ESAS.
2. Remote Manual
    a. Motor-operated valves and pumps can be operated from the main control room.

B. Motive Power
1. The RW 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. Each NSRWS pump has a booster pump which provides filtered water for bearing cooling and/or lubrication.

3.8.7 Section 3.8 References

1. TMI-1 Final Safety Analysis Report, Section 9.6.2.4.
2. TMI-1 Final Safety Analysis Report, Section 9.6.2.3.
3. TMI-1 Final Safety Analysis Report, Section 9.6.2.5.

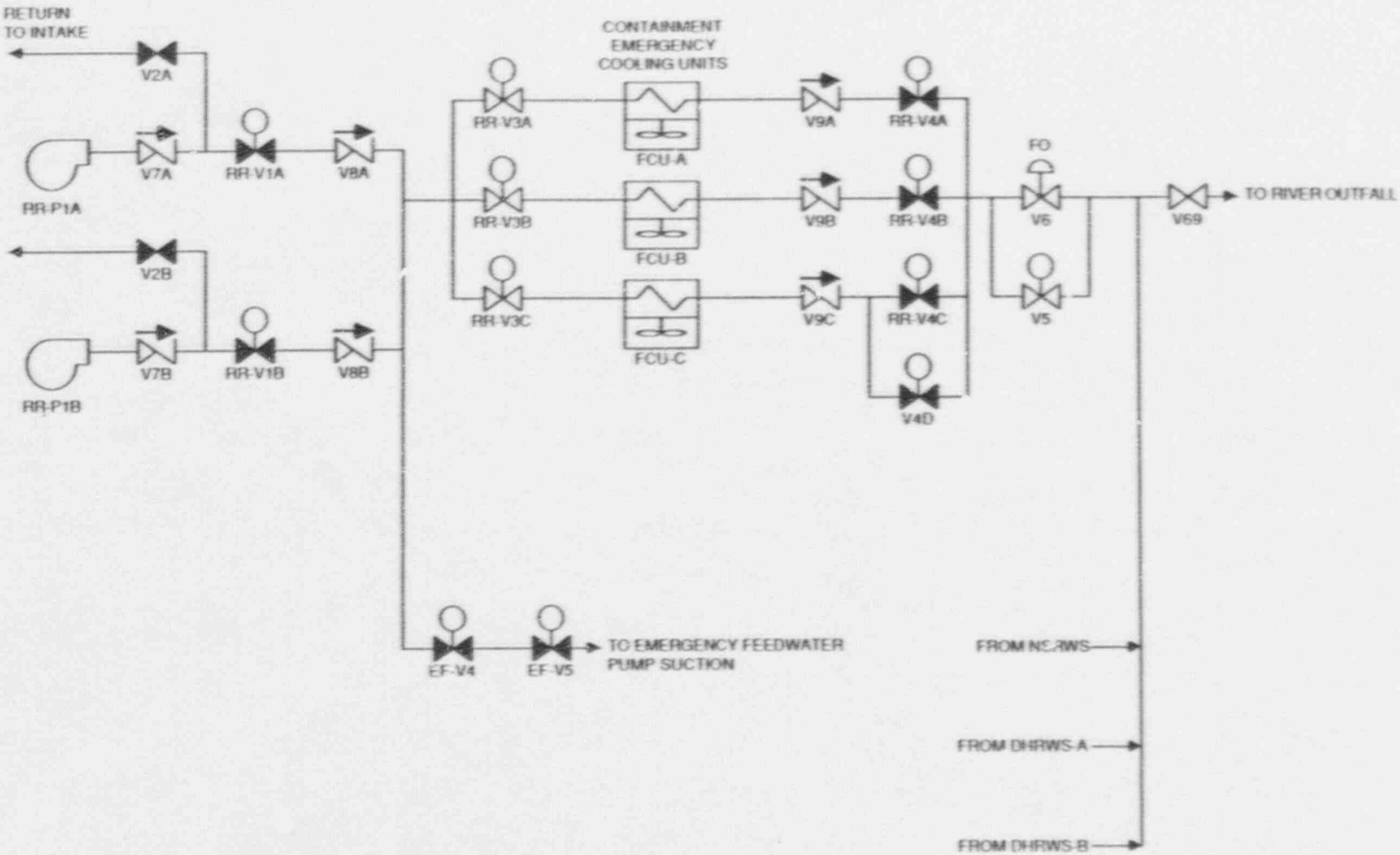


Figure 3.8-1 Three Mile Island 1 Emergency River Water System

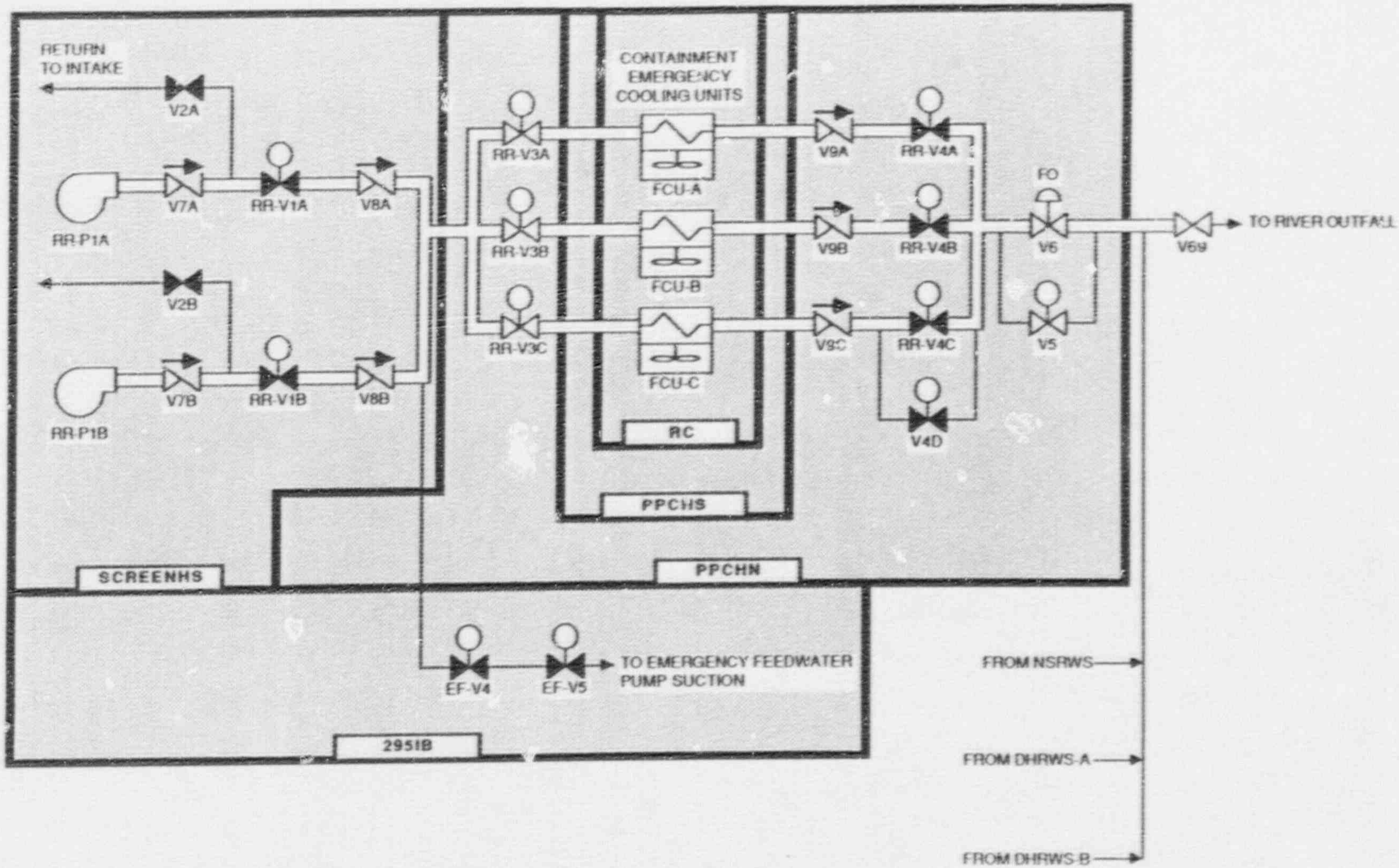


Figure 3.8-2 Three Mile Island 1 Emergency River Water System Showing Component Locations

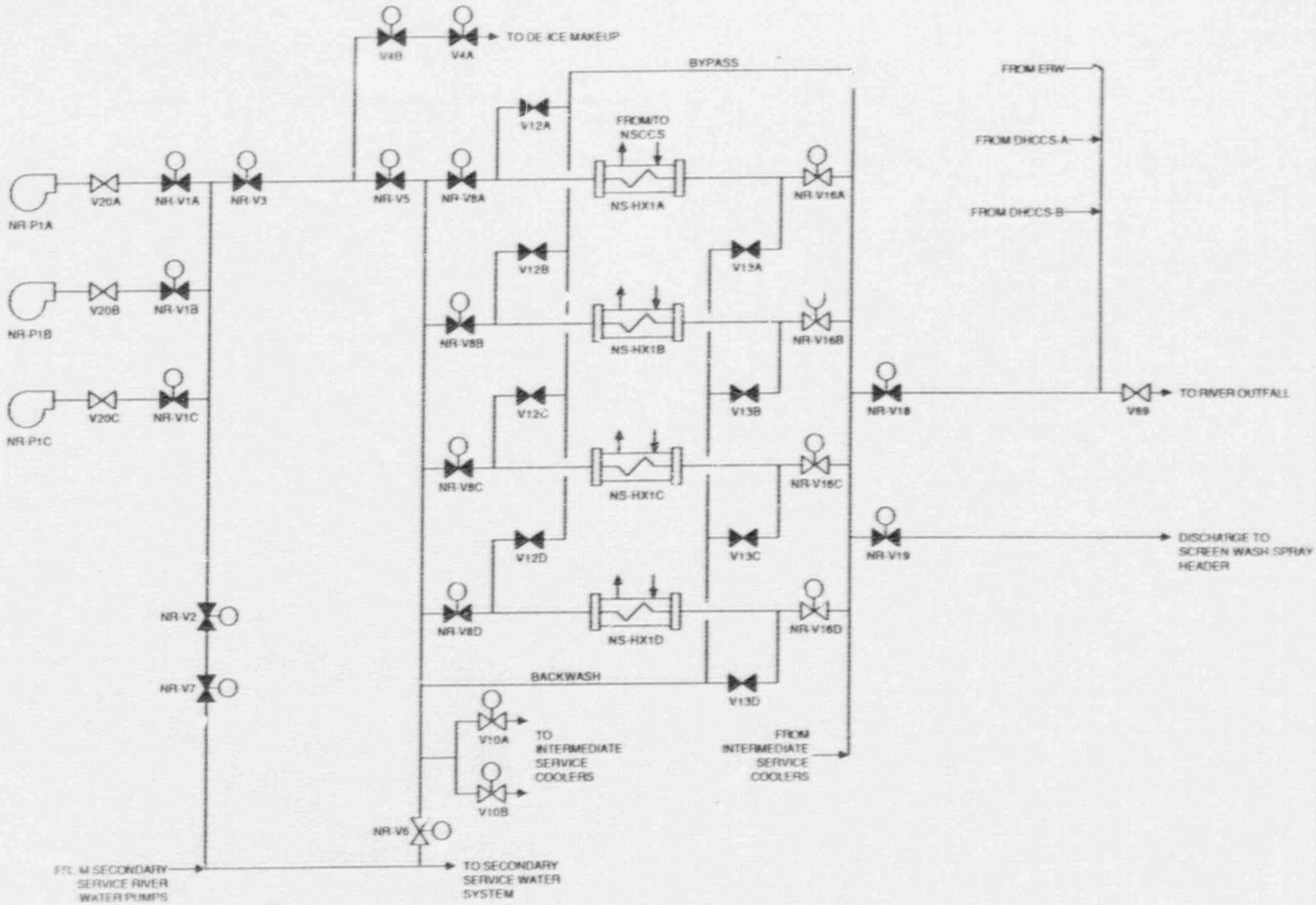


Figure 3.8-3 Three Mile Island 1 Nuclear Service River Water System

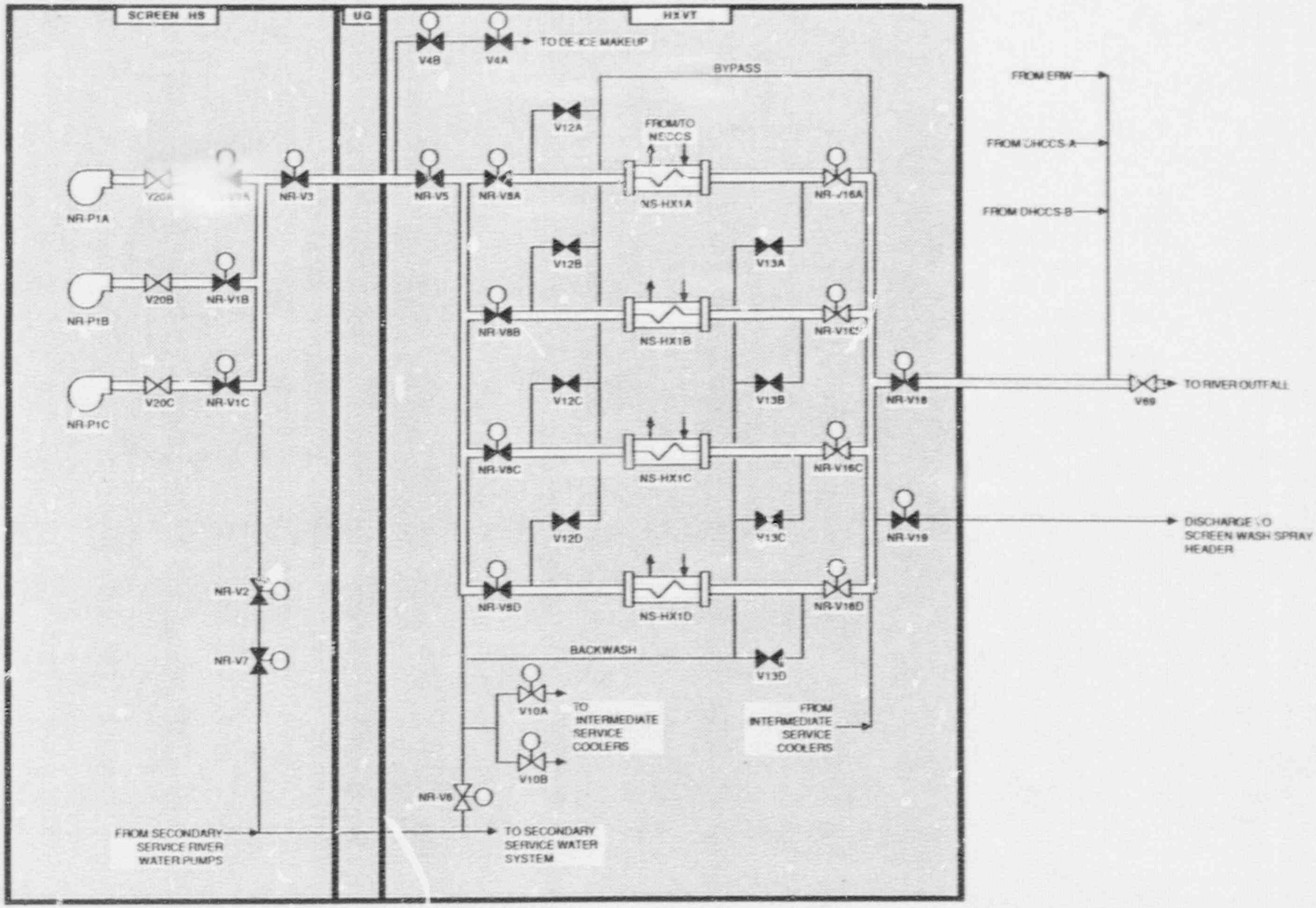


Figure 3.8-4 Three Mile Island 1 Nuclear Service River Water System Showing Component Locations

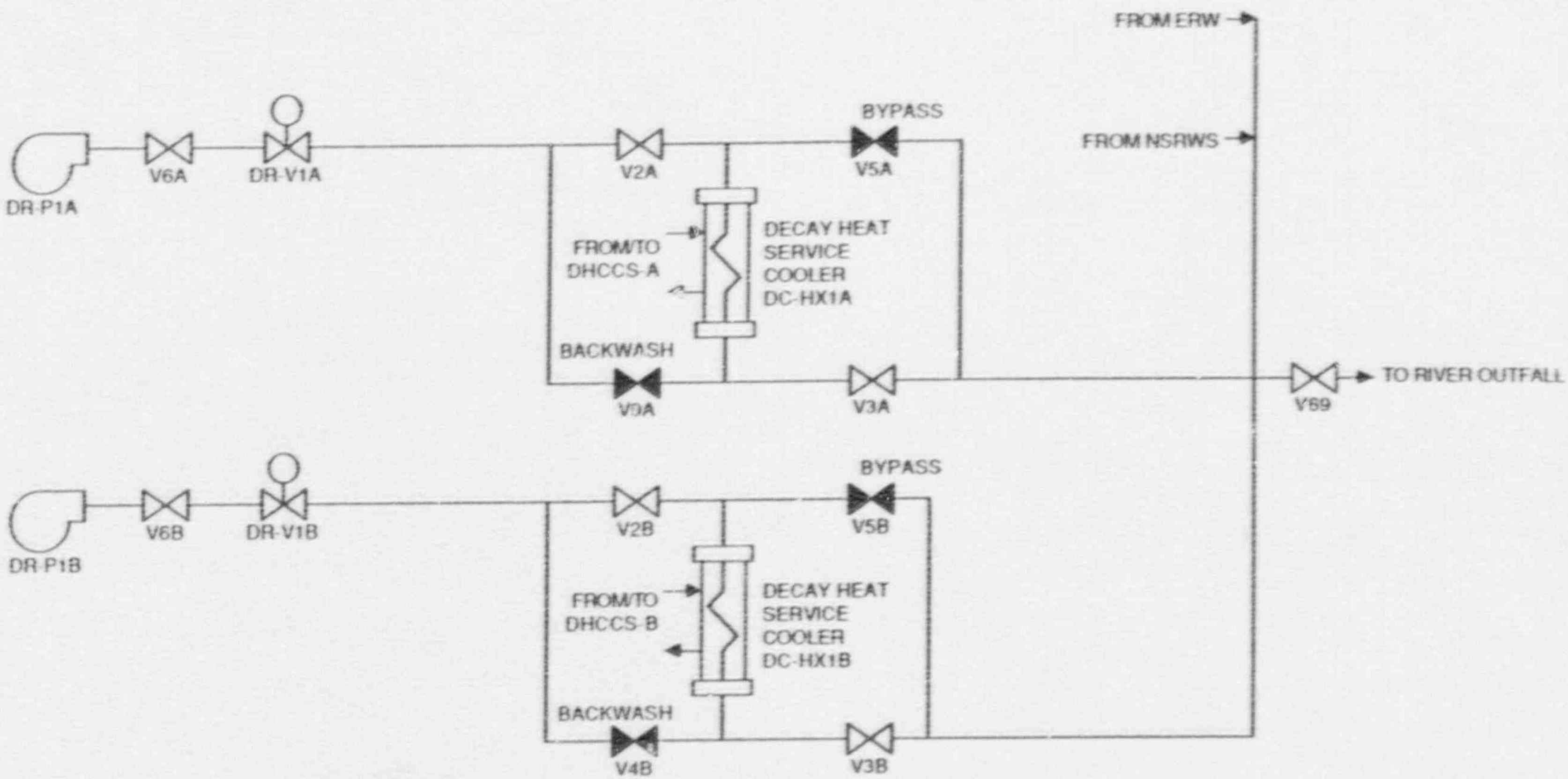


Figure 3.8-5 Three Mile Island 1 Decay Heat River Water System

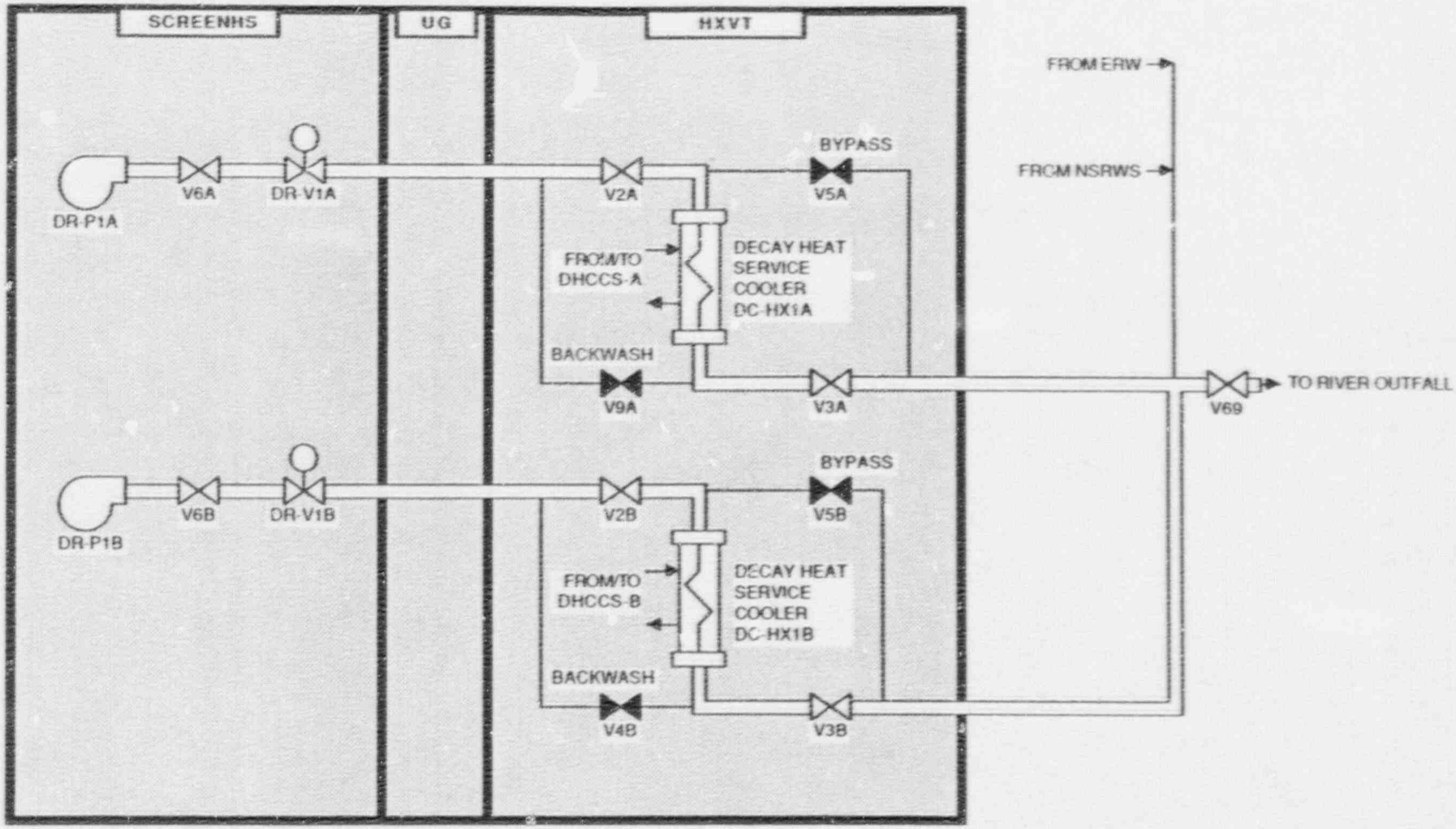


Figure 3.8-6 Three Mile Island 1 Decay Heat River Water System Showing Component Locations

Table 3.8-1. Three Mile Island River Water Systems Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
DR-P1A	MDP	SCREENHS	BUS-1R	480	SCREENHS	AC/A
DR-P1B	MDP	SCREENHS	BUS-1T	480	SCREENHS	AC/B
DR-V1A	MOV	SCREENHS	1AESSHCC	480	SCREENHS	AC/A
DR-V1B	MOV	SCREENHS	1BESSHCC	480	SCREENHS	AC/B
EF-V4	MOV	295IB	1CESVCC	480	1CESVCC	AC/C
EF-V5	MOV	295IB	1CESVCC	480	1CESVCC	AC/C
NR-P1A	MDP	SCREENHS	BUS-1R	480	SCREENHS	AC/A
NR-P1B	MDP	SCREENHS	BUS-1T	480	SCREENHS	AC/B
NR-P1C	MDP	SCREENHS	BUS-1T	480	SCREENHS	AC/B
NR-V16A	MOV	HXVT	1AESVCC	480	305AB	AC/A
NR-V16B	MOV	HXVT	1AESVCC	480	305AB	AC/A
NR-V16C	MOV	HXVT	1BESVCC	480	305AB	AC/B
NR-V16D	MOV	HXVT	1BESVCC	480	305AB	AC/B
NR-V18	MOV	HXVT	1CESVCC	480	1CESVCC	AC/C
NR-V19	MOV	HXVT	1CESVCC	480	1CESVCC	AC/C
NR-V1A	MOV	SCREENHS	1AESSHCC	480	SCREENHS	AC/A
NR-V1B	MOV	SCREENHS	1CESVCC	480	1CESVCC	AC/C
NR-V2	MOV	SCREENHS	1AESSHCC	480	SCREENHS	AC/A
NR-V3	MOV	SCREENHS	1AESSHCC	480	SCREENHS	AC/A
NR-V5	MOV	HXVT	1AESVCC	480	305AB	AC/A
NR-V6	MOV	HXVT	1BESVCC	480	305AB	AC/B
NR-V7	MOV	SCREENHS	1BESSHCC	480	SCREENHS	AC/B
NR-V8A	MOV	HXVT	1AESVCC	480	305AB	AC/A
NR-V8B	MOV	HXVT	1AESVCC	480	305AB	AC/A
NR-V8C	MOV	HXVT	1BESVCC	480	305AB	AC/B
RR-P1A	MDP	SCREENHS	BUS-1D	4160	BUS1D	AC/A
RR-P1B	MDP	SCREENHS	BUS-1E	4160	BUS1E	AC/B
RR-V1A	MOV	SCREENHS	1AESSHCC	480	SCREENHS	AC/A
RR-V1B	MOV	SCREENHS	1BESSHCC	480	SCREENHS	AC/B

Table 3.8-1. Three Mile Island River Water Systems Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RR-V3A	MOV	PPCHN	1AESCC	480	SGRM1P	AC/A
RR-V3B	MOV	PPCHN	1BESCC	480	SGRM1S	AC/B
RR-V3C	MOV	PPCHN	1CESVCC	480	1CESVCC	AC/C
RR-[illegible]	MOV	PPCHN	1AESCC	480	SGRM1P	AC/A
RR-V4B	MOV	PPCHN	1BESCC	480	SGRM1S	AC/B
RR-V4C	MOV	PPCHN	1AESCC	480	SGRM1P	AC/A
NR-V1C	MOV	SCREENHS	1BESSHCC	480	SCREENHS	AC/B

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Three Mile Island 1 site is located on an island in the Susquehanna River about 10 miles southeast of Harrisburg, PA. The site contains one operating unit (TMI-1) and one unit that is out of service following an accident in 1979 (TMI-2). This section presents a summary of facilities associated with the TMI-1 plant. A site arrangement drawing is shown in Figure 4-1. As shown in this drawing, access to the protected area is via a processing center on the northeast corner of the site. Vehicle access points are not shown.

The reactor containment building contains the reactor vessel, RCS loop piping and components, the pressurizer and steam generators. Piping and valves associated with the ECCS, containment cooling systems, and AFW system are located inside containment. Access to the containment is via a personnel airlock at the 305 ft. elevation of the intermediate building, or an equipment hatch at grade level (about 305 ft).

The intermediate building (IB) surrounds the north and east sides of the containment. The IB contains the AFW pump room, main steam lines and isolation valves, and the secondary steam relief system.

The fuel handling building (FHB) is located to the south of the containment. New fuel storage racks and the spent fuel pool are located in this building. Also found in this building are surge tanks for component cooling water systems (329 ft. elevation), and motor control center 1CESVCC (281 ft. elevation).

The auxiliary building (AB) is on the southwest side of the containment. This building contains the ECCS pumps and heat exchangers, containment spray pumps, component cooling water system pumps and several motor control centers. Radioactive waste systems and ventilation systems also are located in this building.

The heat exchanger vault (HXVT) is adjacent to the west side of the AB, with its roof approximately at grade level. Access to the HXVT is via a pipe tunnel from the AB. The HXVT contains the component cooling water system heat exhangers.

The control building is located adjacent to the FHB and the IB. At grade level is a nuclear service area that may be used for maintenance. At the 322 ft elevation, key elements of DC and 480 VAC power distribution systems are located. The 4160 VAC switchgear rooms are located on the 338 ft. elevation, along with a relay room and RPS and ESF relay cabinets. The control room is located one level up, on the 355 ft. elevation. The control building ventilation system is located on the top level (380 ft. elevation).

The diesel generator building (DGB) is adjacent to the north side of the IB. Access to this building is from the yard. Each diesel generator is located in a separate room. The long-term diesel fuel supply is in an underground tank to the north of the DGB.

The main turbine building is on the east side of the intermediate and control buildings. The main turbine generator, main feed and condensate systems and other balance-of-plant systems are located in this building. Motor control center 1ATPCC is located on the 322 ft. elevation of this building.

A service building is located on the north side of the main turbine and intermediate buildings. There are no systems of interest in this building.

A river water screen and pump house is located on the Susquehanna River, to the west of the main plant buildings. This screenhouse contains river water system pumps, valves and associated 480 VAC busses and MCCs.

There are two condensate storage tanks (CSTs) located in the yard area. CST A and its valve box (VVBOXA) are located on the northeast side of the site, while CST B and VVBOXB are on the northwest side. The borated water storage tank (BWST), which supplies the ECCS and containment spray system is located directly west of the containment.

Cooling towers (not shown in Figure 4-1) are located outside the protected area, to the northeast of the main plant buildings.

4.2 FACILITY LAYOUT DRAWINGS

Figures 4-2 through 4-11 are simplified building layout drawings for the Three Mile Island 1 containment, auxiliary building and intake structure. Many of the outlying buildings 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.

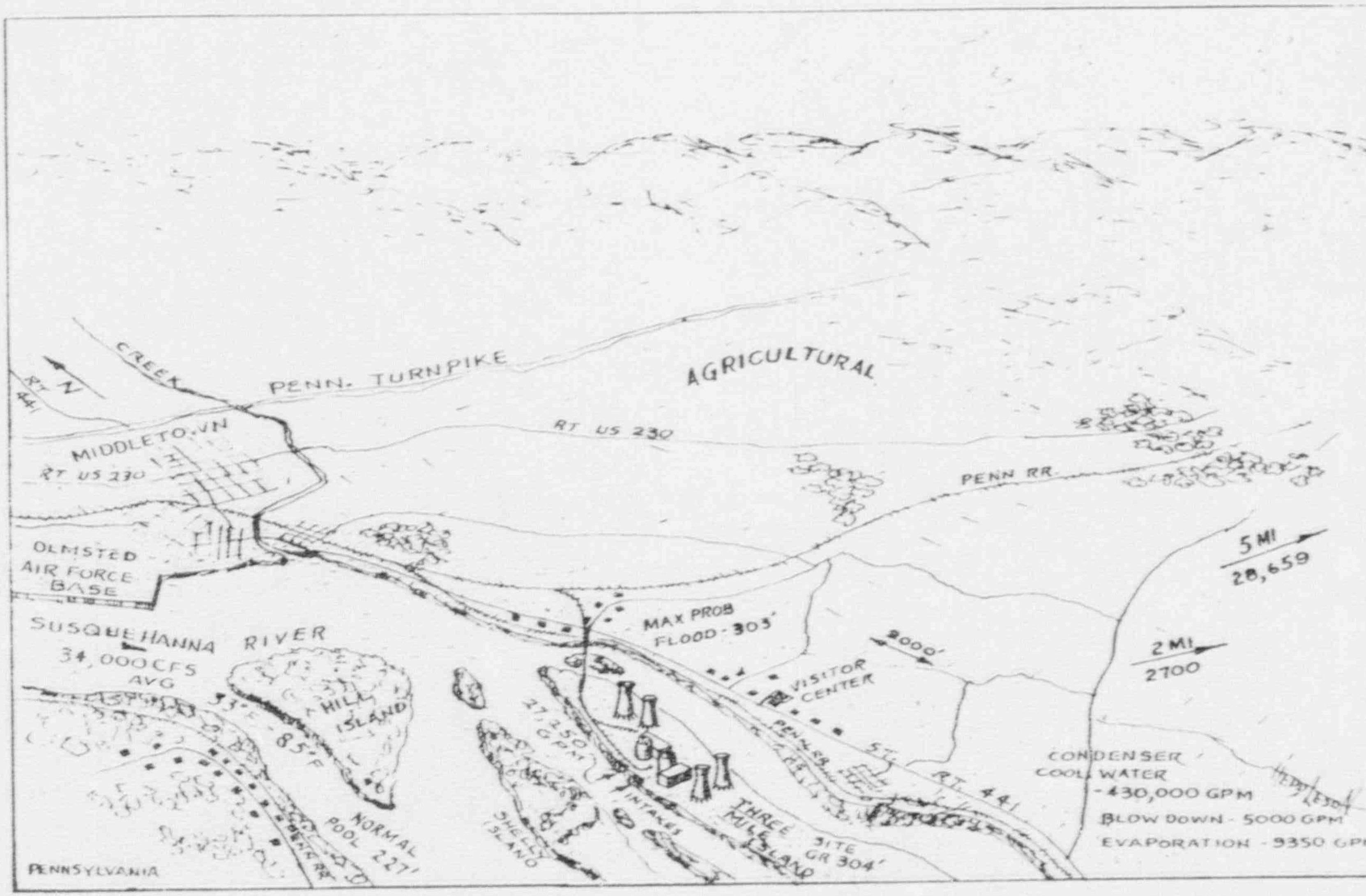


Figure 4-1. General View of the Three Mile Island Site and Vicinity

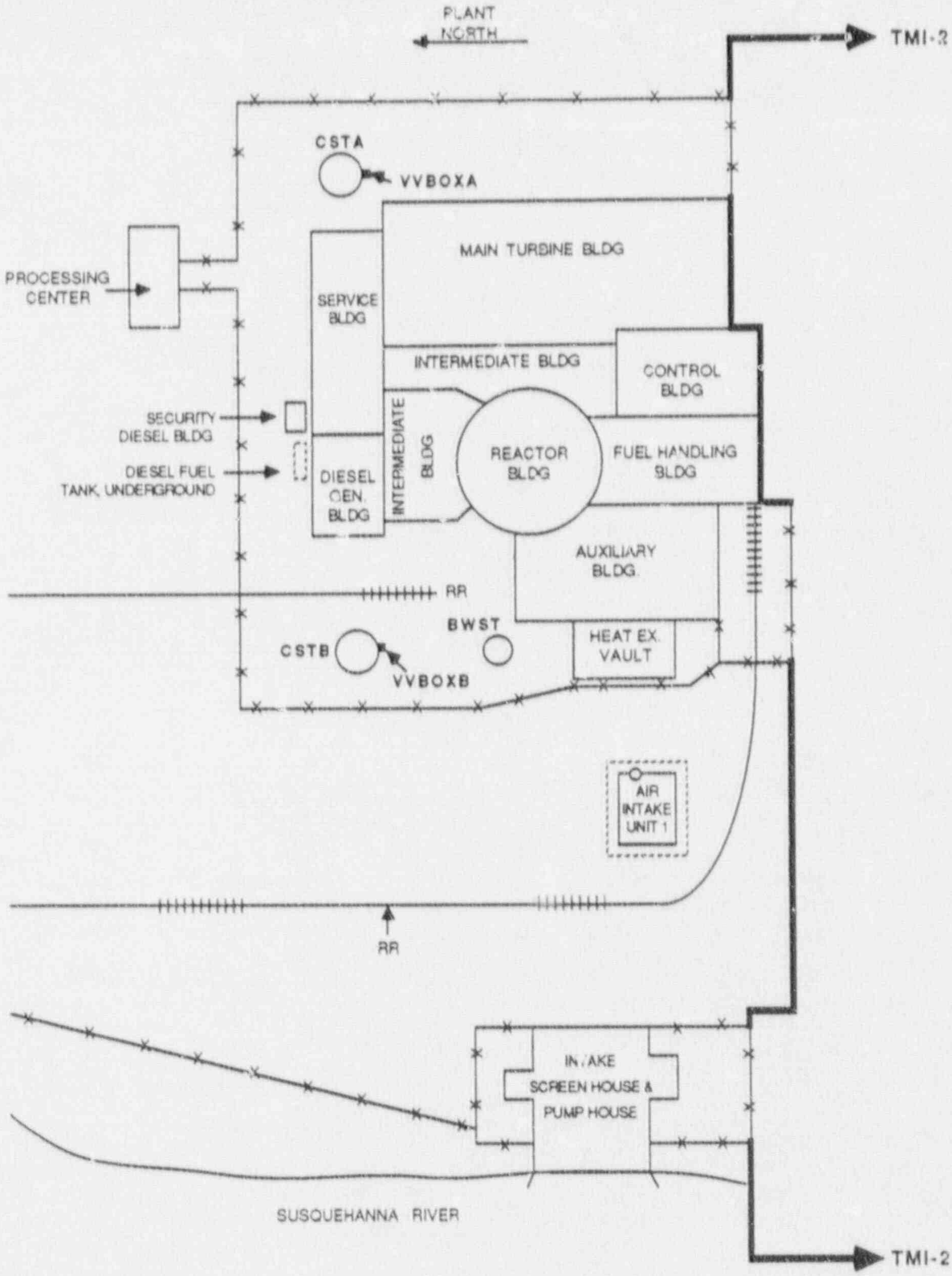


Figure 4-2. Three Mile Island 1 Plot Plan

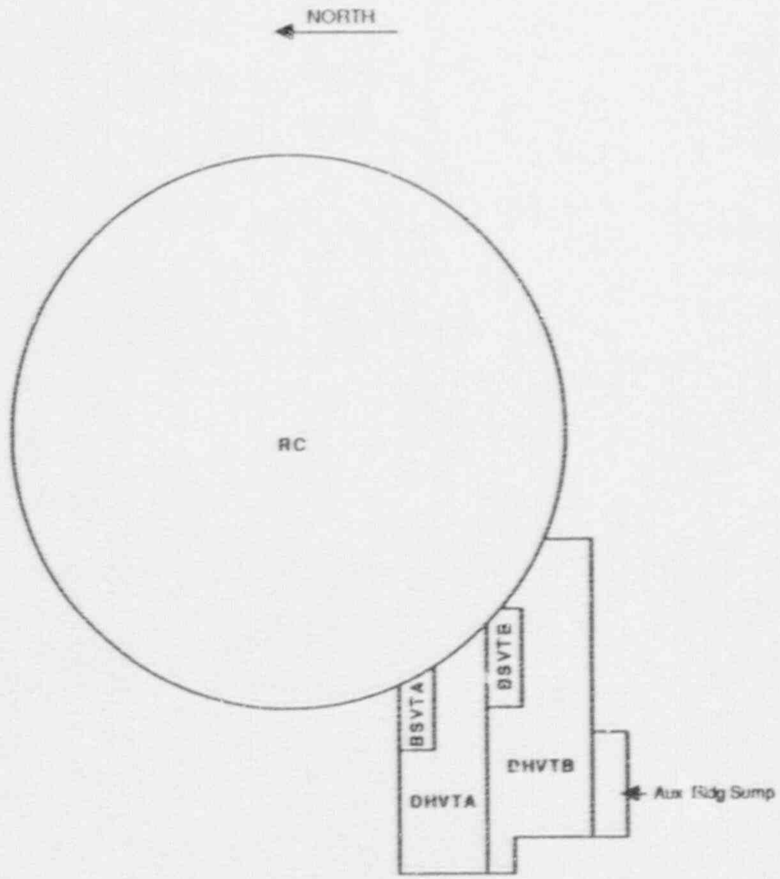


Figure 4-3. Three Mile Island 1 Station Arrangement, Elevation 261 Ft.

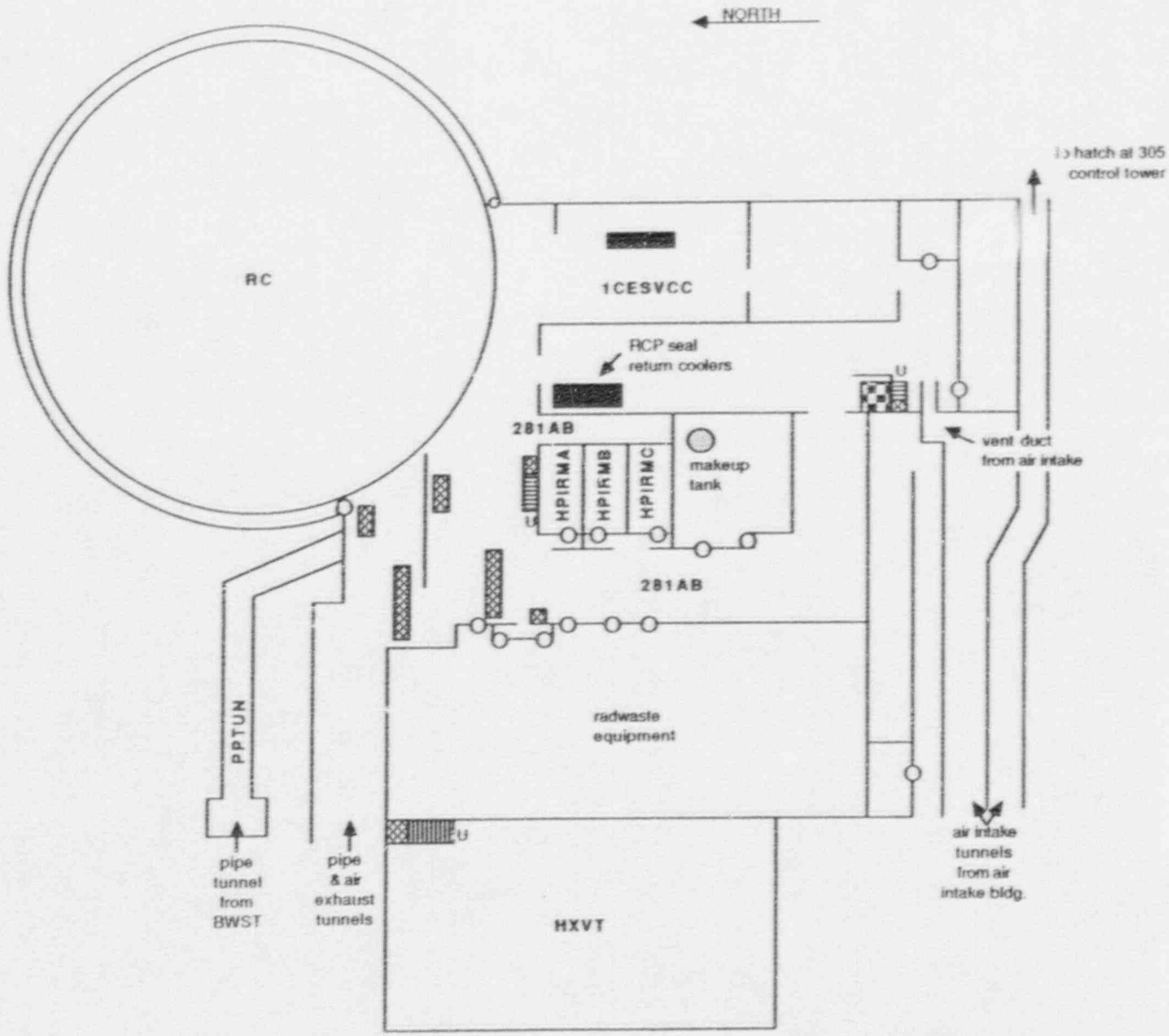


Figure 4-4. Three Mile Island 1 Station Arrangement, Elevation 281 Ft.

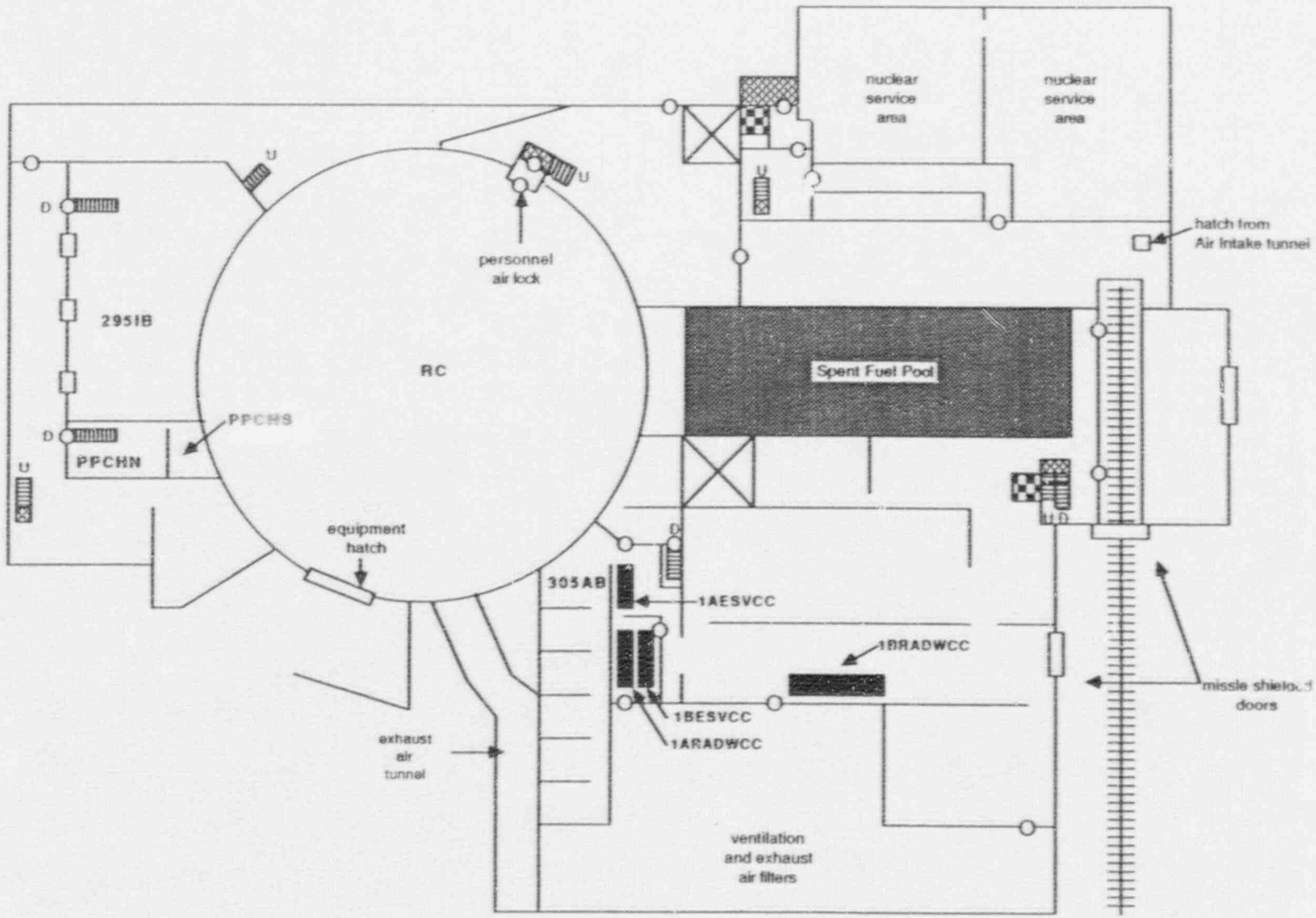


Figure 4-5. Three Mile Island 1 Station Arrangement, Elevations 295 to 305 Ft

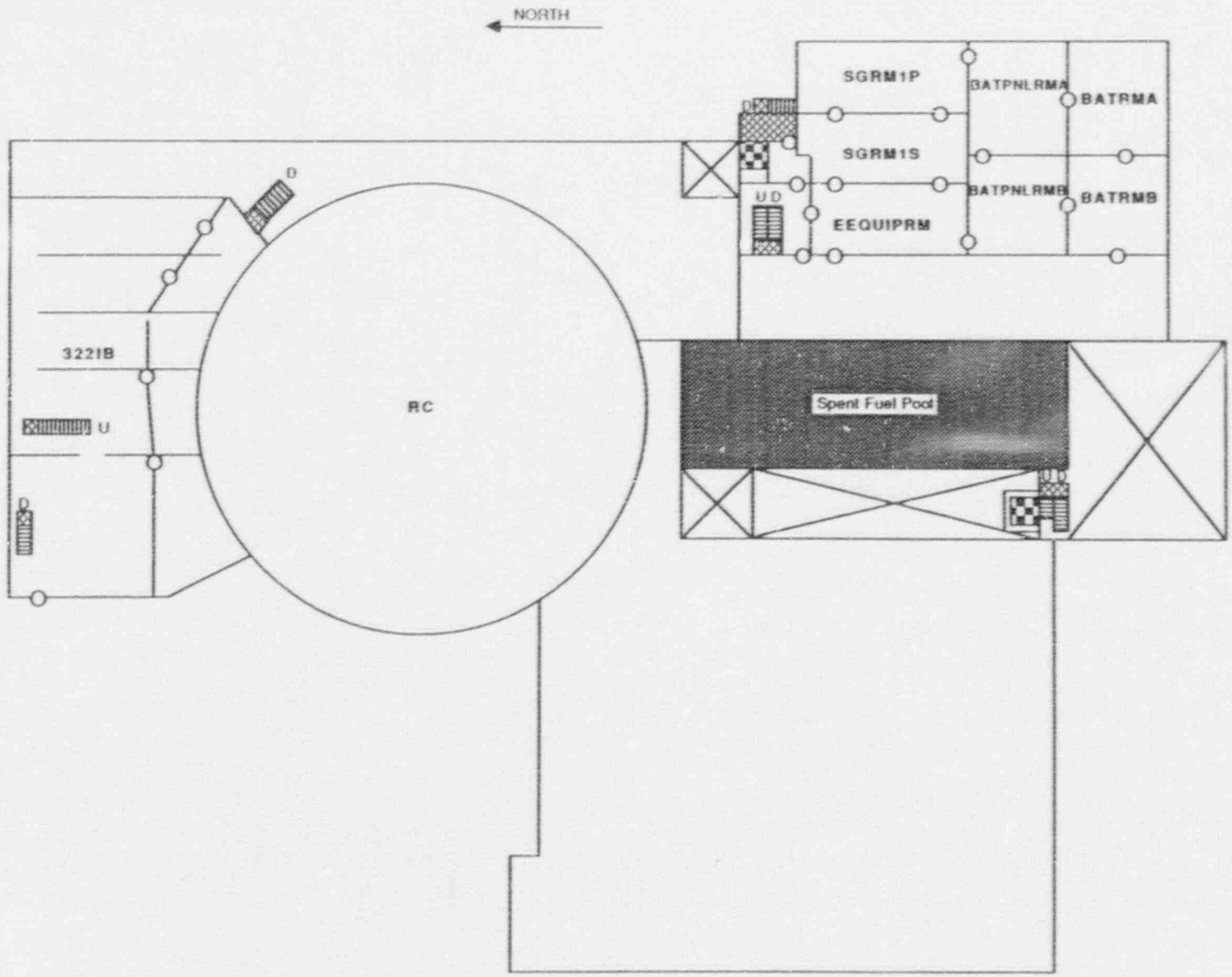


Figure 4-6. Three Mile Island 1 Station Arrangement, Elevation 322 Ft.

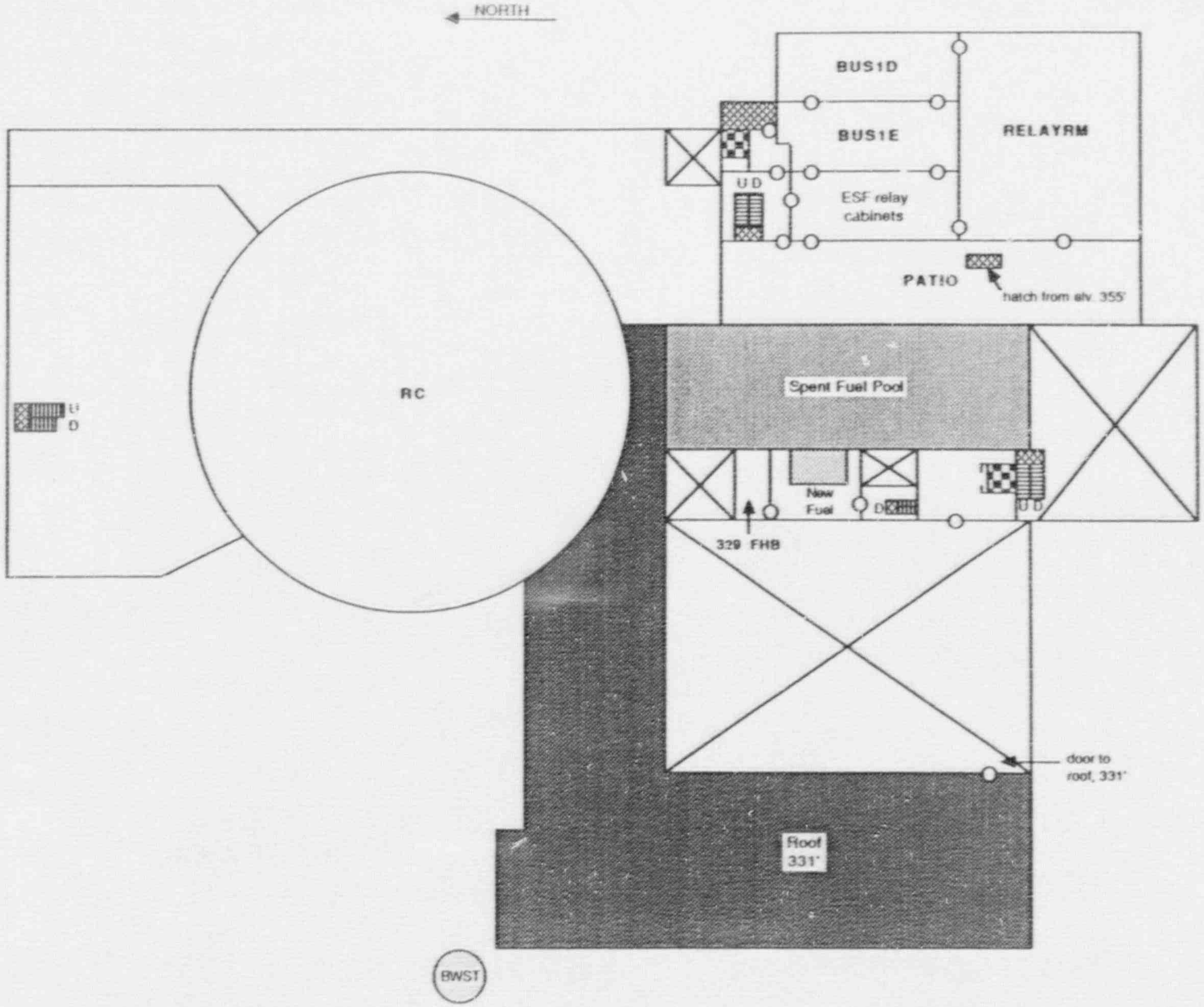


Figure 4-7. Three Mile Island 1 Station Arrangement, Elevation 338 Ft.

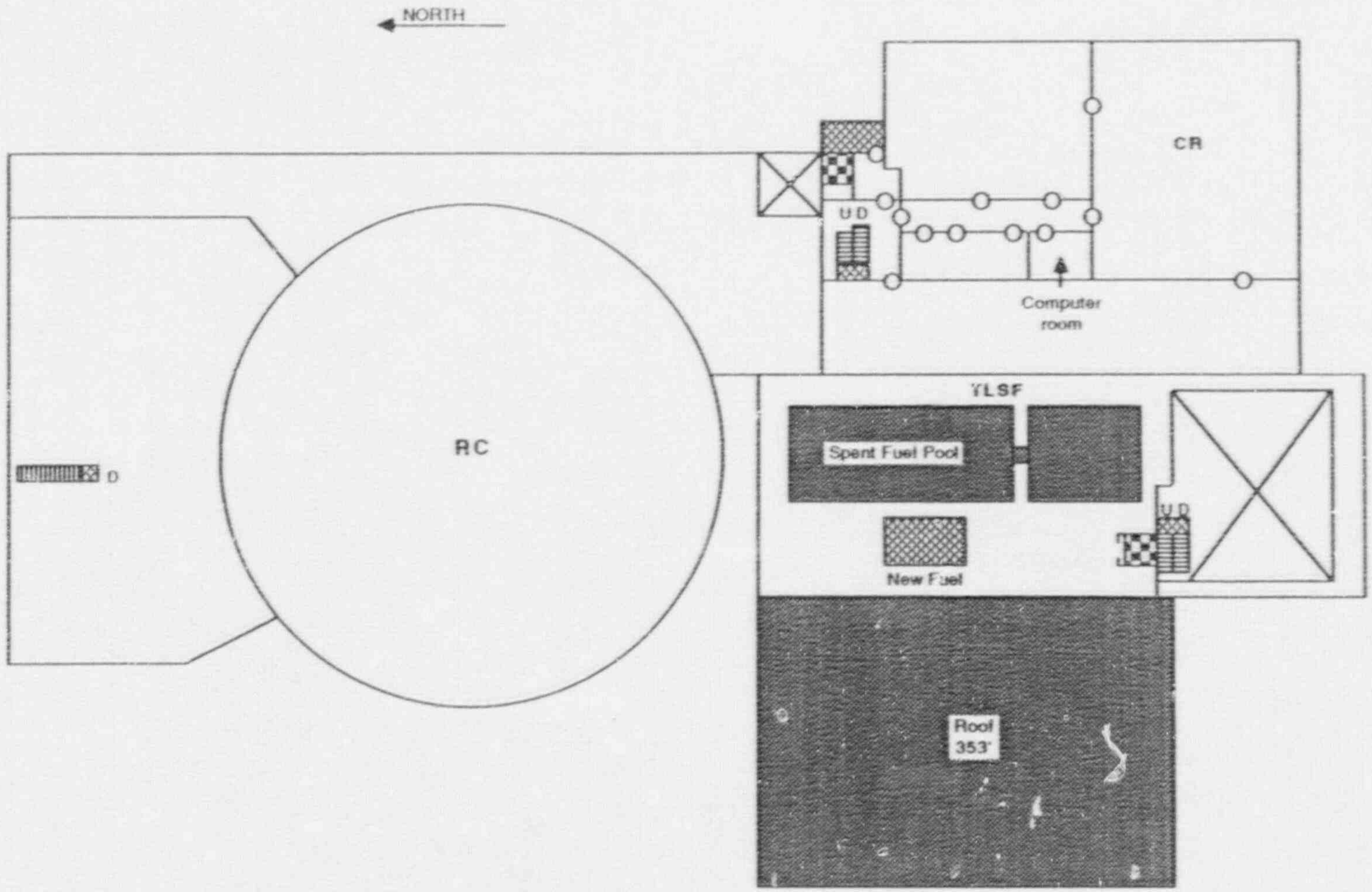


Figure 4-8. Three Mile Island 1 Station Arrangement, Elevation 355 Ft.

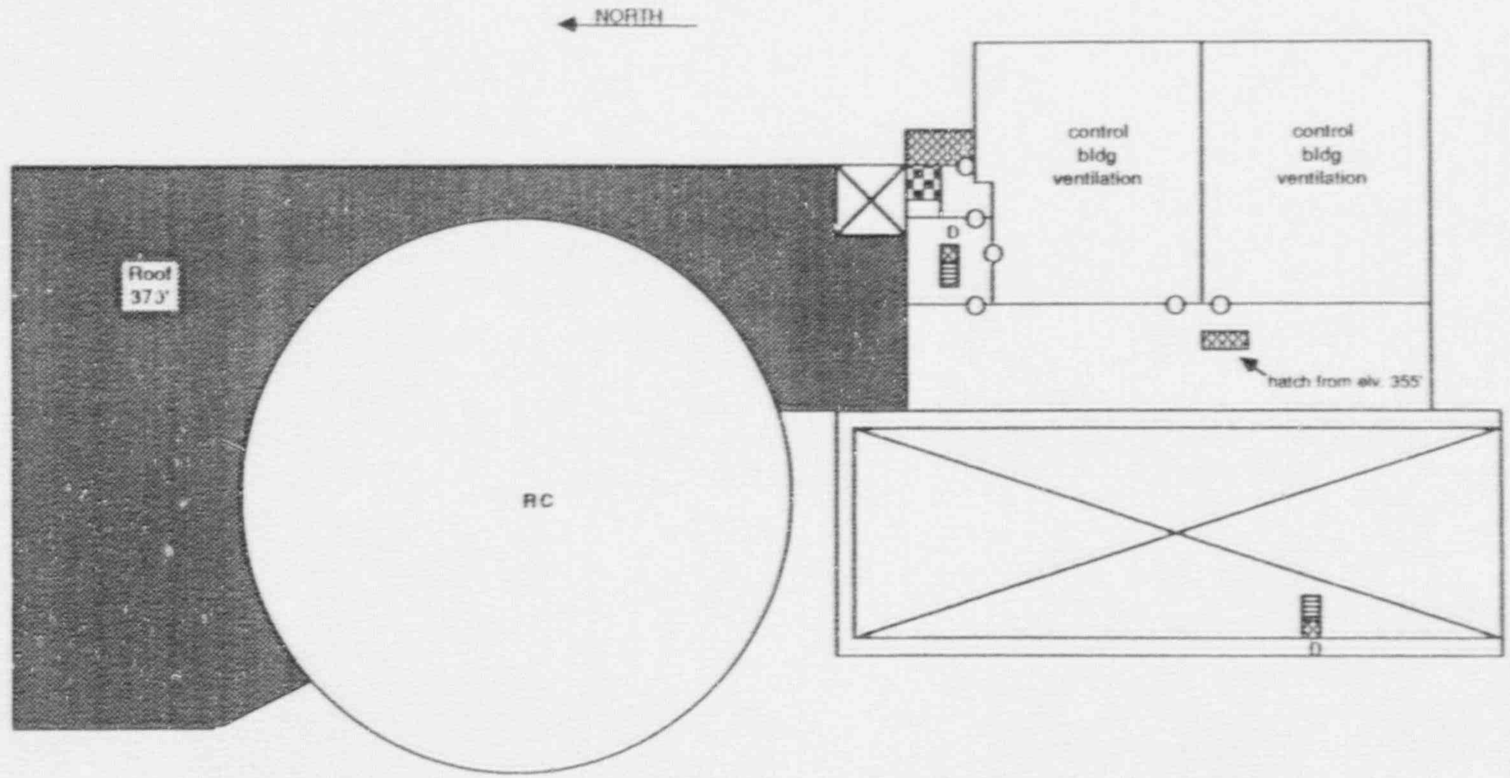


Figure 4-9. Three Mile Island 1 Station Arrangement, Elevation 380 Ft.

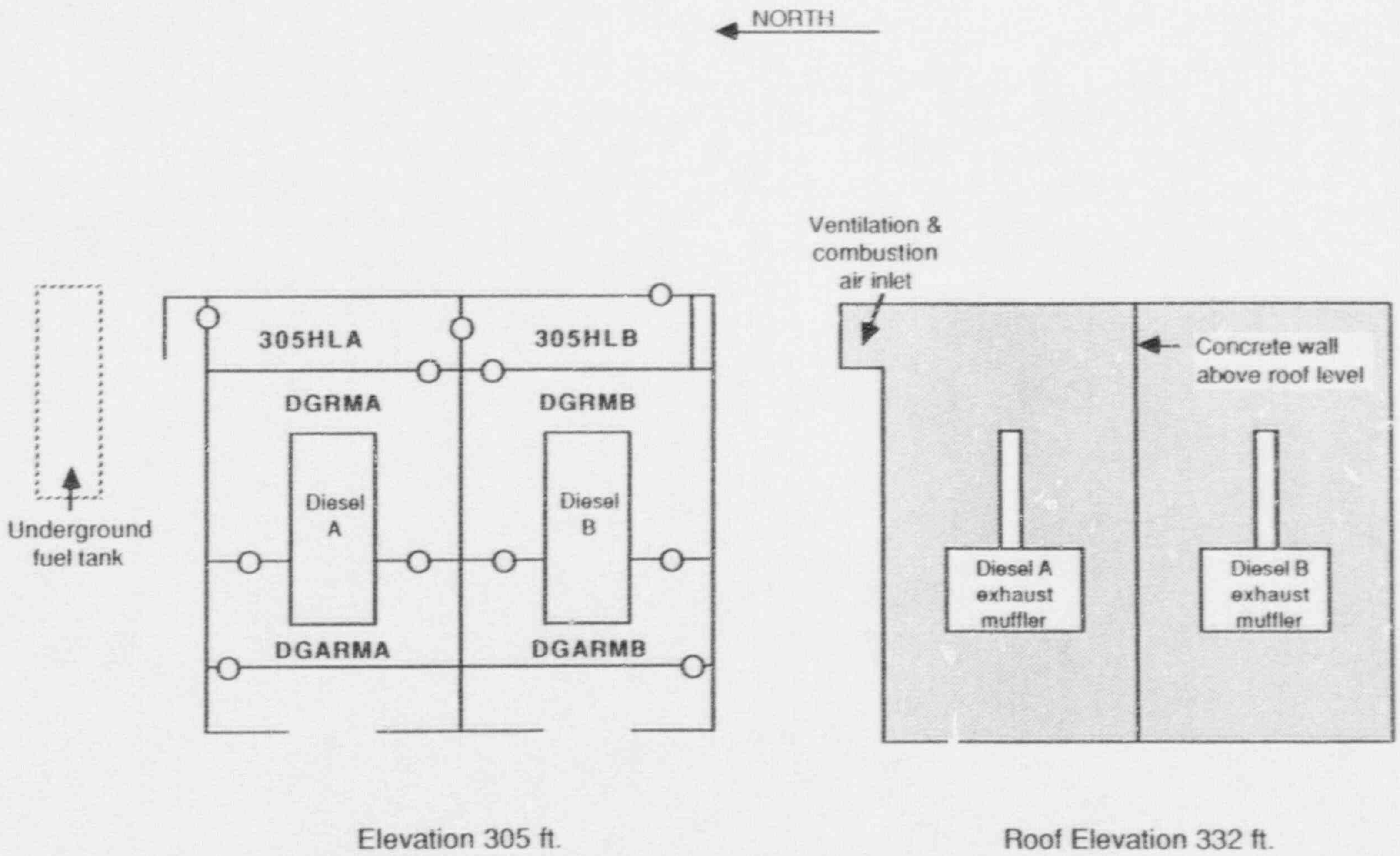


Figure 4-10. Three Mile Island 1 Diesel Generator Building Arrangement, Elevation 305 Ft. and Roof

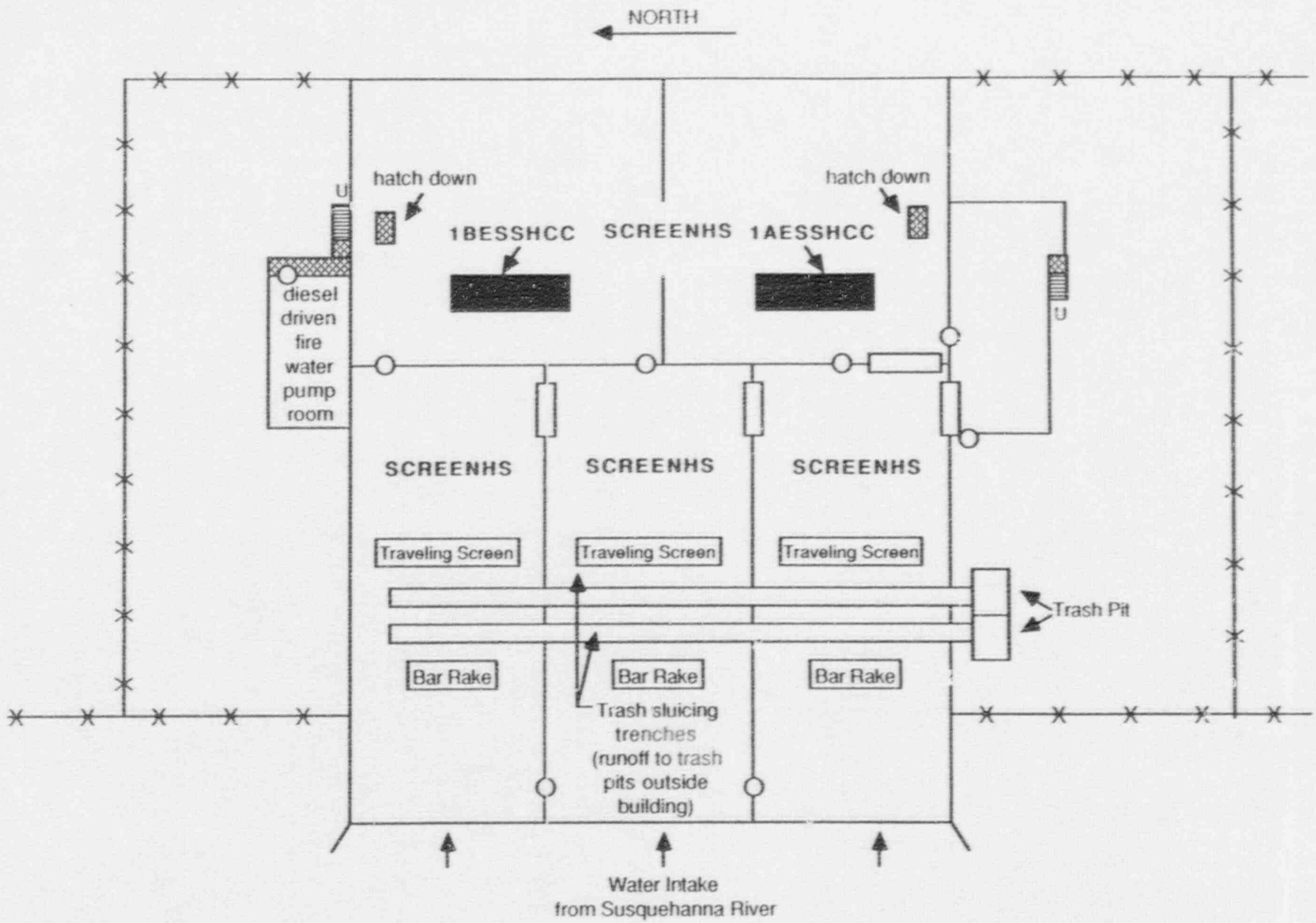


Figure 4-11. Three Mile Island River Water Screenhouse Arrangement

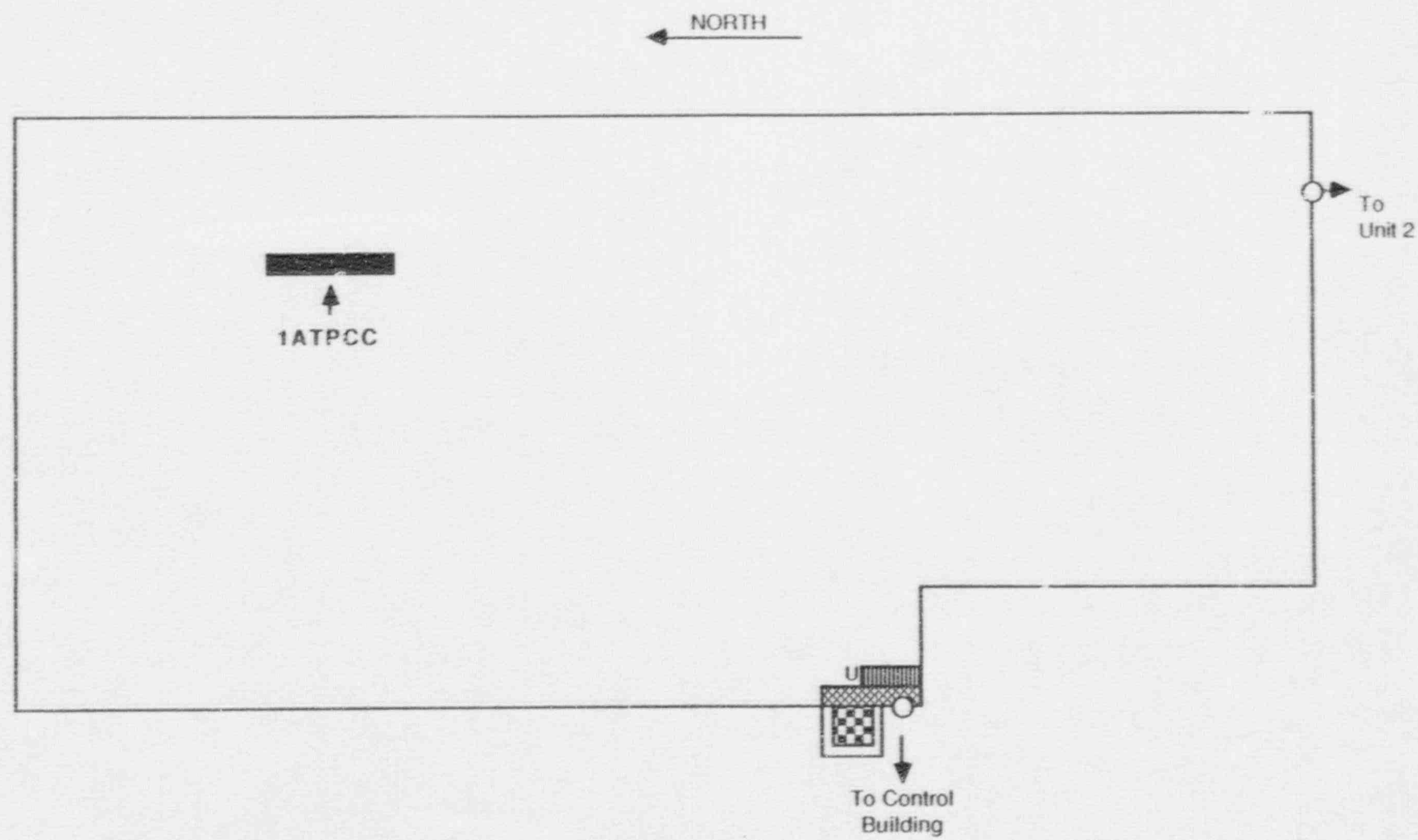


Figure 4-12. Three Mile Island Main Turbine Building Arrangement, Elevation 322 Ft.

Table 4-1. Definition of Three Mile Island 1 Building and Location Codes

	Codes	Descriptions
1.	1AESVCC	480V Motor Control Center 1AESVCC, located on the 305' elevation of the Auxiliary Building (in 305AB)
2.	1ARADWCC	480V Radwaste Motor Control Center 1A, located on the 305' elevation of the Auxiliary Building (in 305AB)
3.	1ATPCC	480V Motor Control Center 1ATP, located on the Mezzanine Floor of the Turbine Building
4.	1BESVCC	480V Motor Control Center 1BESVCC, located on the 305' elevation of the Auxiliary Building (in 305AB)
5.	1BRADWCC	480V Radwaste Motor Control Center 1B, located on the 305' elevation of the Auxiliary Building (in 305AB)
6.	1CESVCC	480V Motor Control Center 1CESVCC, located on the 281' elevation of the Auxiliary Building
7.	295IB	295' elevation of the Intermediate Building
8.	305AB	305' elevation of the Auxiliary Building, Houses 480V MCCS 1AESVCC, 1ARADWCC, 1BESVCC, AND 1BRADWCC
9.	305HLA	Area of the east end of the Diesel Generator Room A - 305' elevation of the Diesel Generator Building
10.	305HLB	Area of the east end of the Diesel Generator Room B - 305' elevation of the Diesel Generator Building
11.	322IB	322' elevation of the Intermediate Building
12.	329FHB	329' elevation of the Fuel Handling Building
13.	BATPNLRMA	Battery Panel Room A, located on the 322' elevation of the Control Tower
14.	BATPNLRMB	Battery Panel Room B, located on the 322' elevation of the Control Tower
15.	BATRMA	Battery Room A, located on the 322' elevation of the Control Room Tower - southeast corner
16.	BATRMB	Battery Room B, located on the 322' elevation of the Control Room Tower
17.	BSVTA	Building Spray Pump Vault A, located on the 261' elevation of the Auxiliary Building

Table 4-1. Definition of Three Mile Island 1 Building and Location Codes (Continued)

Codes	Descriptions
18. BSVTB	Building Spray Pump Vault B, located on the 261' elevation of the Auxiliary Building
19. BUS1D	4160V 1D Switchgear, located on the 338' elevation of the Control Tower
20. BUS1E	4160V 1E Switchgear, located on the 338' elevation of the Control Tower
21. BWST	Borated Water Storage Tank, located on the west side of the Reactor - outside in Yard Area
22. CR	Control Room, located on the elevation 355' elevation of the Control Tower
23. CSTA	Condensate Storage Tank A, located outside in Yard, east of the Service Building
24. CSTB	Condensate Storage Tank B, located outside in Yard, west of the Diesel Generator Building
25. DGARMA	Diesel Generator Auxiliary Room A, located on the 305' elevation of the Diesel Generator Building - west end
26. DGARMB	Diesel Generator Auxiliary Room B, located on the 305' elevation of the Diesel Generator Building - west end
27. DGRMA	Diesel Generator Room A, located on the 305' elevation of the Diesel Generator Building
28. DGRMB	Diesel Generator Room B, located on the 305' elevation of the Diesel Generator Building
29. DHVTA	Decay Heat Vault A, located on the 261' elevation of the Auxiliary Building
30. DHVTB	Decay Heat Vault B, located on the 261' elevation of the Auxiliary Building
31. EEQUIPRM	Electrical Equipment Room located on the 322' elevation of the Control Tower
32. HPIRMA	High Pressure Injection Pump Room A, located on the 281' elevation of the Auxiliary Building
33. HPIRMB	High Pressure Injection Pump Room ROOM B, located on the 281' elevation of the Auxiliary Building

Table 4-1. Definition of Three Mile Island 1 Building and Location Codes (Continued)

Codes		Descriptions
34.	HPIRMC	High Pressure Injection Pump Room C, located on the 281' elevation of the Auxiliary Building
35.	HXVT	Heat Exchanger Vault, located on the 271' elevation of the Auxiliary Building
36.	PATIO	Patio Area, located Just outside and west of the Relay Room - 338' elevation of the Control Tower
37.	PPCHN	North Pipe Chase, located on the 295' elevation of the Intermediate Building
38.	PPCHS	South Pipe Chase, located on the 295' elevation of the Intermediate Building
39.	PPTUN	Pipe Tunnel, located on the 287' elevation of the Reactor - west side
40.	RC	Reactor Containment
41.	RELAYRM	Relay Room, located on the 338' elevation of the Control Tower
42.	SCREENHS	Screen House, Intake Structure, Screen and Pump House, containing 480V BUS 1R, and 1T, and MCC 1AESSHCC, and 1BESSHCC
43.	SGRM1P	480V Switchgear Room 1P, located on the 322' elevation of the Control Tower - includes MCC 1AESCC
44.	SGRM1S	480V Switchgear Room 1S, located on the 322' elevation of the Control Tower - includes MCC 1BESCC
45.	TLSF	Spent Fuel Operating Floor
46.	VVBOXA	Valve Box A, located adjacent to CST A, east of the Service Building
47.	VVBOXB	Valve Box B, located adjacent to CST B, west of the Diesel Generator Building

Table 4-2. Partial Listing of Components by Location at Three Mile Island 1

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
1AESVCC	EP	1AESVCC	MCC
1ARADWCC	EP	1ARADWCC	MCC
1ATPCC	EP	1ATPCC	MCC
1BESVCC	EP	1BESVCC	MCC
1BRADWCC	EP	1BRADWCC	MCC
1CESVCC	EP	1CESVCC	MCC
281AB	ECCS	MU-V16A	MOV
281AB	ECCS	MU-V16B	MOV
281AB	ECCS	MU-V14A	MOV
281AB	ECCS	DH-V19B	XV
281AB	ECCS	DH-V4B	MOV
281AB	ECCS	DH-V19A	XV
281AB	ECCS	DH-V4A	MOV
281AB	ECCS	MU-V14B	MOV
281AB	ECCS	DH-V4B	MOV
281AB	ECCS	DH-V5B	MOV
281AB	ECCS	DH-V19A	XV
281AB	ECCS	DH-V5A	MOV
281AB	PAHR	BS-V1B	MOV
281AB	PAHR	DH-V5B	MOV
281AB	PAHR	DH-V5A	MOV
281AB	PAHR	BS-V1A	MOV
281AB	RCS	DH-V3	MOV
281AB	ECCS	DH-V4A	MOV
295IB	AFW	EF-V1B	MOV
295IB	AFW	EF-V1A	MOV
295IB	AFW	EF-P2A	MDP
295IB	AFW	EF-P2B	MDP
295IB	AFW	EF-V2B	MOV
295IB	AFW	EF-P1	TDP

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
295IB	AFW	MS-V2B	MOV
295IB	AFW	MS-V10B	MOV
295IB	AFW	EF-V2A	MOV
295IB	AFW	MS-V2A	MOV
295IB	AFW	MS-V10A	MOV
295IB	RW	EF-V5	MOV
295IB	RW	EF-V4	MOV
305AB	CCW	DC-P1A	MDP
305AB	CCW	DC-P1B	MDP
305AB	CCW	NS-P1A	MDP
305AB	CCW	NS-P1B	MDP
305AB	CCW	NS-P1C	MDP
305AB	ECCS	MU-V16C	MOV
305AB	ECCS	MU-V16D	MOV
305HLA	EP	DC-PNL-1P	BUS
305HLB	EP	DC-PNL-1Q	BUS
329FHB	CCW	DC-T1A	TANK
329FHB	CCW	DC-T1B	TANK
329FHB	CCW	DC-V19A	NV
329FHB	CCW	DC-V20A	XV
329FHB	CCW	DC-V21A	XV
329FHB	CCW	DC-V19B	NV
329FHB	CCW	DC-V20B	XV
329FHB	CCW	DC-V21B	XV
BATPNLRMA	EP	DC-PNL-1A	BUS
BATPNLRMA	EP	DC-PNL-1C	BUS
BATPNLRMA	EP	DC-PNL-1H	BUS
BATPNLRMA	EP	DC-PNL-1E	BUS
BATPNLRMA	EP	DC-PNL-DCA	BUS
BATPNLRMA	EP	INVERTER-1A	INV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
BATPNLRMA	EP	AC-PNL-VBA	BUS
BATPNLRMA	EP	AC-PNL-VBC	BUS
BATPNLRMA	EP	INVERTER-1C	INV
BATPNLRMB	EP	DC-PNL-1B	BUS
BATPNLRMB	EP	DC-PNL-1D	BUS
BATPNLRMB	EP	DC-PNL-1J	BUS
BATPNLRMB	EP	DC-PNL-1F	BUS
BATPNLRMB	EP	DC-PNL-DCB	BUS
BATPNLRMB	EP	INVERTER-1B	INV
BATPNLRMB	EP	AC-PNL-VBB	BUS
BATPNLRMB	EP	INVERTER-1D	INV
BATPNLRMB	EP	AC-PNL-VBD	BUS
BATRMA	EP	BATT-1A	BATT
BATRMB	EP	BATT-1B	BATT
BSVTA	PAHR	BS-P1A	MDP
BSVTA	PAHR	BS-V41A	XV
BSVTB	PAHR	BS-P1B	MDP
BSVTB	PAHR	BS-V41B	XV
BSWT	ECCS	BWST	TANK
BUS1D	EP	BUS-1D	BUS
BUS1D	EP	EP-CB1D	CB
BUS1E	EP	BUS-1E	BUS
BUS1E	EP	EP-CB1E	CB
BWST	ECCS	BWST	TANK
BWST	ECCS	BWST	TANK
BWST	ECCS	BWST	TANK
BWST	PAHR	BWST	TANK
BWST	PAHR	BWST	TANK
CSTA	AFW	CSTA	TANK
CSTB	AFW	CSTB	TANK

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
DGRMA	EP	EP-DG1A	DG
DGRMB	EP	EP-DG1B	DG
DHVTA	CCW	DC-V2A	NV
DHVTA	CCW	DC-V35A	NV
DHVTA	ECCS	DH-HX1A	HX
DHVTA	ECCS	DH-P1A	MDP
DHVTA	ECCS	DH-V6A	MOV
DHVTA	ECCS	DH-P1A	MDP
DHVTA	ECCS	DH-V15A	XV
DHVTA	PAHR	BS-V3A	MOV
DHVTA	PAHR	DH-V6A	MOV
DHVTB	CCW	DC-V2B	NV
DHVTB	CCW	DC-V65B	NV
DHVTB	ECCS	DH-HX1B	HX
DHVTB	ECCS	DH-P1B	MDP
DHVTB	ECCS	DH-V6B	MOV
DHVTB	ECCS	DH-P1B	MDP
DHVTB	ECCS	DH-V15B	XV
DHVTB	PAHR	BS-V3B	MOV
DHVTB	PAHR	DH-V6B	MOV
EEQUIPRM	EP	DC-ATS-1M	ATS
EEQUIPRM	EP	DC-PNL-1M	BUS
EEQUIPRM	EP	ATS-1CESVCC	ATS
HPIRMA	ECCS	MU-P1A	MDP
HPIRMB	ECCS	MU-P1B	MDP
HPIRMC	ECCS	MU-P1C	MDP
HXVT	CCW	DC-HXA	HX
HXVT	CCW	NS-HX1A	HX
HXVT	CCW	DC-HXB	HX
HXVT	CCW	NS-HX1B	HX

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
HXVT	CCW	NS-HX1C	HX
HXVT	CCW	NS-HX1D	HX
HXVT	RW	NR-V5	MOV
HXVT	RW	NR-V6	MOV
HXVT	RW	NR-V8A	MOV
HXVT	RW	NR-V8B	MOV
HXVT	RW	NR-V8C	MOV
HXVT	RW	NR-V16A	MOV
HXVT	RW	NR-V16B	MOV
HXVT	RW	NR-V16C	MOV
HXVT	RW	NR-V16D	MOV
HXVT	RW	NR-V18	MOV
HXVT	RW	NR-V19	MOV
PPCHN	RW	RR-V4A	MOV
PPCHN	RW	RR-V3A	MOV
PPCHN	RW	RR-V4C	MOV
PPCHN	RW	RR-V3C	MOV
PPCHN	RW	RR-V4B	MOV
PPCHN	RW	RR-V3B	MOV
RC	AFW	SG-A	SG
RC	AFW	SG-B	SG
RC	ECCS	CFS-T1A	TANK
RC	ECCS	CFS-V1A	MOV
RC	ECCS	CFS-V1B	MOV
RC	ECCS	CFS-T1B	TANK
RC	PAHR	SUMP	TANK
RC	PAHR	FCU-A	FCU
RC	PAHR	FCU-B	FCU
RC	PAHR	FCU-C	FCU
RC	PAHR	RX BLDG	BLDG

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	PAHR	SUMP	TANK
RC	PAHR	RX BLDG	BLDG
RC	RCS	DH-V1	MOV
RC	RCS	DH-V2	MOV
RC	RCS	RCS-RV2	RV
RC	RCS	MU-V2A	MOV
RC	RCS	MU-V1A	MOV
RC	RCS	MU-V2B	MOV
RC	RCS	MU-V1B	MOV
RC	RCS	RC-V2	MOV
SCREENHS	EP	BUS-1T	BUS
SCREENHS	EP	EP-TRAN-1	TRAN
SCREENHS	EP	BUS-1R	BUS
SCREENHS	EP	EP-TRAN-R	TRAN
SCREENHS	EP	1AESSHCC	MCC
SCREENHS	EP	1BESSHCC	MCC
SCREENHS	RW	DR-P1A	MDP
SCREENHS	RW	DR-P1B	MDP
SCREENHS	RW	DR-V1A	MOV
SCREENHS	RW	DR-V1B	MOV
SCREENHS	RW	RR-P1A	MDP
SCREENHS	RW	RR-P1B	MDP
SCREENHS	RW	RR-V1A	MOV
SCREENHS	RW	RR-V1B	MOV
SCREENHS	RW	NR-P1A	MDP
SCREENHS	RW	NR-P1B	MDP
SCREENHS	RW	NR-P1C	MDP
SCREENHS	RW	NR-V1A	MOV
SCREENHS	RW	NR-V1B	MOV
SCREENHS	RW	NR-V2	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
SCREENHS	RW	NR-V3	MOV
SCREENHS	RW	NR-V7	MOV
SCREENHS	RW	NR-V1C	MOV
SGRM1P	EP	BUS-1P	BUS
SGRM1P	EP	EP-TRAN-P	TRAN
SGRM1P	EP	1AESCC	MCC
SGRM1S	EP	BUS-1S	BUS
SGRM1S	EP	EP-TRAN-S	TRAN
SGRM1S	EP	1BESCC	MCC
TLSF	SF	FUEL BLDG	BLDG
UNKNOWN	EP	BUS-1C	BUS
UNKNOWN	EP	EP-TRAN-C	TRAN
UNKNOWN	EP	BUS-1G	BUS
UNKNOWN	EP	EP-TRAN-G	TRAN
UNKNOWN	EP	BUS-1L	BUS
UNKNOWN	EP	EP-TRAN-L	TRAN
UNKNOWN	EP	BUS-1A-TP	BUS
UNKNOWN	EP	BUS-1B-TP	BUS
UNKNOWN	EP	BUS-1C-TP	BUS
VVBOXA	AFW	CO-V10A	MOV
VVBOXB	AFW	CO-V10B	MOV

5. BIBLIOGRAPHY FOR THREE MILE ISLAND 1

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2. NUREG-0680, "TMI-1 Restart - Evaluation of Licensees Compliance with the Short- and Long Term Items of Section II of the NRC Order Dated August 9, 1979," USNRC, June 1980 with Supplement 1, November 1980; Supplement 2, March 1981; and Supplement 3, April 1981.

3. NUREG-0680, Supplement 4, "TMI-1 Restart - An Evaluation of the RHR, BETA, and Draft INPO Reports as they Affect Restart Issues at Three Mile Island Nuclear Station, Unit 1," USNRC, October 1983.

4. NUREG-0680, Supplement 5, "TMI-1 Restart - An Evaluation of the Licensee's Management Integrity as it Affects Restart of Three Mile Island, Unit 1," USNRC, July 1984.

5. NUREG-0752, "Control Room Design Review Report for TMI-1," USNRC.

6. NUREG-1019, "Safety Evaluation Report Related to Steam Generator Tube Repair and Return to Operation, Three Mile Island Nuclear Station, Unit No. 1," USNRC, November 1983.

7. NUREG-1020, "GPU vs. B&W Lawsuit Review and its Effect on TMI-1," USNRC, June 1984.

8. NUREG/CP-0026, "Workshop on Psychological Stress Associated with the Proposed Restart of Three Mile Island, Unit 1," Mitre Corp., April 1982.

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

10. NUREG/CR-2749, Volume 12, "Socioeconomic Impacts of Nuclear Generating Stations: Three Mile Island Case Study," Social Impact Research, Inc., July 1982.

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)

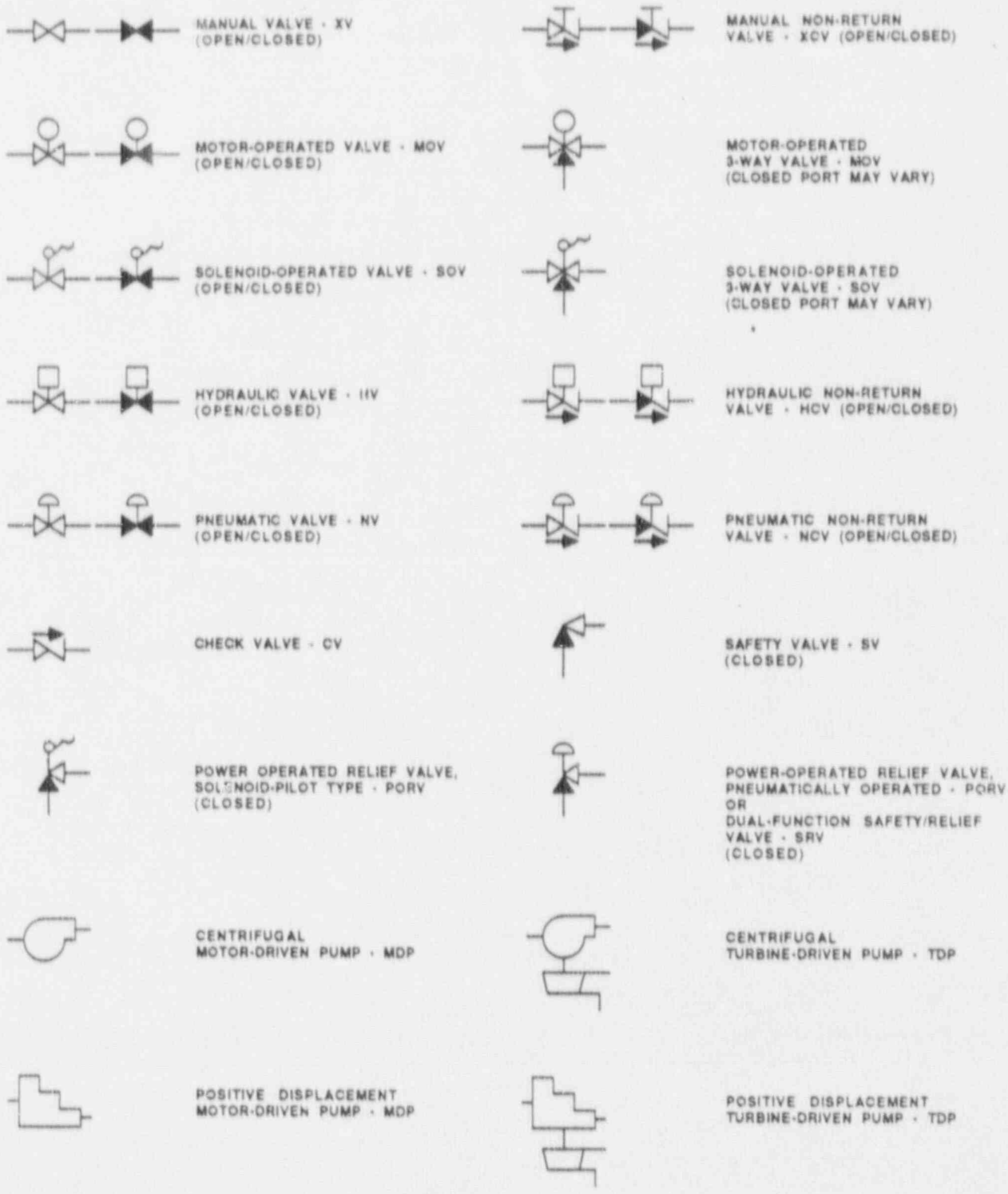
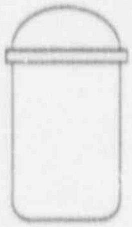
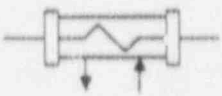


Figure A-1. Key To Symbols In Fluid System Drawings



PWR/BWR
REACTOR VESSEL - RV



HEAT EXCHANGER - HX

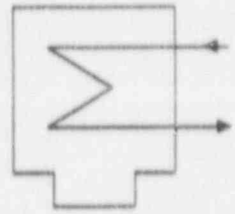
STEAM-TO-WATER
OR WATER-TO-STEAM HEAT
EXCHANGER (I.E. FEEDWATER
HEATER, DRAIN COOLER, ETC.) - HX

 OR 

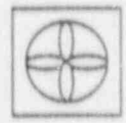
TANK - TK

RUPTURE DISK - RD

ORIFICE - OR



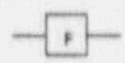
MAIN CONDENSER - COND



MECHANICAL DRAFT
COOLING TOWER

AIR COOLING UNIT - ACU

SPRAY NOZZLES - SN



FILTER - FLT

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

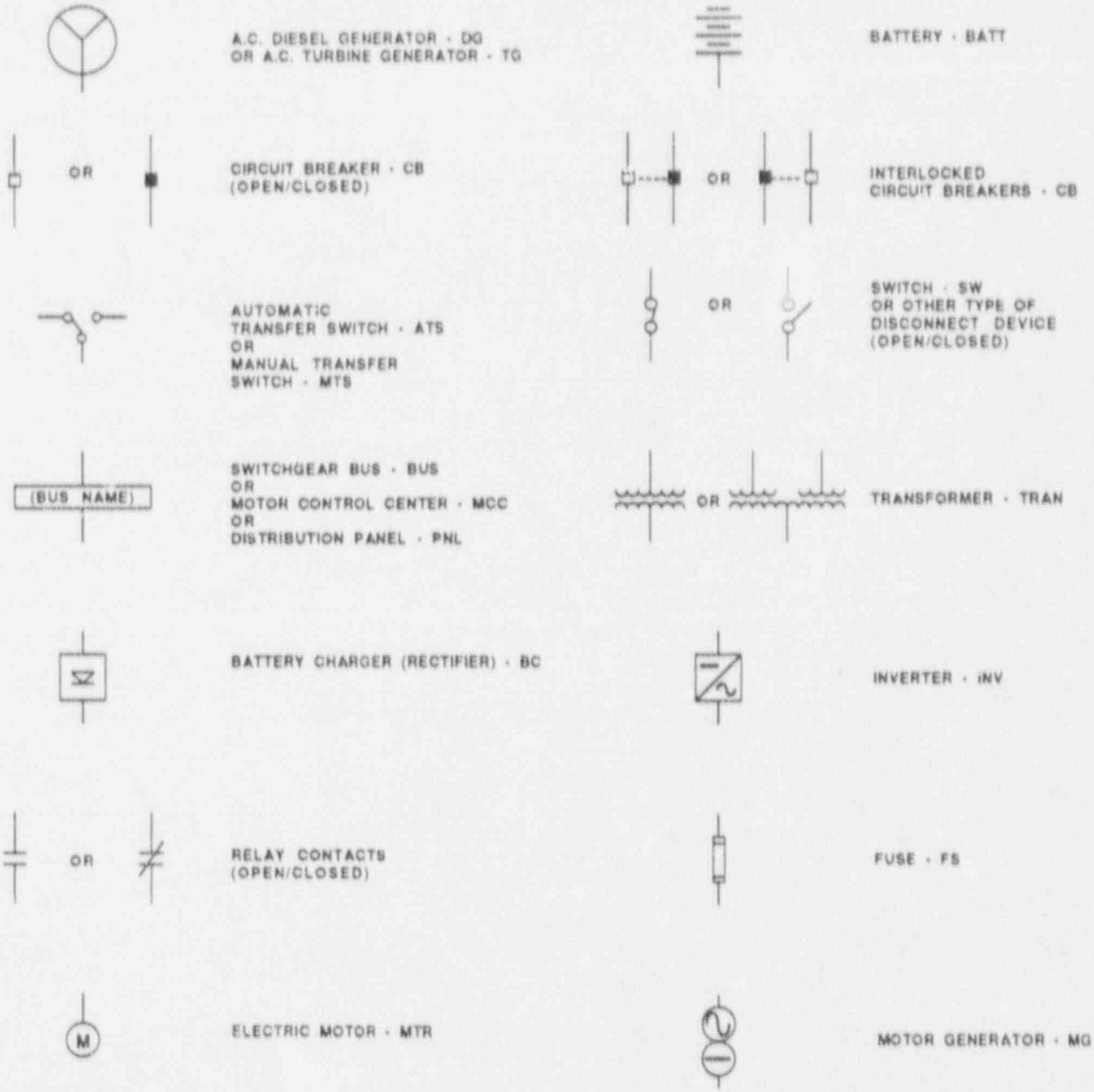


Figure A-2. Key To Symbols In Electrical System Drawings

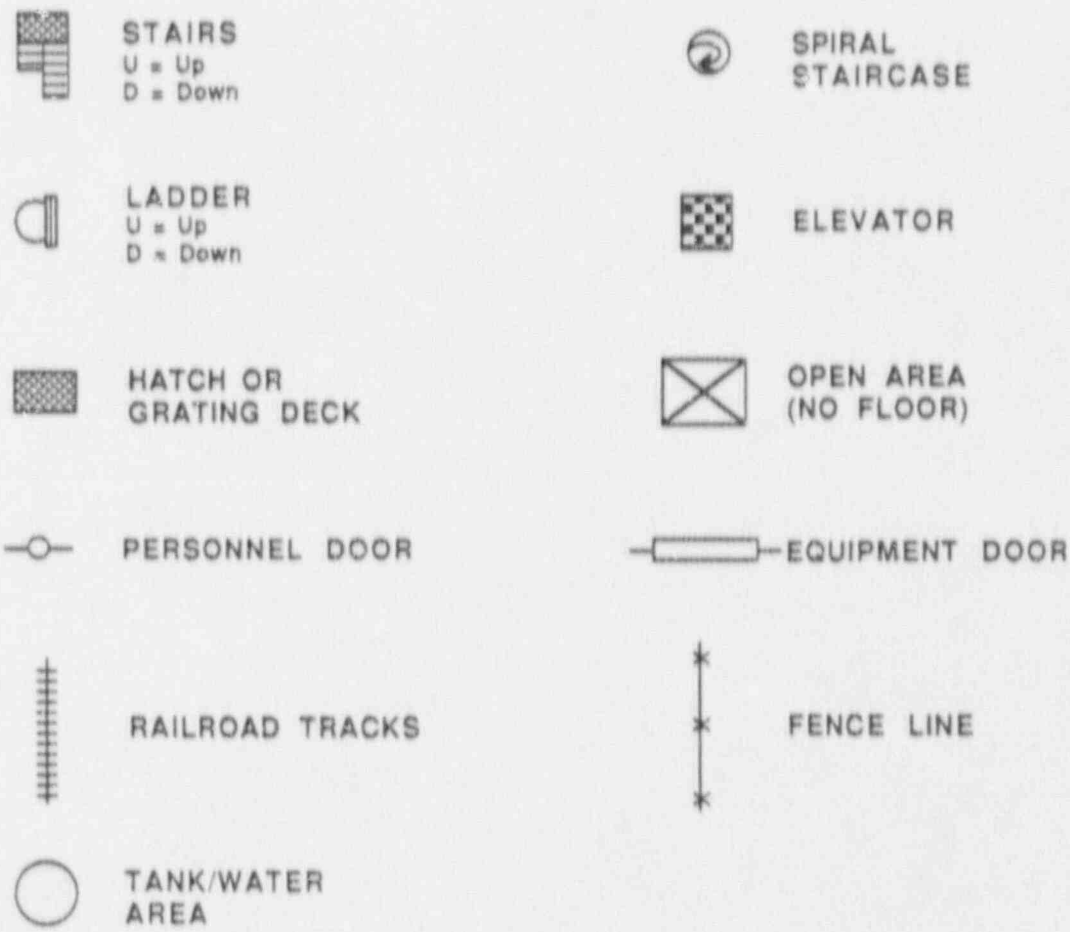


Figure A-3. Key To Symbols In Facility Layout Drawings

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 (Emergency) Feedwater System
ECCS	Emergency Core Cooling System (including HPI and LPI)
PAHR	Containment Cooling Systems (including spray and fan cooler systems)
EP	Electric Power System
CCW	Component Cooling Water Systems (including NSCCS and DHCCS)
RW	River Water System (including ERWS, NSRWS, and DHRWS)

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