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ASEA BROWN BOVERI

August 10, 1992
LD-92-089

Docket 52-002

Mr. Robert C. Pierson, Director
Standardization Project Directorate
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Revised System 80+™ Pilot ITAAC

References:
1) Letter LD-92-060, C. B. Brinkman (ABB-CE) to NRC, dated April 30, 1992.
2) Letter, R. C. Pierson (NRC) to E. H. Kennedy (ABB-CE), dated May 21, 1992.

Dear Mr. Pierson:

Enclosed are eight (8) draft pilot ITAAC for the System 80+™ Standard Design. These ITAAC are revised versions of those submitted by Reference 1. The revisions respond to NRC comments (Reference 2) on the Reference 1 submittal, account for comments provided by NUMARC, and reflect comments obtained in an industry meeting on July 16, 1992, convened at ABB-CE's request to review the pilot ITAAC. They have been further modified to conform to the comments of legal counsel.

Two of the ITAAC provided by Reference 1 have been removed from the enclosed submittal for the reasons noted below.

1. ITAAC 1.3.2, Design for the Protection of Structures, Components, Equipment and Systems against Dynamic Effects of Pipe Break and Leak before Break, has been removed because it is presently planned to incorporate it into a broader scope Design Acceptance Criterion (DAC) for piping design.

2. ITAAC 1.9.22.9, Station Service Water System (SSWS) Pump Structure, has been removed because it may not be appropriate as an interface ITAAC as originally envisioned. Although the approach to handling interface ITAAC continues to evolve, it presently appears that interface ITAAC may be appropriate only for design-specific requirements that a certified design imposes upon a site. The SSWS Pump Structure does not appear to fall into this category. It is a feature outside the System 80+ scope that may be treated straight forwardly as a COL design matter.

Per Tom Boyce
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Each comment in Reference 2 was evaluated by the cognizant engineering group. Most comments were addressed by revisions to the ITAAC. Some comments, however, could not be incorporated for reasons such as requiring information beyond that available for design certification. For example, the shielding requirements for operators to conduct Safety Injection System (SIS) maintenance during post-LOCA long term cooling would depend, in part, on the number of personnel available and on the time required to perform maintenance. Personnel availability is a utility planning matter, and time requirements depend on the installation and assembly details of specific equipment.

Regarding the level of detail for the SIS, we have added numerical criteria to the SIS design description and ITAAC in response to the NRC staff's comments. The concept of deviation criteria presented in the lead plant ITAAC may, however, augment or modify the use of Tier 1 numerical criteria. Modifications to the enclosed pilot ITAAC where numerical criteria are presented may be required as the concept of deviation criteria is developed.

We anticipate meeting with the staff to obtain concurrence that the revised ITAAC are acceptable in scope, level of detail, and specificity. Prompt NRC feedback on this submittal is key to the quality of the entire System 80+ Tier 1 Design Description and ITAAC package which is presently under preparation. We will contact you in the near future to make the necessary meeting arrangements. In the meantime, please do not hesitate to contact me or Mr. Henry Windsor at (203) 285-9661 should you have any questions on the enclosed ITAAC.

Very truly yours,

COMBUSTION ENGINEERING, INC.

G. L. Hess for

C. B. Brinkman
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gdh/lw

Enclosures: As Stated

cc: T. Boyce (NRC)
A. Heymer (NUMARC)
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1.6.3 ANNULUS VENTILATION SYSTEM

Design Description

The Annulus Ventilation System (AVS) is an engineered safety feature which reduces the concentration of radioactivity in the annulus air by filtration, holdup (decay) and recirculation before the air is released to the atmosphere.

The AVS takes air from above the primary containment dome, filters it and discharges a portion of the air through openings close to the annulus floor and a portion of the air through the unit vent to the atmosphere. Two redundant filtration trains are provided. Each AVS filtration train includes a fan, filter, dampers, ductwork, and control systems. A general conceptual illustration of the AVS is shown in Figure 1.6.3-1 (NOTE 1). Dampers modulate exhaust air to maintain a negative pressure higher than 0.25 inches of water gauge within the annulus. By design, fan flow is limited to less than 18000 CFM.

Each filter train includes a moisture eliminator, prefilter, electric heater, carbon adsorber and HEPA filters; one HEPA filter before and one HEPA filter after the carbon adsorber. The HEPA filters remove 99% or more of airborne particulate matter greater than 0.3 micron size. The carbon adsorbers remove 95% or more of elemental iodine and organic iodine. Failure of the AVS to perform the intended functions can be detected by a unit vent radiation monitor, which monitors the radioactivity level of the AVS effluent and triggers an alarm in the control room.

Electrical and control component separation is maintained between the two AVS trains, although the ducting inside the annulus is shared. All components of the AVS are safety related and of Seismic Category I classification and qualified for the environment for locations where installed.

The AVS is not operated during routine (normal) plant operations. Rather, each AVS train is activated by a containment spray actuation signal. Each AVS train is powered by the Class 1E Auxiliary Power System or the on-site emergency power source (Emergency Diesel Generator). Indications of fan operating status are provided in the control room. High temperature in each adsorber unit and high and low differential pressures across filter units trigger alarms in the control room.

The AVS design permits periodic inspection and testing of fans, filters, dampers, ductwork, and starting controls.

Inspections, Tests, Analyses and Acceptance Criteria

Table 1.6.3-1 provides the inspections, tests and/or analyses and associated acceptance criteria for the AVS.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in [illegible] referencing the certified design.

TABLE 1.6.3-1

ANNULUS VENTILATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The general configuration of the A^'S is shown in Figure 1.6.3-1 (NOTE 1).	1. Inspections of the as-built AVS.	1. Actual AVS configuration, for those components shown, conforms with Figure 1.6.3-1 (NOTE 1).
2. The AVS has the following capabilities:	2. Documented record reviews and tests conducted to verify the capabilities specified in the Table 1.6.3-1 Certified Design Commitment, No. 2, specifically;	2.a) AVS filter efficiencies meet the following requirements: ≥95% for elemental and organic iodine ≥99% for particulate matter greater than 0.3 microns.
a) Filter Efficiencies: ≥95% for elemental and organic iodine ≥99% for particulate matter greater than 0.3 microns	a) Each carbon adsorber stage tested in place for elemental and organic iodine filter efficiencies using a refrigerant tracer gas or equivalent. DOP (Dioctyl phthalate) test or equivalent to measure particulate matter efficiencies for HEPA filters.	
b) Fan Generated Flow: < 18000 CFM	b) Fan generated flow tested in a straight portion of duct either upstream or downstream of the fan.	b) AVS fan generated flow meets the following requirement: < 18,000 CFM

TABLE 1.6.3-1 (Continued)

ANNULUS VENTILATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3. The AVS operates when powered from the Class 1E Auxiliary Power System or the on-site emergency power source (emergency diesel generator).	3. Tests performed to demonstrate operation of the AVS when supplied by the Class 1E Auxiliary Power Source or the onsite emergency power source.	3. The AVS is capable of operating when supplied by either of the electrical power sources.
4. All AVS components are Seismic Category I classification and qualified for the environment for locations where installed.	4. See Generic Equipment Qualification (ITA)	4. See Generic Equipment Qualification (AC)
5. Each AVS train is activated by a Containment Spray Actuation Signal.	5. Tests to verify the actuation of each train upon receiving a simulated Containment Spray Actuation Signal.	5. Each AVS train is activated by a simulated Containment Spray Actuation Signal.
6. The AVS maintains the annulus volume at a negative pressure greater than 0.25 inches of water gauge when the AVS is in operation.	6. Test to measure annulus pressure during AVS operation.	6. During AVS operation, the AVS maintains a negative pressure greater than 0.25 inches of water gauge in the annulus volume.

TABLE 1.6.3-1 (Continued)

ANNULUS VENTILATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. Unit vent radiation monitoring capability of AVS effluents is provided with alarm capability that triggers in the control room.	7. Inspection of the as-built configuration to verify capability. Test to verify alarm activation using simulated actuation signal.	7. Radiation monitoring of the AVS effluent paths to the environment is provided at the Unit Vent. High radiation alarms trigger in the control room in response to a simulated activation signal.
8. Instrumentation indications and alarms are provided in the control room for: a) Fan operation status indications b) Alarms for adsorber unit high temperature c) Alarms for high and low differential pressure across filter units.	8. Inspection of the as-built configuration. Test to verify alarms activation using simulated activation signals.	8. The AVS has the instrumentation indications and alarms specified in Table 1.6.3-1, Certified Design Commitment, No. 8.
9. The AVS design permits periodic inspection and testing of AVS components depicted in Figure 1.6.3-1 (NOTE 1).	9. Evaluation of the as-built configuration.	9. The AVS components depicted in Figure 1.6.3-1 (NOTE 1) are accessible for periodic inspections and testing.

TABLE 1.6.3-1 (Continued)

ANNULUS VENTILATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. The AVS has electrical and control component separation between trains except for shared ducting within the annulus volume.	10. Inspection of the as-built AVS.	10. With the exception of shared ducting within the annulus volume, the AVS provides electrical and control component separation between trains.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of t he System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

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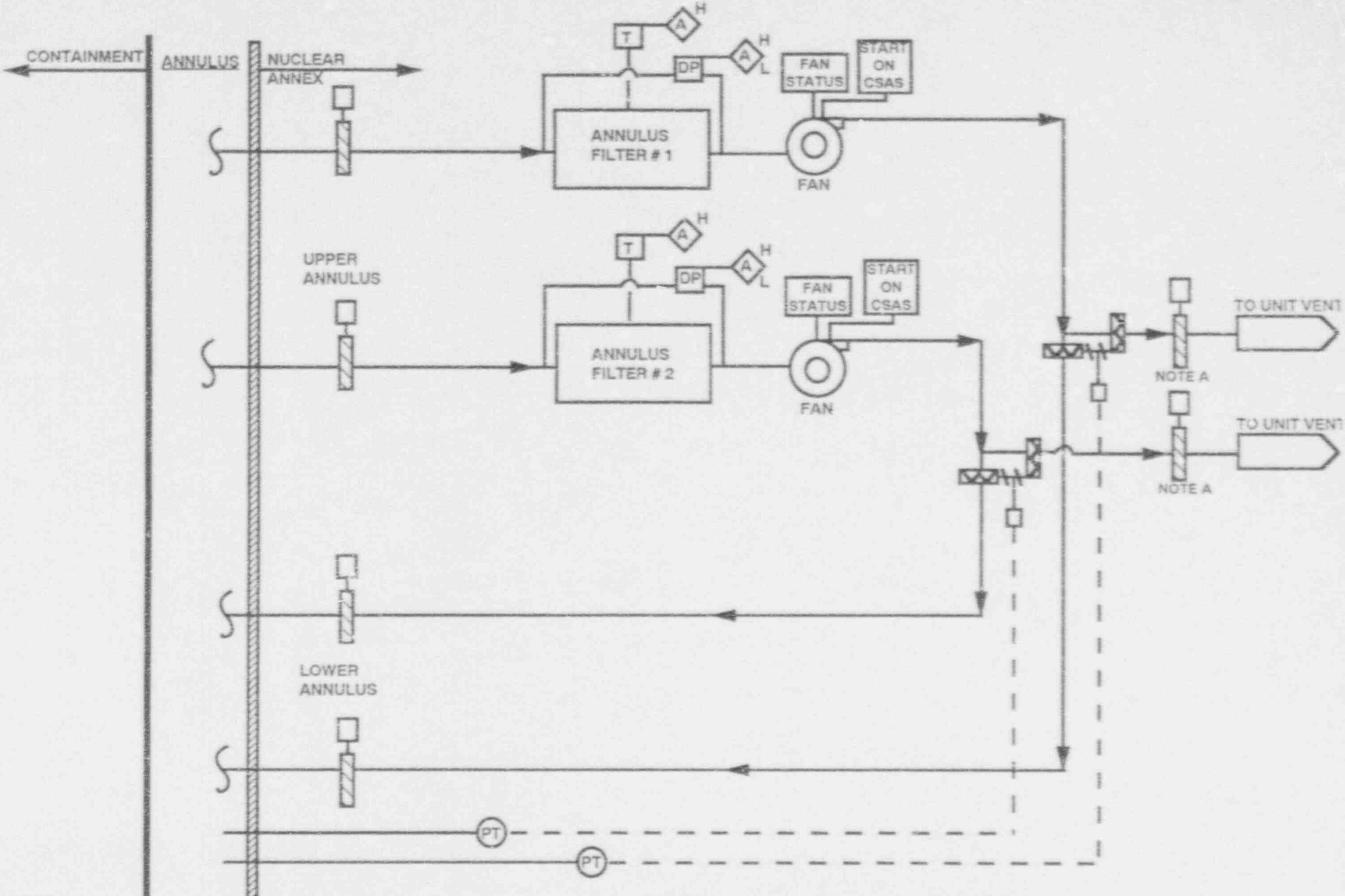

NOTE A:
1. THIS DAMPER IS FOR TORNADO PROTECTION AND FOR ISOLATION WHEN FAN IS OFF

FIGURE 1.6.3-1
ANNULUS VENTILATION SYSTEM

1.6.5 SAFETY INJECTION SYSTEM

Design Description

The safety injection system (SIS) injects borated water into the reactor vessel to provide core cooling in response to a loss-of-coolant-accident (LOCA). The SIS limits fuel damage in order to maintain a coolable core geometry, limits the cladding metal-water reaction, removes the decay heat in the core, and maintains the core subcritical during the extended period of time following a LOCA.

The SIS also injects borated water into the reactor vessel to mitigate accidents other than LOCAs, such as steam generator tube ruptures, steam line breaks or control element assembly (CEA) ejection incidents. The borated water injected by the SIS provides inventory and reactivity control for these events.

The SIS accomplishes these functional requirements by use of active and passive injection subsystems. The active portion of the SIS consists of four mechanically separated trains, each consisting of a motor-driven centrifugal safety injection (SI) pump and associated valves. Each SI pump is provided with a separate suction line from the in-containment refueling water storage tank (IRWST) and a separate discharge line to a direct vessel injection (DVI) nozzle on the reactor vessel. The passive portion consists of four identical pressurized safety injection tanks (SITs), described below. Each SIT discharge line is headered with an SI pump discharge line. Figure 1.6.5-1 shows basic system components and their configuration (NOTE 1).

For large break LOCAs (greater than the size of a DVI line), two SI pumps, in conjunction with the SITs, provide 100 percent of the minimum injection flow required to satisfy LOCA performance requirements. For small breaks (equal to, or smaller than, the size of a DVI line), one SI pump, in conjunction with the SITs, provides 100 percent of the capacity to satisfy LOCA performance requirements. Long-term cooling for LOCAs is accomplished by manually realigning the SI pumps for simultaneous hot leg injection and DVI nozzle injection. This provides flushing flow and core subcooling for LOCAs until the shutdown cooling system (SCS) can be used.

The SIS is automatically initiated by a safety injection actuation signal (SIAS) on low reactor coolant system (RCS) pressure or high containment pressure. An SIAS starts all four SI pumps and opens all four SI header isolation valves. The SIS provides indication in the control room when the SIAS is bypassed or when the SIS is inoperable. The SIS can also be manually initiated from the Main Control Room. SIS indications are provided in the control room to monitor system actuation and operation.

The SITs, which contain borated water pressurized by a nitrogen cover gas, constitute a passive injection system. No operator action or electrical signal is required for operation. Each tank is connected to a DVI nozzle by a separate line containing two check valves which isolate the tank from the RCS during normal operation. When RCS pressure falls below SIT pressure, the check valves open, discharging the contents of the tank into the reactor vessel. A remotely operated isolation valve in each SIT discharge line is administratively controlled open to assure SIT injection when needed. To further assure SIT availability, each SIT isolation valve receives an open signal upon an SIAS. Two remotely operated vent valves are connected to each SIT. Venting may be required to lower SIT pressure to shutdown cooling system entry pressure following some small break LOCAs.

The shutoff head and flow rates of the SI pumps were selected to insure that adequate flow is delivered to the reactor vessel to cool the core during LOCAs and non-LOCA design basis events. The SIS provides net positive suction head (NPSH) greater than the pump's required NPSH for all expected fluid temperature conditions during SIS operation. Each SIS pump has a minimum flow recirculation line to the IRWST to ensure pump flow during low-flow operation exceeds the pump's required minimum flow.

Key system and equipment parameters are:

Pump flow to RCS at 0 psig	980-1232 gpm
SI pump differential pressure at minimum flow recirculation	1600-2040 psig
Response time from SIAS to initiation of SI flow, maximum	40 seconds
Volume of unborated water in each SI line prior to SIAS, max.	15 cubic feet
IRWST volume, minimum	495,000 gallons
SIT volume, minimum	2406 cubic feet each
SIT nozzle elevation above DVI nozzle centerline	0-25 feet
Hot Leg flow with split between hot leg and DVI and RCS at 0 psig pressure	[illegible] 1 gpm minimum to hot leg

The SIS components, instrumentation and controls necessary for injecting water into the reactor vessel can be powered from the plant startup power source (offsite power) or the emergency diesel generators (emergency power). Power connections are through at least two independent electrical divisions. One independent electrical division supplies power to two SI pumps and associated valves. A second independent electrical division supplies power to the other two SI pumps and associated valves.

Power is supplied to the SIS hot leg injection valves such that a single electrical failure cannot cause spurious initiation of hot leg injection flow, nor can a single electrical failure prevent initiation of flow through at least one hot leg injection line.

SIS components required for injection of borated water into the reactor vessel are of Seismic Category I classification. The SIS is installed, and SIS mechanical components are built to meet ASME Boiler and Pressure Vessel Code Section III requirements as follows: IRWST, SI pumps, SITs, piping and valves up to the second check valve from the RCS are Class 2; piping and valves from (and including) the second check valve from the RCS are Class 1.

SIS components and instrumentation which must operate following a design basis event are designed, built, and qualified to operate in the post-event environment in the compartment where the component or instrument is located.

Physical separation is provided between the piping trains and containment penetrations for redundant SIS lines (IRWST to pump suction, pump discharge to RCS, SIT discharge to RCS) to prevent a failure of one train from preventing or interrupting operation of other trains.

SIS piping trains are protected from the effects of internal or local flooding. The SIS is also protected against dynamic effects associated with postulated ruptures of high energy and moderate energy fluid systems.

The SIS permits periodic inspection of important components such as injection nozzles, piping, pumps, valves, and those pressure retaining welds which are not exempted by the ASME Code from inspection, and periodic functional testing, including the full operational sequence that brings the system into operation. The SIS also permits system testing at design flow during reactor power operation.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.6.5-1 specifies the inspections, tests, analyses and associated acceptance criteria for the SIS.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

TABLE 1.6.5-1

SAFETY INJECTION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The general configuration of the SIS is shown in Figure 1.6.5-1. (NOTE 1)	1. Perform inspections of the as-built SIS configuration.	1. Actual SIS configuration, for those components shown, conforms with Figure 1.6.5-1.
2. The SIS components shown in Figure 1.6.5-1 are installed, and SIS mechanical equipment is built, in accordance with the ASME Code, Section III, Class categorizations that are shown in Figure 1.6.5-1.	2. Inspect Code Data Reports for installation and components. Inspect the system and components for the presence of N stamps for ASME Section III components.	2. SIS installation and components have required ASME, Section III, Class code stamps, per the Code Classes shown in Figure 1.6.5-1.
3. All SIS components required for injecting water into the reactor vessel are of Seismic Category I classification and qualified for the environment for locations where installed.	3. See generic Equipment Qualification (ITA)	3. See generic Equipment Qualification (A.C.)
4. A safety injection actuation signal (SIAS) actuates the SIS.	4. Perform SIS functional tests to demonstrate the SIS actuates in response to an SIAS.	4. An SIAS starts the SI pumps, opens the SI header isolation valves, and sends an open signal to the SIT isolation valves.

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TABLE 1.6.5-1 (Continued)

SAFETY INJECTION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Test, Analyses	Acceptance Criteria
5.a) The SIS operates when powered from the offsite power source the on-site emergency power source.	5.a) Perform SIS functional tests to demonstrate operation when supplied by either the offsite power source or the on-site emergency power source.	5.a) The SIS is capable of operating when supplied by either of the electrical power sources.
b) Electric power for SIS components is supplied through at least two independent electrical divisions. One independent division supplies power to two SI pumps and associated valves. A second independent division supplies power to the other two SI pumps and associated valves.	b) Inspect the electrical power distribution system. Confirm that at least two independent electrical divisions supply SIS components and that each division supplies power for two SI pumps and associated valves.	b) Electric power for SIS components is supplied through at least two independent electrical divisions. One independent division supplies power to two SI pumps and associated valves. A second independent division supplies power to the other two SI pumps and associated valves.
6. The SIS injects borated water into the reactor vessel to provide core cooling following a LOCA, and inventory and reactivity control following non-LOCA accidents such as steam generator tube ruptures, steam line breaks or CEA ejections.	6. Perform SIS functional tests and inspections in a), b), and c), below, to confirm the assumptions of the performance analyses for LOCA and non-LOCA design basis events.	6.

TABLE 1.6.5-1 (Continued)

SAFETY INJECTION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Test, Analyses	Acceptance Criteria
6. (continued)	6.a) Perform SIS functional tests to determine as-built system flow vs. RCS pressure and time to rated flow after an SIAS.	6.a) Pump differential pressure (at minimum recirculation flow) = 1600 to 2040 psi; pump flow rate to RCS = 980 to 1232 gpm at 0 psig RCS pressure; response time not to exceed 40 seconds from SIAS to initiation of SI flow.
	b) Perform tests to confirm the SITs and associated valves respond to an SIAS and the pressurized SITs discharge water to the depressurized RCS.	b) SIT isolation valves open on SIAS and the pressurized SITs discharge water to the depressurized RCS.
	c) Inspect drawings and documents of as-built SIS components to determine the following:	c) The calculated parameters meet the following acceptance criteria:
	1) Volume of unborated water in each SI line prior to an actuation,	1) Volume of unborated water in each SI line prior to an SIAS not to exceed 15 cubic ft.
	2) IRWST volume,	2) IRWST volume not less than 495000 gallons
	3) SIT internal volume,	3) SIT internal volume not less than 2406 cubic feet

TABLE 1.6.5-1 (Continued)

SAFETY INJECTION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Test, Analyses	Acceptance Criteria
6. (continued)	6. 4) SIT nozzle elevation above the DVI nozzles centerline.	6. 4) SIT nozzle elevation above the DVI nozzles center = 0 to 25 feet
7.a) Long term cooling for large break LOCAs is accomplished by manually realigning the SI pumps for simultaneous hot leg injection and DVI nozzle injection.	7.a)(1) Manually align the SIS from the Control Room for long term cooling using simultaneous DVI and hot leg injection.	7.a)(1) The SIS can be manually aligned from the Control Room for long term cooling using simultaneous DVI and hot leg injection.
	(2) Perform functional tests to determine the hot leg flow with flow split between hot leg and DVI lines.	(2) With flow split between the hot leg and DVI lines, hot leg flow is not less than 441 gpm with the RCS at 0 psig pressure.
b) Power is supplied to the hot leg injection valves is designed such that a single electrical failure cannot cause spurious initiation of hot leg injection flow, nor will a single electrical failure prevent initiation of flow through at least one hot leg injection line.	b) Inspect the electric power distribution system. Confirm that the two valves in each hot leg injection line receive power from separate electrical buses. Confirm that the electrical buses for the two valves in one hot leg injection line are separate and independent from the electrical buses for the two valves in the other hot leg injection line.	b) The two valves in each hot leg injection line receive power from separate electrical buses. The electrical buses for the two valves in one hot leg injection line are separate and independent from the electrical buses for the two valves in the other hot leg injection line.

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TABLE 1.6.5-1 (Continued)

SAFETY INJECTION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Test, Analyses	Acceptance Criteria
8. Available NPSH meets or exceeds required pump NPSH for conditions under which the pump must operate.	8. Inspect Pump vendor data to determine NPSH required by the as-procured pump. Inspect actual system installation and/or take measurements, and correct by analysis for saturated IRWST fluid conditions and minimum IRWST water level, to determine available pump NPSH.	8. Corrected pump NPSH available, as determined based on as-built conditions and the results of vendor tests and/or analyses, meets or exceeds as-procured pump NPSH requirements.
9. Indication is provided in the main control room when the SIAS is bypassed and when SIS components are inoperable.	9. Perform functional tests to verify operation of control room indications when the SIAS is bypassed and SIS components are inoperable.	9. SIAS bypassed and SIS components inoperable are indicated in the main control room.
10. Piping trains and containment penetrations for redundant SIS lines (IRWST to pump suction, pump discharge to RCS, and SIT discharge to RCS) are physically separated such that failure of one train will not prevent or interrupt operation of other trains.	10. Perform walkdown inspections to verify physical separation of piping trains and containment penetrations for the SIS redundant lines (IRWST to pump suction, pump discharge to RCS, and SIT discharge to RCS).	10. Four-quadrant separation is provided for the SIS piping trains and the containment penetrations for the SIS redundant lines (IRWST to pump suction, pump discharge to RCS, and SIT discharge to RCS).

TABLE 1.6.5-1 (Continued)

SAFETY INJECTION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Test, Analyses	Acceptance Criteria
11. The SIS permits periodic inspection of injection nozzles, piping, pumps, valves and pressure-retaining welds which are not exempted from inspection by the ASME Code.	11. Perform visual inspection of accessibility for periodic inspections of the SIS injection nozzles, piping, pumps, valves and pressure-retaining welds, as detailed in the In-Service Inspection Plan.	11. Access is provided for inspection of SIS injection nozzles, piping, pumps, valves, and pressure-retaining welds, except for the exemptions allowed in Code Articles IWB-1220, IWC-1220, and IWD-1220.
12.a) The SIS permits functional testing of the full operational sequence that brings the system into operation.	12.a) Demonstrate that the SIS full operational sequence can be tested by performing tests to show that a simulated low pressurizer pressure condition or high containment pressure condition generates an SIAS, and an SIAS actuates the SI pumps and associated valves.	12.a) The initiation signals generate an SIAS, and an SIAS actuates the SI pumps and associated valves.
b) The SIS permits testing the SI pumps at design flow during reactor power operation.	b) Demonstrate the capability for testing the SIS at design flow by manually aligning SI flow to the IRWST and manually starting each SI pump.	b) The SIS delivers design flow to the IRWST through each subtrain.

TABLE 1.6.5-1 (Continued)

SAFETY INJECTION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Test, Analyses	Acceptance Criteria
13. The SIS provides indications in the control room to monitor system actuation and operation, and controls to manually initiate SI flow from the control room.	13. Visually inspect the control room for the presence of the indications shown on Figure 1.6.5-1. Perform test to operate the SI pumps and the remote-operated injection valves from the control room.	13. The instrumentation shown on Figure 1.6.5-1 are indicated in the control room. The SI pumps and remote-operated injection valves can be operated from the control room.
14. The SIS is protected from the effects of internal or local flooding.	14. Perform walkdown inspections of the SIS to verify the presence of design features to protect the SIS from internal flooding.	14. Flood barriers exist between the 4 quadrants of the containment subsphere which house the 4 SI trains, flood barriers exist between the SIS and emergency feedwater equipment in the same quadrant, and drain lines to sumps from the area below the SI pumps are installed.
15. The SIS is protected against dynamic effects associated with postulated ruptures of high energy and moderate energy fluid systems.	15. See the inspections, tests, and analyses of Section 1.3.1, Piping Design.	15. See the acceptance criteria of Section 1.3.1, Piping Design.

TABLE 1.6.5-1 (Continued)

SAFETY INJECTION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Test, Analyses	Acceptance Criteria
16. The SIS includes a minimum flow recirculation path for each SI pump to protect the pump from overheating during low-flow operation.	16. Inspect pump vendor data to determine minimum flow required by the as-procured pump. Inspect actual system installation and/or take measurements, to determine actual minimum flow. Perform functional tests for extended minimum flow operation (until pump and fluid temperatures stabilize).	16. Minimum flow recirculation, as determined based on as-built conditions, meets or exceeds the pump's required minimum flow. No deleterious effects are observed during extended operation at minimum flow. (Recirculation flow does not degrade below minimum required.)
17. The safety injection tanks can be depressurized by venting to permit lowering RCS pressure to shutdown cooling entry pressure.	17. With the SIT pressurized and the associated SIT isolation valve shut, open each SIT vent valve from the control room. Perform this test for all 4 SITs and 8 vent valves.	17. The SIT vent valves can be opened from the control room.

NOTE 1 Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

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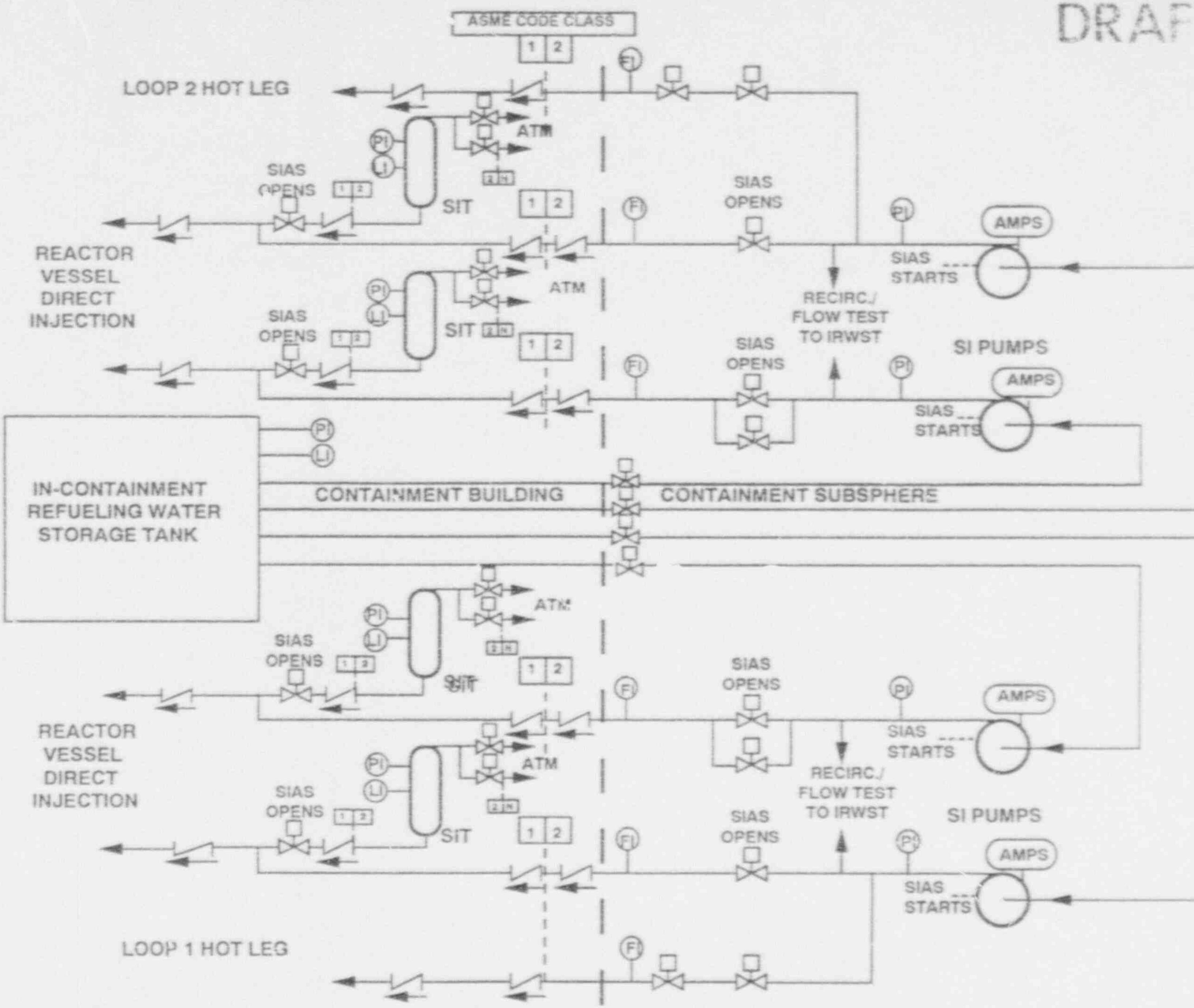

FIGURE 1.6.5-1
SAFETY INJECTION SYSTEM

1.7.1 PLANT PROTECTION SYSTEM

Design Description

The System 80+ Plant Protection System (PPS) is a warning and trip system which supports two plant protection functions: (1) reactor trip, and (2) actuation of engineered safeguards features. The PPS monitors information provided by the process instrumentation to determine the need to initiate plant safety system responses. Initial warning and trip decisions are implemented in the PPS with software logic installed in programmable digital devices to provide limit logic, coincidence logic and safety system initiation logic.

Reactor Trip Initiation Function

An automatic reactor trip is performed to protect against the onset and consequences of events or conditions that threaten the integrity of the fuel barriers. Process instrumentation, the PPS and the reactor trip switchgear are implemented to perform an automatic reactor trip. The process instrumentation provides sensor data input which the PPS uses to monitor selected plant conditions for this protective function. An acceptable set of monitored conditions for achieving this protective function, any one of which will result in an automatic reactor trip, is provided here:

Variable Overpower
High Logarithmic Power Level
High Local Power Density
Low Departure from Nucleate Boiling Ratio
High Pressurizer Pressure
Low Pressurizer Pressure
Low Steam Generator Water Level
Low Steam Generator Pressure
High Containment Pressure
High Steam Generator Water Level
Low Reactor Coolant Flow

An alternate set of conditions may be determined to also achieve this protective function.

Setpoints for initiation of a reactor trip are selected for each monitored condition to protect the core fuel thermal limits and the Reactor Coolant System pressure boundary for Anticipated Operational Occurrences, and also to mitigate the consequences of accidents. If a monitored condition exceeds its setpoint, the PPS automatically initiates a reactor trip, which is actuated by the reactor trip switchgear.

If the setpoint for a trip condition varies with power, the setpoint change is performed automatically within the PPS. For each trip condition, pre-trip alarms are provided. These provide the operator with an opportunity to take control actions to avoid the trip limit condition. Manual initiation of a reactor trip can be performed from either the main control room or the remote shutdown panel.

Engineered Safety Features Initiation Function

Automatic actuation is provided for the engineered safety feature systems which act to mitigate the consequences of Anticipated Operational Occurrences and to limit radiological release in the highly unlikely event of an accidental release of radioactive fission products from the Reactor Coolant System. Process instrumentation, the PPS, the Engineered Safety Features-Component Control System (ESF-CCS), motor starters and actuated devices are implemented to actuate the engineered safety features. The process instrumentation provides sensor data input which the PPS uses to monitor selected plant conditions for this protective function. An acceptable set of monitored conditions which result in automatic actuation of one or more of the engineered safety features is provided here:

Low Pressurizer Pressure
Low Steam Generator Water Level
Low Steam Generator Pressure
High Containment Pressure
High Steam Generator Water Level
High High Containment Pressure

If a monitored condition exceeds its setpoint, the PPS automatically generates one or more of the following Engineered Safety Feature Actuation Signals (ESFAS):

Safety Injection Actuation Signal
Containment Isolation Actuation Signal
Containment Spray Actuation Signal
Main Steam Isolation Signal
Emergency Feedwater Actuation Signal-1
Emergency Feedwater Actuation Signal-2

These initiating signals are provided to the ESF-CCS which responds by actuating the engineered safety feature systems. These signals can be initiated manually from either the main control room or the remote shutdown panel.

Elements Of The PPS

The PPS is divided into four redundant channels. The following elements, depicted in Figures 1.7.1-1 and 1.7.1-2 (Note 1), are included in each channel of the PPS:

Limit Logic
Local Coincidence Logic
Reactor Trip Initiation Logic
ESF Initiation Logic
Interface and Test Processor

Limit logic for simple process-value to set point comparison is implemented in one or more bistable processors in each channel, referred to as the Plant Protection Calculator (PPC). The bistable trip processors generate trips based on the measurement channel digitized value exceeding a digital setpoint. Limit logic for complex calculations (i.e., the departure from nucleate boiling ratio and high local power density), are implemented in each channel in a device referred to as a Core Protection Calculator (CPC).

The trip outputs of the PPC and the CPC in each channel are sent to the local coincidence logic processors in all four channels. Therefore, for each trip condition, the local coincidence logic processor in each channel receives four trip signals, one from its associated PPC or CPC from within the channel, and one from the equivalent PPC or CPC located in each of the other three channels. The coincidence processors evaluate the local coincidence logic based on the state of the four like trip signals and their respective bypasses. A coincidence of two-out-of-four like trip signals is required to generate a reactor trip or ESF initiation signal. The fourth channel is provided as a spare and allows bypassing of one channel while maintaining a two-out-of-three system.

Upon coincidence of two signals indicating one of the conditions for reactor trip, the PPS initiates actuation of the reactor trip switchgear. The reactor trip switchgear breakers interrupt power to the Control Element Drive Mechanism coils, allowing all Control Element Assemblies to drop into the core by gravity. The reactor trip switchgear can be tripped manually from the main control room or the remote shutdown panel, independent of the PPS bistable and coincidence processors.

Upon coincidence of two signals indicating a condition for generating an ESFAS, the ESF initiation logic transmits the actuation signal to the ESF-CCS. The functional logic used in the PPS to generate each of the ESF initiation signals is shown in Figures 1.7.1-3, 1.7.1-4, 1.7.1-5 and 1.7.1-6 (Note 1).

The PPS interfaces at the main control panel and at the remote shutdown panel each provide for manual initiation of all ESF actuation signals. Manual initiation of all ESF actuation signals can be performed independent of the bistable and coincidence processors from the main control room. Manual initiation of the Main Steam Isolation Signal can be performed independent of the bistable and coincidence processors from the remote shutdown panel. The ESF-CCS interface in both locations provides for initiation of all ESF functions on a train or component basis.

The Interface and Test Processor (ITP) performs automatic testing of PPS logic.

PPS Divisional Separation and Isolation

The PPS is a four division system which provides reliable single failure proof capability for initiation of reactor trip and actuation of engineered safety features, while maintaining protection against unnecessary reactor trips resulting from single failures in the PPS. All functions of the PPS and all PPS components implemented for initiation of reactor trip or engineered safety feature actuation are safety-related. The PPS and the electrical equipment implemented for protective functions are of Safety Class 3, Seismic Category I and of IEEE electrical category Class 1E classifications.

Figure 1.7.1-2 shows the PPS divisional separation aspects and the signal flow from the process instrumentation to the individual channels for initiation of protection system functions. Four measurement channels with electrical and physical separation are provided for each parameter used in the direct generation of trip signals, with the exception of the Control Element Assembly position which is a two channel measurement.

Basic System Parameters are:

a.	Number of independent divisions of equipment	4
b.	Minimum number of sensors per trip variable (at least one per division)	4
c.	Number of automatic trip systems (one per division)	4
d.	Automatic trip initiation logic used for plant sensor inputs	2-out-of-4
e.	Number of separate manual trip systems	4
f.	Manual/Automatic actuation trip logic	Selective 2-out-of-4
g.	ESF Manual/Automatic Actuation Logic	Selective 2-out-of-4

Physical separation and electrical isolation are provided between the PPS and the process control system. Where the PPS and the process control system interface with the same component (i.e., sensors, signal conditioners, or actuated devices), electrical isolation is provided between the process control system and the shared component. Where the PPS and the process control system interface with the same sensor or signal conditioner, the PPS and process control system functions are independent, such that a failure of the sensor or signal conditioner does not result in a process control system response that conflicts with the PPS response.

Capability is provided to electrically isolate operator interfaces to the PPS, the reactor trip swithchgear and the ESF-CCS, such that a failure at the interface will neither result in a failure of a protective function or spurious actuation of a protective function. Use of a switch to transfer manual initiation capability for ESF functions from the main control room to the remote shutdown panel is an acceptable implementation for this purpose.

The PPS remains single-failure proof even when one entire division of channel sensors is bypassed and/or when one of the four PPCs or CPCs is out-of-service. In the event of a failure, equipment within the PPS is designed to fail into a trip initiating state or other safe state upon loss of power or input signals, or upon disconnection of portions of the system. The system also includes trip bypasses and isolated outputs for display, annunciation and performance monitoring. PPS interfaces with the Power Control System, Discrete Indication and Alarm System, Data Processing System, PPC Operator Modules and the Maintenance and Test Panel are electrically isolated so that no malfunction of the associated equipment can functionally disable any portion of the PPS. The PPS related equipment is divided into four redundant divisions of sensor (instrument) channels, trip logics and trip actuators, and manual scram controls and scram logic circuitry. The manual trip uses diverse and independent methods and equipment from the automatic trip, to provide defense in depth against common mode failures. Once a reactor trip has been initiated, the breakers in the reactor trip switchgear latch open, assuring that the intended fast insertion of all control rods into the reactor core cannot be compromised by any action of the normal power control system. After all of the trip conditions have been cleared, deliberate operator action is required to manually reclose the trip breakers.

PPS Interfaces and Testing

As illustrated in Figure 1.7.1-1, the PPS interfaces with the following:

- Class 1E safety process instrumentation:

  Reed Switch Position Transmission (for Control Element Assembly position).

Auxiliary Process Cabinet (for Pressurizer Pressure, Steam Generator Level, Steam Generator Pressure, Containment Pressure, Reactor Coolant Flow, Reactor Coolant System Hot Leg Temperature, Reactor Coolant System Cold Leg Temperature, Reactor Coolant Pump Speed Pulses, and Ex-Core Neutron Flux Power)

- Manual Actuation Signals for Reactor Trip at the Main Control Panel and the Remote Shutdown Panel.

- Manual Actuation Signals for ESF Systems at the Main Control Panel and the Remote Shutdown Panel.

- Reactor Trip Switchgear.

- Engineered Safety Feature Component Control System (ESF-CCS).

- The Interface and Test Processor portion of the PPS provides optical cable data link interfaces to the following:

  Power Control System
  Discrete Indication and Alarm System
  Data Processing System
  PPC Operator's Module in the Main Control Room
  PPC Operator's Module at the Remote Shutdown Panel

PPS interfaces for operator interaction, alarm annunciation and testing (manual and automatic) are illustrated in Figure 1.7.1-7 (Note 1).

The local and main control room PPS operator's module (one per channel) provides operators with the capability to enter trip channel bypasses, operating bypasses, and variable setpoint resets. These modules also provide indication of status of bypasses, operating bypasses, bistable trip and pre-trip. The local operator module provides the human-machine interface for manual testing of bistable trip functions.

An Interface and Testing Processor (ITP), one per channel, communicates with the bistable trip processors, coincidence processors, operator's modules, ESF-CCS and reactor trip switchgear within that channel and with the ITP's in the other three channels to monitor, test and control the operational state of the PPS. Each ITP also provides selected PPS channel status and test results information to the Data Processing System (DPS) and the Discrete Indication and Alarm System (DIAS).

Access to PPS trip setpoints, calibration controls and test points is restricted by physical barriers and administrative controls.

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Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.7.1-1 provides the inspections, tests and/or analyses, together with associated acceptance criteria, for the PPS.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

TABLE 1.7.1-1

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. PPS safety related software is developed, implemented, verified, validated, and integrated with hardware in accordance with a NRC approved plan, which is included in the design documentation.	1. Examine design documentation to verify that a quality assurance plan, approved by the NRC for safety related software has been included in the design documentation and that audits have been performed which verify that the plan was implemented.	1. A quality assurance plan which addresses software development, implementation, verification, validation and integration with hardware, and which has received NRC approval for application to safety related software, is included in the design documentation. The design documentation includes records of audits which certify that the quality assurance plan was implemented.
2. Setpoints used for initiation of PPS protective functions are determined using a NRC approved method.	2. Examine design documentation for the setpoint methodology and its implementation.	2. Documentation of the methodology used to determine the setpoints for initiation of PPS protective functions is included in the design documentation and has received NRC approval. Documentation of the implementation of the approved setpoint methodology is provided and has received NRC approval.
3. PPS equipment is designed to be protected from effects of noise, such as electromagnetic interference (EMI), and has adequate surge withstand capability (SWC).	3. See Generic EMI/SWC Qualification verification activities (ITA).	3. See Generic EMI/SWC Qualification Acceptance Criteria (AC).

TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4. PPS equipment is qualified for seismic loads and environment for locations where installed.	4. See Generic Equipment Qualification verification activities (ITA).	4. See Generic Equipment Qualification Acceptance Criteria (AC).
5. Failures in the process control systems can not propagate to the PPS.	5. Review of the design documentation to verify physical separation and electrical isolation between the PPS equipment and the process control systems.	5. Separate equipment in physically separate locations are used for the PPS and process control systems. Isolation is provided at interfaces between the PPS and the process control systems.
6. Failures in sensors or signal conditioners used by both the process control systems and the PPS will not result in a process control system response that conflicts with the PPS response.	6. A preoperational test on a set of PPS components that is representative of all sets of components demonstrates independence of PPS and process control system responses for the single failure of any common sensor or common signal conditioner.	6. The response of the process control system to the single failure does not impede or delay the PPS response.

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TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. Upon loss of power or disconnection of components, fail-safe failure modes result.	7. Field tests to confirm that upon loss of power or disconnection of a representative sample of active Sub Assembly PPS components, trip conditions or bypass inhibits will result. The representative sample shall consist of one of each different type module, power supply, and cable utilized in one PPS Channel.	7. Upon loss of power or disconnection of the representative sample of the PPS, a trip condition or bypass inhibit occurs.
8. Access to trip setpoints, calibration controls and test points is restricted by physical barriers and administrative controls.	8. Visual field inspections of the installed equipment confirm the existence of physical barriers and administrative controls.	8. Physical barriers exist. Administrative controls exist and include procedures that restrict personnel access to sensitive areas by requiring prior administrative approval.
9. The four divisions of the PPS are redundant, separated and electrically isolated.	9. Inspections of fabrication and installation records and construction drawings or visual field inspections of the installed PPS equipment will be used to confirm the quadruple redundancy of the PPS, physical separation between the four divisions and electrical isolation at interfaces.	9. Installed PPS equipment as depicted in Figures 1.7.1-2, 1.7.1-3, 1.7.1-4, 1.7.1-5 and 1.7.1-6 (Note 1).

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TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. PPS operations, both on-line and off-line, can be verified by means of individual instrument channel functional tests, trip system functional tests and total system functional tests.	10. Preoperational tests confirm the capability to perform trip bistable tests, channel functional tests, channel calibrations, coincident logic tests, reactor trip initiation logic tests, manual trip test, and engineered safety feature initiation and actuation logic tests. These tests will involve simulation of PPS testing modes of operation. Tests will confirm interlocks associated with the reactor mode switch positions, and with other operational and maintenance bypasses or test switches and associated annunciation, display and logging functions.	10. The installed reactor protection system configuration, controls, power sources and installatic of interfacing systems supports the PPS logic system functional testing and the operability verification of design as follows: a. Installed PPS hardware/firmware initiates trip conditions in all four PPS automatic trip systems upon coincidence of trip conditions in two or more instrument channels associated with the same trip variable(s). b. Installed system initiates trip upon coincidence of trip conditions in two or more of the four PPS automatic trip systems. c. Installed system initiates trip conditions if two manual trip switches are operated.

TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. (continued)	10. (continued)	d. Installed system initiates ESFAS actuation signal upon coincidence of associated ESF trip conditions in two or more of the four PPS automatic trip systems.
		e. Installed system initiates ESFAS actuation signal if two of the four associated ESF manual initiation switches are operated.
		f. Trip system and ESF initiation (automatic and manual) trip conditions latch and protective actuation signals are maintained.
		g. Installed system provides isolated status and control signals to data logging, display, and annunciator systems.
		h. Installed system demonstrates operational interlocks (i.e., trip inhibits or permissives) required for different conditions of reactor operation.

TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11. The PPS provides timely initiation of reactor trip and protective system actuations.	11. Preoperational tests confirm the design response times.	11. Response times less than or equal to the following:

(continued on next page)

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

Acceptance Criteria (continued)

11. (continued)

(RPS)

Pressurizer Pressure - High	(1.15) seconds [a]
Pressurizer Pressure - Low	(1.15) seconds [a]
Steam Generator Level - High	(1.15) seconds [a]
Steam Generator Level - Low	(1.25) seconds [a]
Steam Generator Pressure - Low	(1.15) seconds [a]
Containment Pressure - High	(1.15) seconds [a]
Reactor Coolant Flow - Low	(1.20) [b], (0.85) [c] seconds
Variable Over Power Trip	(0.55) seconds [a]
Logarithmic Power Level - High	(0.55) seconds [a]
Local Power Density - High	
a) Neutron Flux Power from Excores	(0.55) seconds [d]
b) CEA Positions	(1.35) seconds [d]
c) CEAC Penalty Factor	(0.75) seconds [d]
DNBR - Low	
a) Neutron Flux Power from Excores	(0.55) seconds [d]
b) CEA Positions	(1.35) seconds [d]
c) Cold Leg Temperature	(0.55) seconds [d]
d) Hot Leg Temperature	(2.61) seconds [d]
e) Primary Coolant Pump Shaft Speed	(0.30) seconds [d]
f) Reactor Coolant Pressure from Pressurizer	(0.55) seconds [d]
g) CEAC Penalty Factor	(0.75) seconds [d]

a. Unless otherwise noted, response time is defined as the time interval from when the monitored parameter exceeds the trip setpoint value at the input to the channel sensor until electrical power is interrupted to the CEA drive mechanism.

b. For sheared shaft event, reactor trip is required 1.20 seconds after the flow in the hot leg reaches its analysis setpoint.

c. For steam line break with loss of off-site power up to 30 minutes into the event. Reactor trip is required 0.85 seconds after the core flow reaches its analysis setpoint.

d. The CPC signal delay is defined as the time interval from when the monitored parameter exceeds the trip setpoint at the output of the channel sensor until electrical power is interrupted to the CEA mechanism.

Acceptance Criteria (continued)

11. (continued)

(ESFAS)

Lo Pressurizer Pressure - SIAS, CIAS	(1.35) seconds [a]
Lo Steam Generator Level - AFAS	(1.45) seconds [a]
Lo Steam Generator Pressure - MSIS	(1.35) seconds [a]
Hi Steam Generator Level - MSIS	(1.35) seconds [a]
Hi Containment Pressure - SIAS, CIAS, MSIS	(1.35) seconds [a]
Hi Hi Containment Pressure - CSAS	(1.35) seconds [a]

a. Time interval from when the monitored parameter exceeds the trip setpoint value at the input to the channel sensor until the output of the actuation relays in the ESF Cabinet changes state.

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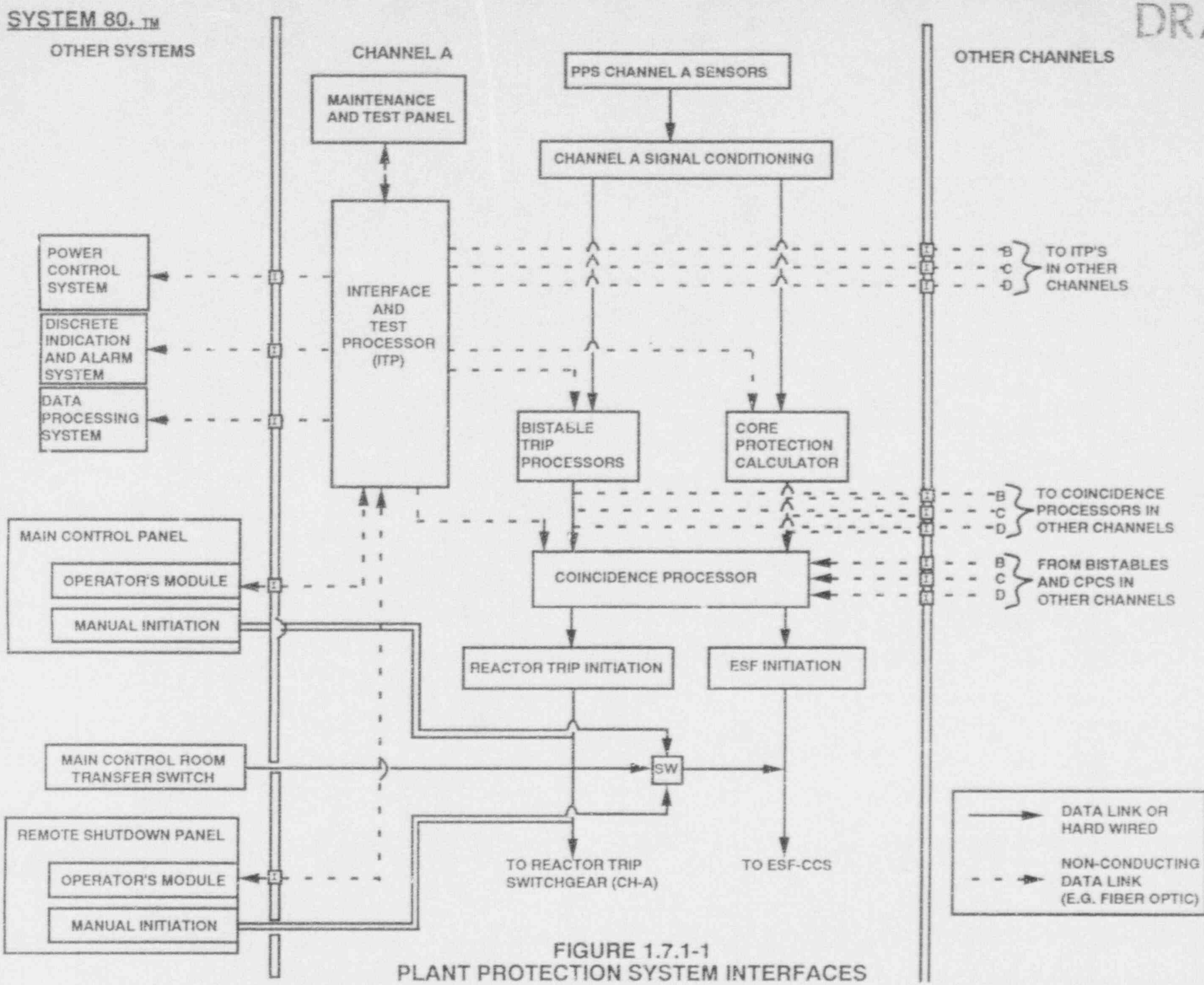

FIGURE 1.7.1-1
PLANT PROTECTION SYSTEM INTERFACES

SYSTEM 80+™

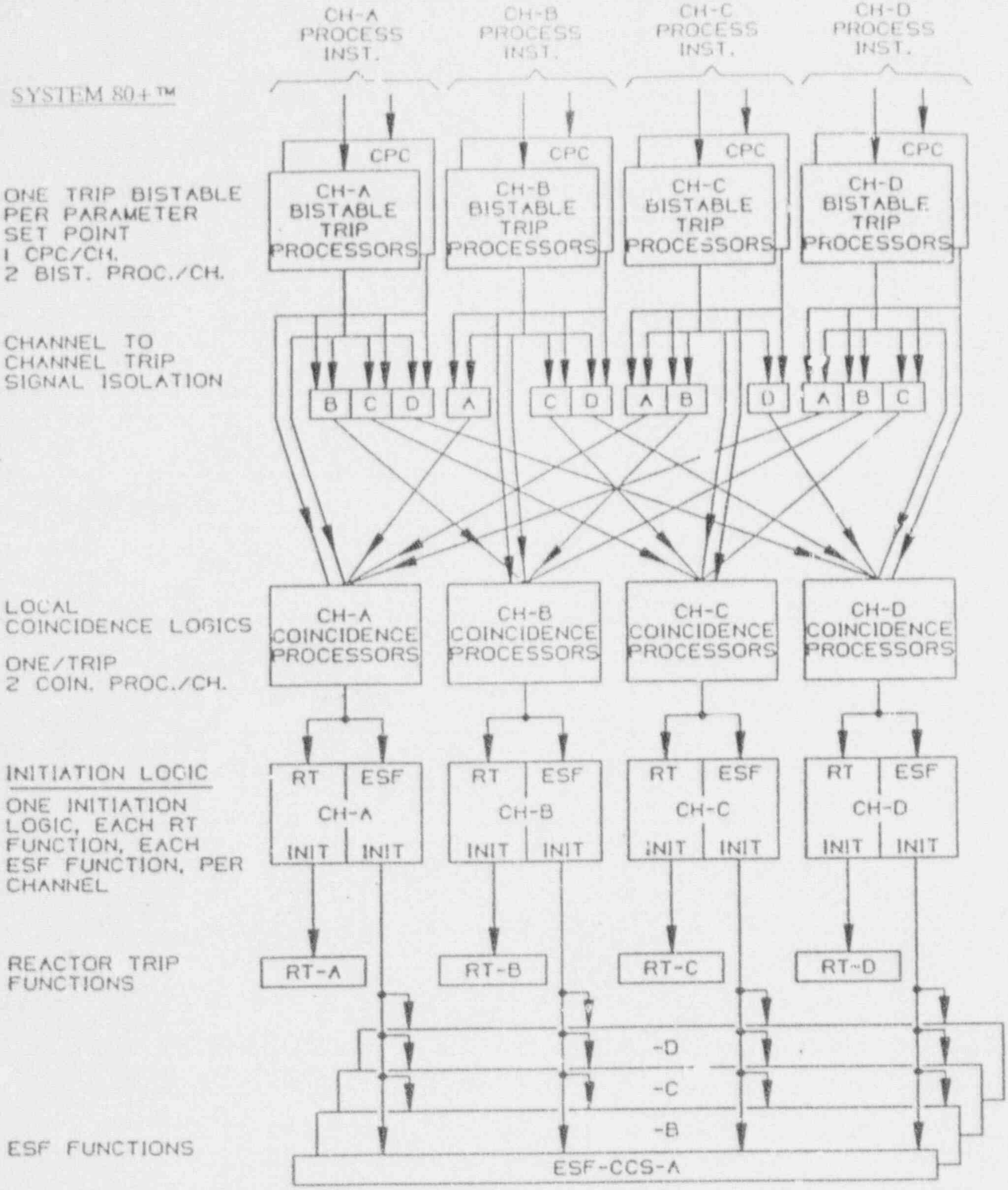

FIGURE 1.7.1-2
PPS BASIC BLOCK DIAGRAM

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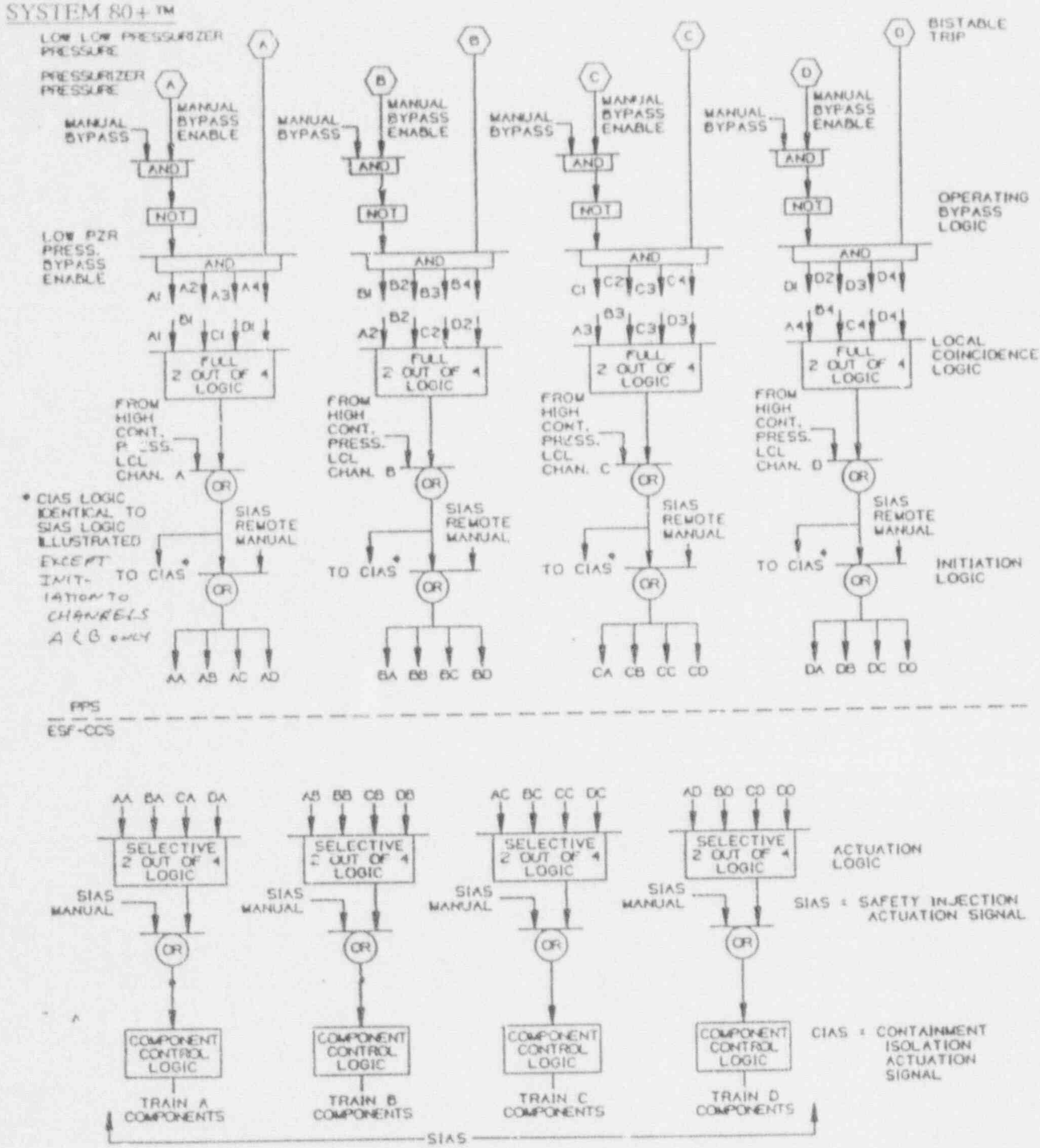

FIGURE 1.7.1-3

ESFAS FUNCTION LOGIC (SIAS)

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SYSTEM 80+™

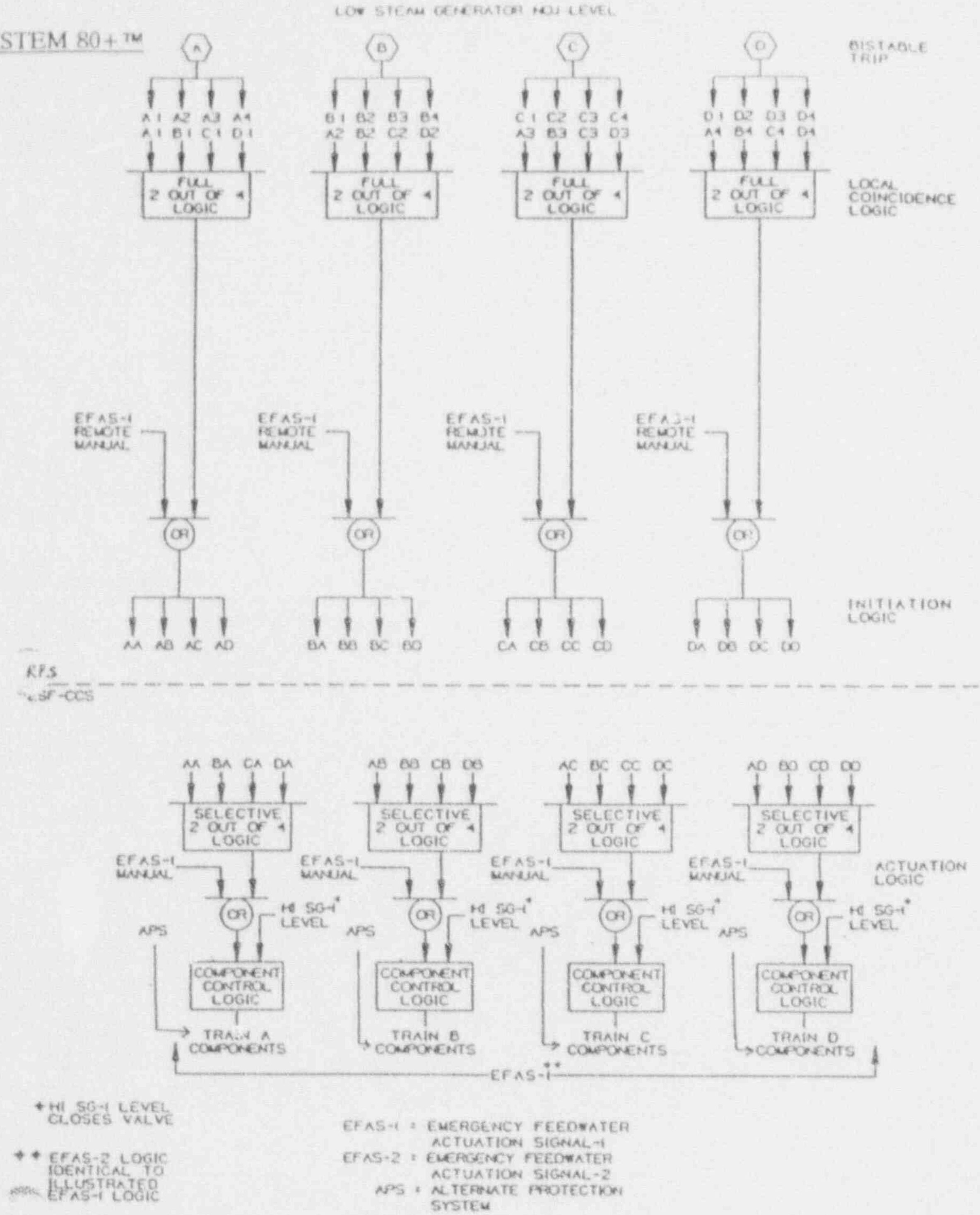

FIGURE 1.7.1-4
ESFAS FUNCTIONAL LOGIC (EFAS1, EFAS2)

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SYSTEM 80+™

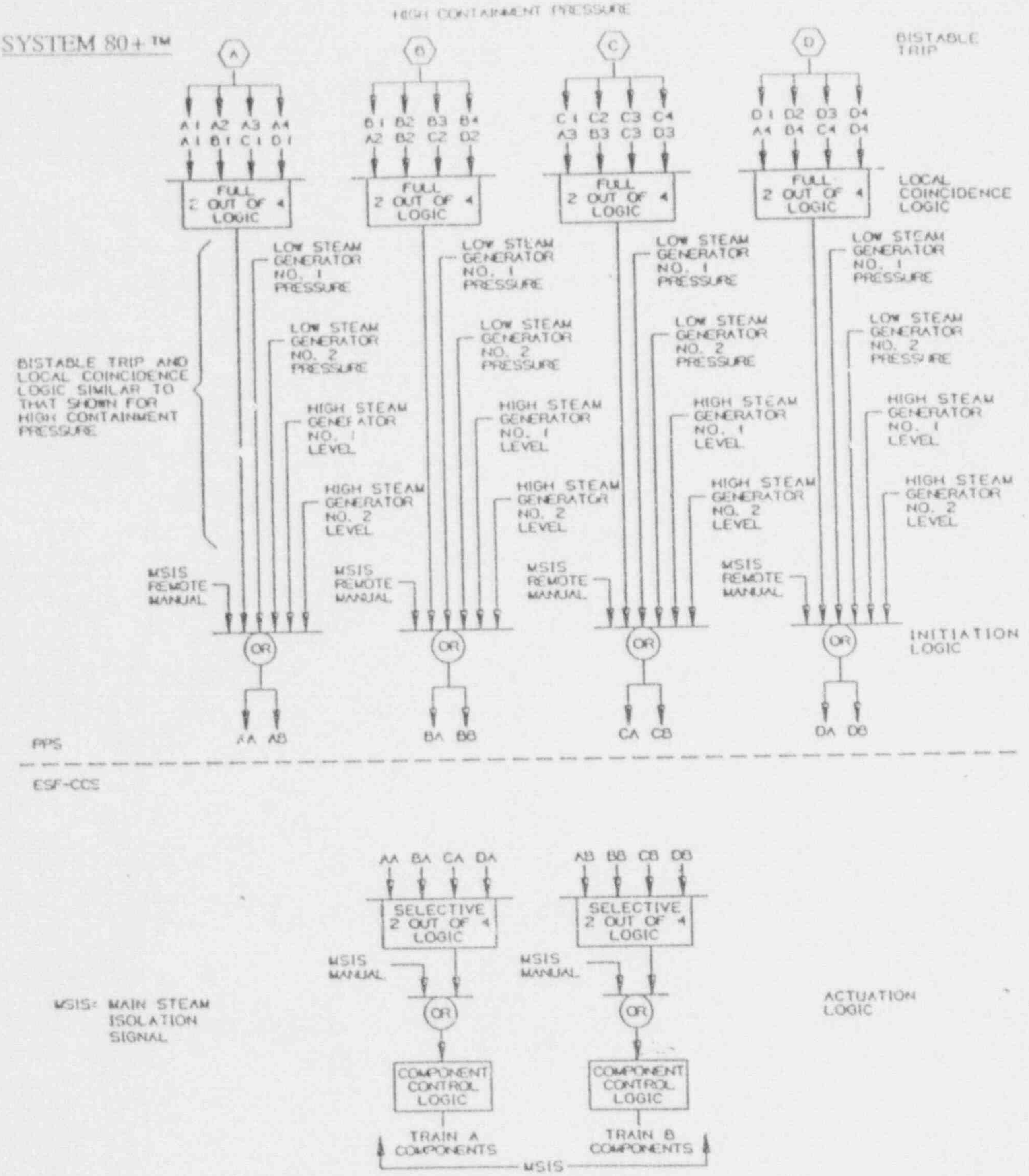

FIGURE 1.7.1-5

ESFAS FUNCTIONAL LOGIC (MSIS)

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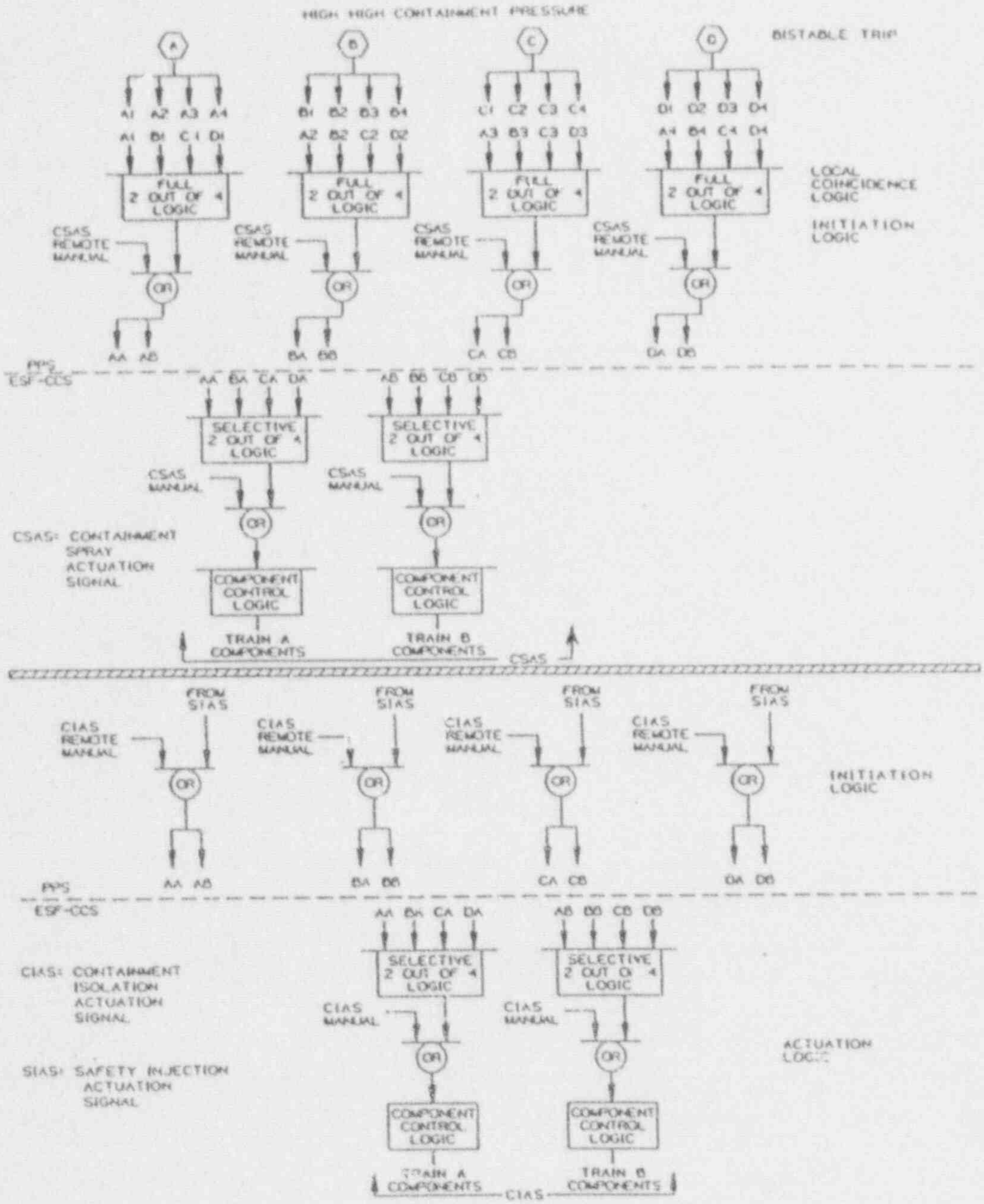

FIGURE 1.7.1-6

EFSAS FUNCTIONAL LOGIC (CSAS, CIAS)

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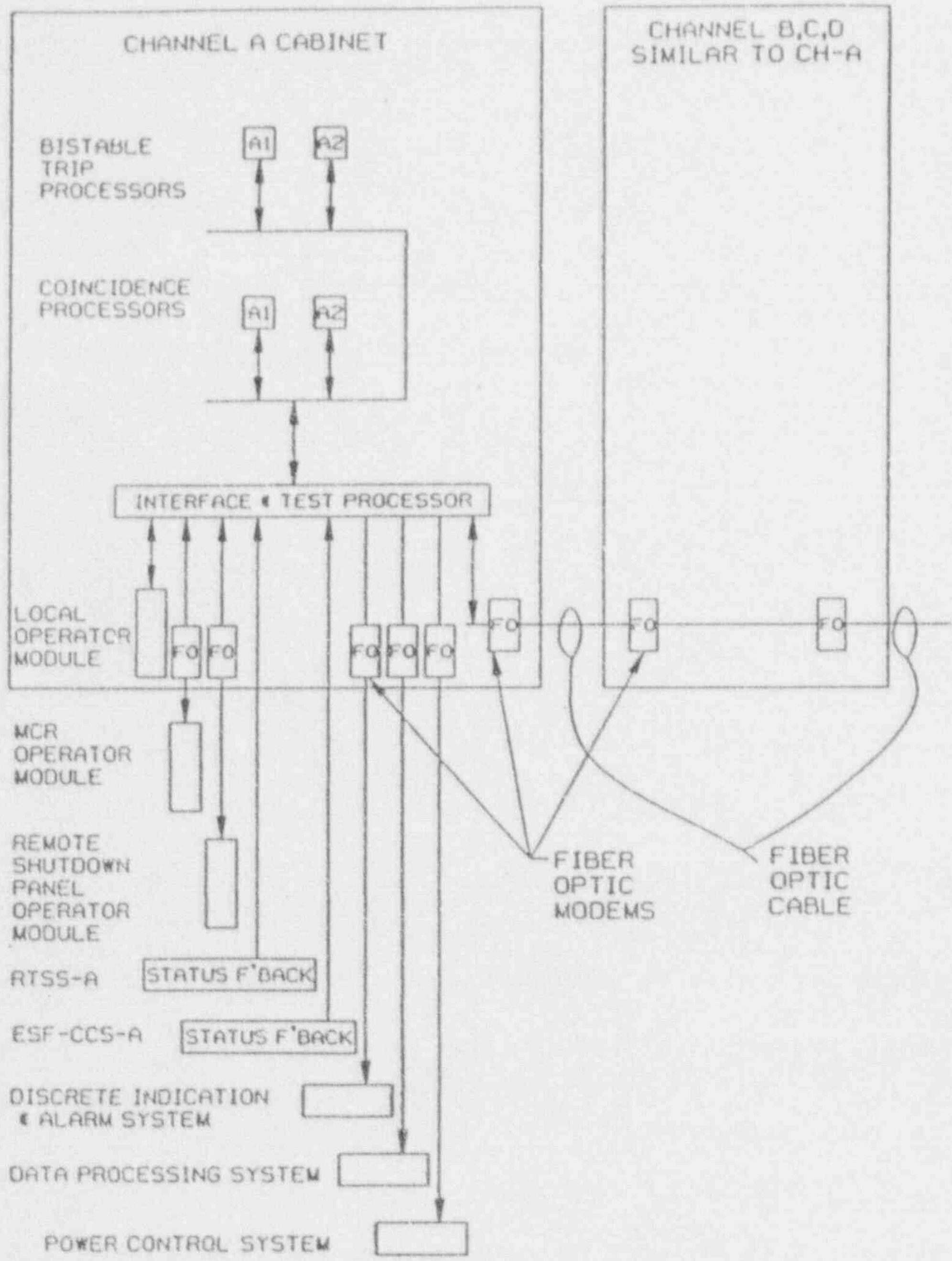

FIGURE 1.7.1-7
PPS FUNCTION INTERFACE AND TESTING DIAGRAM

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1.9.1 SPENT FUEL STORAGE

Design Description

The spent fuel storage racks are free standing structures that support and protect spent fuel assemblies and assure a geometrically safe configuration with respect to nuclear criticality. Conceptual illustrations of both the Spent Fuel Storage Rack and the Spent Fuel Storage Rack Arrangement are shown in Figures 1.9.1-1 and 1.9.1-2, respectively (NOTE 1). The number of Spent Fuel Storage Racks used meets plant storage capacity as licensed by the NRC.

The spent fuel storage racks are designed to maintain a neutron multiplication factor less than Keff=.95 for each of the two following loading conditions considered separately:

1. a) Loaded Fuel Rack dead weight
   b) Maximum temperature variation
   c) Three component seismic loading resulting from the Safe Shutdown Earthquake (SSE)

2. Drop of a fuel assembly plus fuel assembly handling tool onto the rack

The spent fuel storage racks are designed and constructed to meet the stress acceptance criteria of the ASME Code, Section III, Subsection NF, Class 3, Component Supports.

The spent fuel storage racks are of Seismic Category I classification.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.9.1-1 specifies the inspections, tests, analyses and associated acceptance criteria for spent fuel storage.

NOTE 1: Such diagrams are for the purpose of illustr 'ng the general conceptual design features of the System 80+ systems, comp.nents, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

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TABLE 1.9.1-1

SPENT FUEL STORAGE

Inspection, Tests, Analysis and Acceptance Criteria

Certified Design Commitment	Inspection, Test, Analysis	Acceptance Criteria
1. The rack arrangement has storage locations for spent fuel storage as shown generally in Figures 1.9.1-1 and 1.9.1-2. (NOTE 1)	1. Visual inspection of the rack verifies rack size, location and capacity. Count available cells.	1. The number of cells available equals licensed capacity.
2. The rack is designed and constructed in accordance with the following specific sections of ASME Code, Section III, Subsection NF, Class 3, Component Supports.	2. Examine the following information in the Fabrication Data Package and Certificate of Conformance in accordance with Quality Class 3:	2. Fabrication Data Package and Certificate of Conformance document the following:
a) Stress limits in accordance with NF - "Design by Analysis for Class 3 Components"	a) Calculated stresses and stress limits	a) Calculated stresses do not exceed the stress limits set by NF - "Design by Analysis for Class 3 Components"

TABLE 1.9.1-1 (Continued)

SPENT FUEL STORAGE
Inspection, Tests, Analysis and Acceptance Criteria

Certified Design Commitment	Inspection, Test, Analysis	Acceptance Criteria
2.b) Weld process in accordance with NF - "Rules governing Making, Examining, and Repairing Welds	2.b) Weld process description	2.b) Weld process complies with NF - "Rules governing Making, Examining, and Repairing Welds"
c) Visual inspection acceptance criteria in accordance with NF - "Acceptance Standards for Visual Examination of Welds"	c) Visual weld inspection results	c) Welds comply with visual inspection acceptance criteria of NF - "Acceptance Standards for Visual Examination of Welds"
3. The Spent Fuel Storage Racks have the following structural characteristics to maintain Keff less than .95:	3. Perform the following activities:	3. Design Verification Analysis shows the following:
a) Dead weight plus thermal plus SSE loads result in membrane stress intensity less than 1.20 Sy and membrane plus bending stress intensity less than 1.80 Sy.	a) For dead weight plus therm plus SSE loads, compare the calculated membrane stress intensity and calculated membrane plus bending stress intensity in the Design Verification Calculation to the limits of 1.20 Sy and 1.80 Sy, respectively.	a) The calculated values of membrane stress intensity and membrane plus bending stress intensity are, respectively, less than 1.20 Sy and 1.80 Sy.

TABLE 1.9.1-1 (Continued)

SPENT FUEL STORAGE
Inspection, Tests, Analysis and Acceptance Criteria

Certified Design Commitment	Inspection, Test, Analysis	Acceptance Criteria
3.b) Storage Rack loads produced by the drop of a fuel assembly plus a fuel assembly handling tool do not cause permanent deformation in the region of the active fuel.	3.b) In the Design Verification Calculation, compare the calculated stress resulting from the drop of a fuel assembly plus a fuel assembly handling tool to the yield stress over the height of the active fuel.	3.b) The calculated stress is less than the yield stress in the region of the active fuel.
c) Pitch between cells and separation between modules meet the limits shown on the design drawings and used in the criticality analysis.	c) Measure pitch between cells and separation between modules and compare the measured values to the values on design drawings and to the values used in the criticality analysis.	c) Measured pitch and separation are in accordance with the design drawings and the values used in the criticality analysis.

TABLE 1.9.1-1 (Continued)

SPENT FUEL STORAGE
Inspection, Tests, Analysis and Acceptance Criteria

Certified Design Commitment	Inspection, Test, Analysis	Acceptance Criteria
4. Licensed fuel assemblies will fit in storage locations.	4. A gauge shall be inserted for the full length of each storage location.	4. The inspection gauge passes freely through the full length of each storage location.

Note (1) Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

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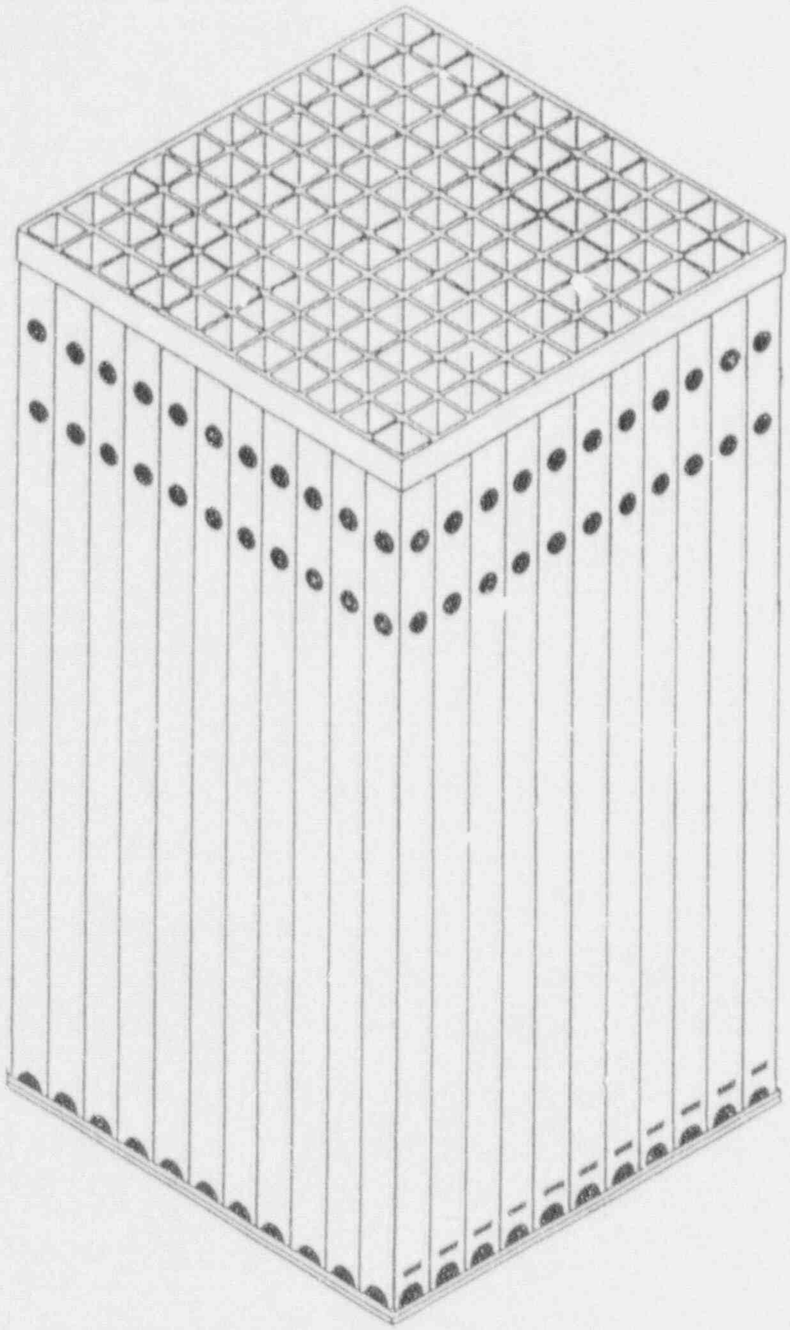

FIGURE 1.9.1-1
SPENT FUEL STORAGE RACK

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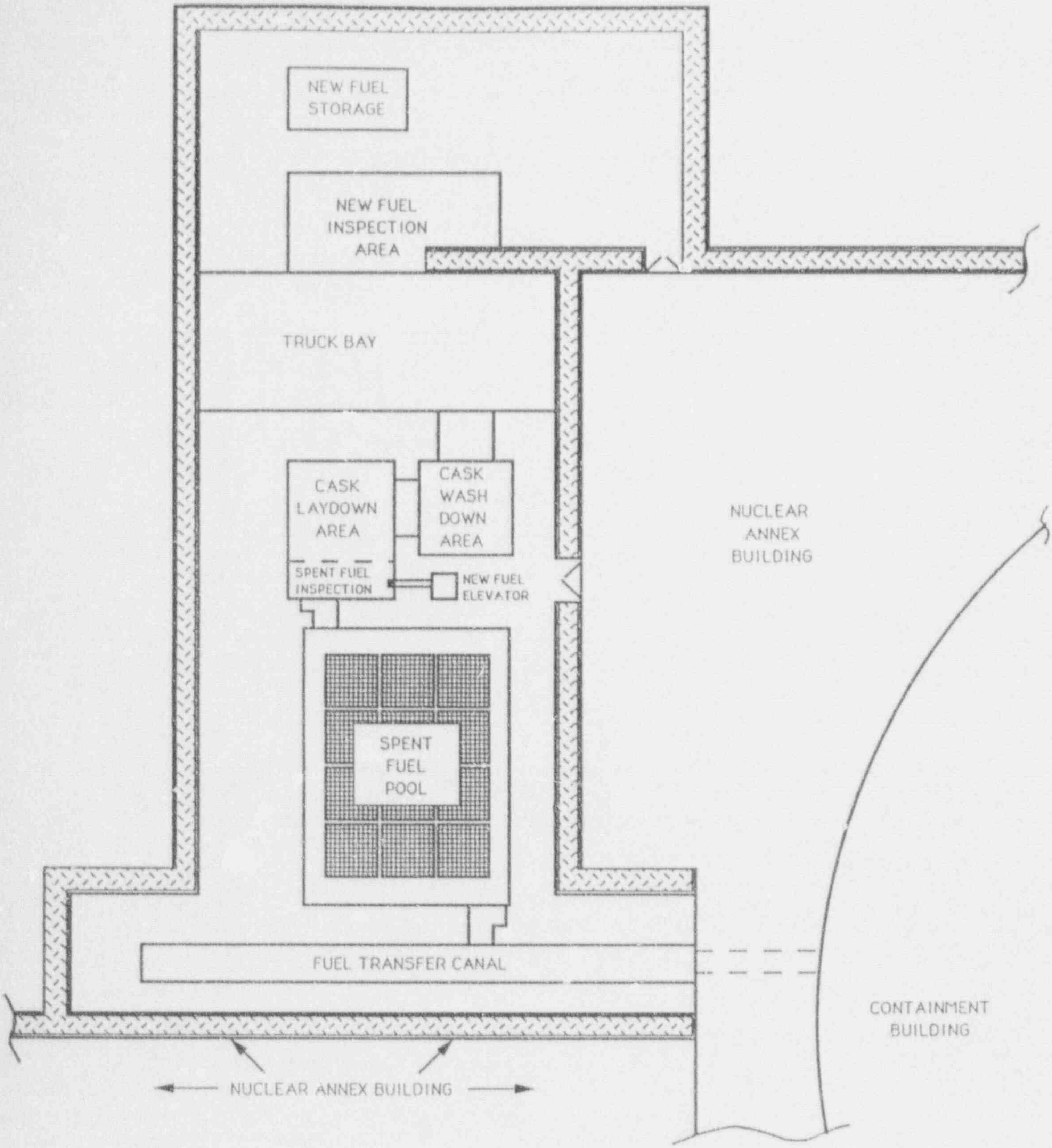

FIGURE 1.9.1-2
SPENT FUEL POOL ARRANGEMENT

1.9.2.2 COMPONENT COOLING WATER SYSTEM

Design Description

The Component Cooling Water System (CCWS) is a closed loop cooling water system that removes heat from the plant's safety related and non-safety related components and heat exchangers during operation, shutdown, refueling, and design basis accident conditions. The CCWS, in conjunction with the Station Service Water System (SSWS) and the Ultimate Heat Sink (UHS), is capable of removing the heat generated by essential components and heat exchangers that require component cooling water to achieve and maintain safe reactor cold shutdown and cooling following a limiting design basis event.

The Component Cooling Water System is an intermediate cooling water system between the Reactor Coolant System (RCS) and the Station Service Water System (SSWS). The CCWS provides protection against station service water leakage into the Reactor Coolant System. The CCWS also is a barrier against the release of radiological contamination into the environment.

The CCWS has two 100% capacity divisions. Each division is connected to its corresponding SSWS division through the component cooling water heat exchangers. Each division has heat dissipation capacity to achieve and maintain safe cold shutdown.

Each division of the CCWS includes two component cooling water heat exchangers, a component cooling water surge tank, two component cooling water pumps, piping, valves, controls, and instrumentation. There are no cross connections between the two divisions. A single failure of any component in the CCWS will not impair the ability of the CCWS to meet its functional requirements. A general conceptual illustration of the CCWS is shown in Figure 1.9.2.2-1 (NOTE 1).

Equipment depicted in Tables 1.9.2.2-2 and 1.9.2.2-3 receives component cooling water flow during the plant operating modes indicated.

The temperature of the component cooling water leaving each component cooling water heat exchanger is regulated by a component cooling water bypass control valve. A flow path is provided in each division to meet each CCWS pump's minimum pumped flow requirements.

The component cooling water surge tanks supply component cooling water at a pressure equal to or greater than each CCWS pump's required NPSH. Each tank allows for expansion and contraction of fluid in the system due to temperature changes and provides a means to monitor fluid leakage into and out of the system.

Fluid losses are accommodated by fluid volume in the surge tank. System venting and filling are accomplished using the surge tanks. Each tank is also provided with an overflow line to protect against overpressurization. Instrumentation is provided to monitor component cooling water level in each surge tank. In the event that surge tank level falls below the low-low level setpoint, CCWS controls isolate component cooling water flow to cooling loops composed of non-nuclear safety class component cooling water piping.

Redundant isolation valves on the supply and return lines for cooling loops composed of non-nuclear safety class component cooling water piping assure the integrity of the safety related portions of the system. All pneumatic valves fail to safe positions upon the loss of instrument air. The valves terminate flow to these cooling loop components upon the receipt of a Safety Injection Actuation Signal (SIAS) except cooling water flow to the reactor coolant pumps.

System water chemistry is controlled to minimize corrosion. The capability is provided to sample water, and to adjust water pH by the addition of chemicals. Organic fouling and inorganic buildups are minimized by water treatment. Radiation monitors and system sampling are provided to detect radioactive contamination in water. Contaminated water can be processed as liquid waste.

Makeup water to the CCWS is supplied by the Demineralized Water Makeup System (DWMS). Makeup to the component cooling water surge tanks is automatic or can be initiated manually by operator action. If the DWMS is unavailable, a safety related backup makeup line of Seismic Category I construction is provided from the Station Service Water System. A removable spool piece on this line prevents the inadvertent addition of station service water. The spool piece does not interconnect independent divisions.

Instrumentation and controls monitor and control the CCWS. Failure of non-safety related instrumentation and controls will not cause degradation of the performance of safety equipment. The following process indications are provided in the Control Room:

A. Component cooling water pump discharge pressure.

B. Component cooling water pump discharge flow.

C. Component cooling water heat exchanger outlet temperature.

D. Component cooling water surge tank level.

E. Component cooling water radiation activity.

The following alarms are provided in the Control Room:

A. Component cooling water pump high and low discharge flow alarms.

B. Component cooling water heat exchanger alarms for high and low outlet temperature.

C. Component cooling water surge tank alarm for high, low, and low-low level.

D. Component cooling water high radiation activity alarm.

Controls are provided to initiate manually or to terminate manually component cooling water flow to components. Flow to each shutdown cooling heat exchanger is initiated and terminated manually from the control room. Flow to each containment spray heat exchanger is initiated automatically upon the receipt of a Containment Spray Actuation Signal (CSAS) and can be terminated manually from the control room. Flow to each spent fuel pool cooling heat exchanger can be initiated and terminated manually from the Control Room. Flow to each spent fuel pool cooling heat exchanger is terminated automatically by a Safety Injection Actuation Signal (SIAS), but can be re-established manually.

Each division of the CCWS consists of essential and non-essential cooling loops. Essential cooling loop piping and components are of ASME Section III Class 3 classification. The component cooling water pumps, component cooling water heat exchangers, and component cooling water surge tanks, are of ASME III Section III Class 3 classification.

Containment isolation valves and containment penetration piping are of ASME Section III Class 2 classification. With the exception of those containment isolation valves that isolate component cooling water flow to the reactor coolant pumps, containment isolation valves within the CCWS close upon receipt of a Containment Isolation Actuation Signal (CIAS).

The essential portions of the CCWS are designed as Seismic Category I. Failure of non-essential portions within the CCWS does not cause degradation of the cooling water flow to safety related components.

Each division of the CCWS receives power from the Class 1E Auxiliary Power System. In the event of a loss of offsite power, each CCWS division receives power from its associated on-site emergency power source (emergency diesel generator).

Components of the CCWS depicted in Figure 1.9.2.2-1 are capable of being inspected and tested (NOTE 1).

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.9.2.2-1 provides the inspections, tests, and/or analyses and associated acceptance criteria for the CCWS.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

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TABLE 1.9.2.2-1

COMPONENT[illegible]LING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The general configuration of the CCWS is shown in Figure 1.9.2.2-1 (NOTE 1).	1. Inspections of the as-built CCWS configuration.	1. Actual CCWS, [illegible] those components shown, conforms with Figure 1.9.2.2-1 (NOTE 1).
2. Each CCWS division has the capacity to dissipate the heat loads of connected condensers, coolers, and heat exchangers.	2. Tests and analysis to verify heat dissipation capacity.	2. Each CCWS division can dissipate the heat loads of connected condensers, coolers, and heat exchangers.
3. Each CCWS division is provided a flow path to meet each CCWS pump's minimum pumped flow requirements.	3. Tests to measure flow in the flow path in each CCWS division. Compare measured flow to each CCWS pump's minimum flow requirement.	3. The CCWS flow in the flow path in each division meets each CCWS pump's minimum flow requirement.
4.a) The following process indications are provided in the control room: A. Component cooling water pump discharge pressure B. Component cooling water pump discharge flow C. Component cooling water heat exchanger outlet temperature D. Component cooling water surge tank level E. Component cooling water radiation activity	4. Inspection of control room instrumentation. Alarm generated by simulated signals.	4.a) The process indicators are provided in the Control Room in accordance with the Table 1.9.2.2-1, Certified Design Commitment No. 4a.

TABLE 1.9.2.2-1 (Continued)

COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4.b) The following alarms are provided in the Control Room: A. Component cooling water pump high and low discharge flow alarm. B. Component cooling water heat exchanger alarms for high and low outlet temperature. C. Component cooling water surge tank alarm for high, low, and low-low level. D. Component cooling water high radiation activity alarm.		4.b) The alarms are provided in the Control Room in accordance with the Table 1.9.2.2-1, Certified Design Description, No. 4b. Alarms actuate in response to simulated signals.
5. Controls are provided to initiate manually or to terminate component cooling water flow to the following components as specified below:	5. Tests of initiation and termination, both automatically and manually, of component cooling water flow from the Control Room. SIAS and CSAS signals are simulated.	5. CCWS controls operate in accordance with the Table 1.9.2.2-1, Certified Design Commitment, No. 5.

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TABLE 1.9.2.2-1 (Continued)

COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. (Continued) a. Flow to each shutdown cooling heat exchanger can be initiated and terminated manually from the Control Room. b. Flow to each containment spray heat exchanger is initiated automatically upon the receipt of a Containment Spray Actuation Signal (CSAS) and can be terminated manually from the Control Room. c. Flow to each spent fuel pool cooling heat exchanger can be initiated and terminated manually in the Control Room. Flow to each spent fuel pool cooling heat exchanger is terminated automatically by a Safety Injection Actuation Signal (SIAS). Flow can be reestablished manually.		

TABLE 1.9.2.2-1 (Continued)

COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6.a) Redundant isolation valves are provided on the supply and return lines for cooling loops composed of non-nuclear safety class component cooling water piping.	6.a) Inspection of construction records and as-built installation.	6.a) Redundant isolation valves are provided.
b) The isolation valves close upon receipt of a SIAS.	b) Test for closure of valves using a simulated SIAS signal.	b) Isolation valves close in response to a simulated SIAS signal.
7. Containment isolation valves and containment penetration piping are designed in accordance with ASME Section III Class 2 (date) requirements. Containment isolation valves close upon the receipt of a Containment Isolation Actuation Signal (CIAS) with the exception of those containment isolation valves which isolate component cooling water flow to the reactor coolant pumps.	7. Review of plant records to verify compliance. Test containment isolation valve closure using simulation of a CIAS.	7. Containment isolation valves and penetration piping meet ASME Section III Class 2 (date) requirement. Containment isolation valves close on a CIAS signal with the exception of those containment isolation valves which isolate component cooling water flow to the reactor coolant pumps.

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TABLE 1.9.2.2-1 (Continued)

COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8. Level indications and controls isolate supply and return lines of cooling loops composed of non-nuclear safety class component cooling water piping in the event of a low-low surge tank level.	8. Simulate a low-low surge tank signal to test the response of valves that isolate cooling loops composed of non-nuclear safety class component cooling water piping.	8. The affected valves isolate supply and return lines consisting of non-nuclear safety class component cooling water piping in response to a simulated low-low surge tank level signal.
9. Pneumatically operated valves fail to safe positions upon the loss of instrument air.	9. Simulate loss of instrument air conditions to test response of valves operated by instrument air.	9. The affected valves respond to a loss of instrument air by failing to their safe positions.
10. The CCWS components required to supply cooling water to safety related equipment are Seismic Category I and qualified for the environment for locations where installed.	10. See Generic Equipment Qualification (ITA)	10. See Generic Equipment Qualification (AC).
11. Each CCWS division operates when powered from the Class 1E Auxiliary Power System or its on-site emergency power source (Emergency Diesel Generator).	11. CCWS functional tests to demonstrate operation when supplied by the Class 1E Auxiliary Power Source or its on-site emergency power source.	11. Each CCWS division is capable of operating when supplied by either its Class 1E Auxiliary Power Source or its on-site emergency power source.

TABLE 1.9.2.2-1 (Continued)

COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
12. The CCWS design permits periodic inspection and testing of CCWS components depicted in Figure 1.9.2.2-1 (NOTE 1).	12. Evaluation of the as-built configuration will be performed.	12. The CCWS components depicted in Figure 1.9.2.2-1 are accessible for periodic inspections and testing.
13. Available NPSH meets or exceeds required CCWS pump net positive suction head for conditions under which the CCWS pumps must operate.	13. Inspect pump vendor data to determine NPSH required by the as-procured pump. Actual system installation will be inspected, and/or measurements taken to determine available pump NPSH.	13. Minimum pump NPSH, as determined based on as-built conditions and the results of vendor tests and/or analyses, meets or exceeds as-procured pump NPSH requirements.
14a) System water chemistry is controlled. The capability is provided to sample water, and to adjust water pH by addition of chemicals. b) Radiation monitors and system sampling are provided to detect radioactive contamination in water. Contaminated water can be processed as liquid waste.	14. Inspection of installation records and plant walkdowns to ensure provisions for sampling, chemical addition, radiation monitoring, and processing as liquid wastes.	14. The CCWS includes provisions for sampling, chemical addition, radiation monitoring, and processing as liquid waste.

TABLE 1.9.2.2-1 (Continued)

COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
15. The CCWS components shown in Figure 1.9.2.2-1 are installed, and CCWS mechanical equipment is built in accordance with ASME Section III requirements that are shown in Figure 1.9.2.2-1 (NOTE 1).	15. Inspect Code Data Reports for installation and components. Inspect the systems and components for N stamps for ASME Section III components.	15. CCWS installation and components have required ASME Section III class code stamps per the Code Classes shown in Figure 1.9.2.2-1 for each component (NOTE 1).

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

TABLE 1.9.2.2-2

COMPONENT COOLING WATER CONSUMERS

Division 1

Operating Mode/ Components	Normal Operation	Shutdown Cooling Initial	Shutdown Cooling Final	Refueling	Design Basis Accident
ESSENTIAL	Note a				
Shutdown cooling heat exchanger	-	X	X	X	-
Containment spray heat exchanger	-	-	-	-	X
Spent fuel pool cooling heat exchangers	X (Note b)	-	X (Note b)	X	-
Diesel Generator	X	X	X	X	X
Others (essential) (Note c)	X	X	X	X	X

TABLE 1.9.2.2-2 (Continued)

COMPONENT COOLING WATER CONSUMERS

Division 1

Operating Mode/ Components	Normal Operation	Shutdown Cooling Initial	Shutdown Cooling Final	Refueling	Design Basis Accident
NON-ESSENTIAL					
Reactor coolant pumps and pump motors	X	X	X	X	X
Charging pump motor coolers	X	X	X	X	X
Charging pump miniflow heat exchanger	X	X	X	X	X
Others (non-essential) (Note d)	X	X	X	X	-

TABLE 1.9.2.2-3

COMPONENT COOLING WATER CONSUMERS

Division 2

Operating Mode/ Components	Normal Operation	Shutdown Cooling Initial	Shutdown Cooling Final	Refueling	Design Basis Accident
ESSENTIAL		Note a			
Shutdown cooling heat exchanger	-	X	X	X	-
Containment spray heat exchanger	-	-	-	-	X
Spent fuel pool cooling heat exchangers	X (Note b)	-	X (Note b)	X	-
Diesel generator	X	X	X	X	X
Others (essential) (Note c)	X	X	X	X	X

TABLE 1.9.2.2-3 (Continued)

COMPONENT COOLING WATER CONSUMERS

Division 2

Operating Mode/ Components	Normal Operation	Shutdown Cooling Initial	Shutdown Cooling Final	Refueling	Design Basis Accident
NON-ESSENTIAL					
Reactor coolant pumps and pump motors	X	X	X	X	X
Charging pump motor coolers	X	X	X	X	X
Charging pump miniflow heat exchanger	X	X	X	X	X
Others (Non-essential) (Note d)	X	X	X	X	-

NOTES FOR TABLES 1.9.2.2-2 AND 1.9.2.2-3

a. (X) = Equipment receives component cooling water flow in this mode
(-) = Equipment does not receive component cooling water flow in this mode

b. Either or both spent fuel pool cooling heat exchangers can receive flow during this operating mode.

c. Pump motor coolers, miniflow heat exchangers, and essential chilled water condensers are included in this category.

d. Normal chilled water condensers, instrument air compressors, letdown heat exchanger, sample heat exchangers, gas stripper, and boric acid concentrator are included in this category.

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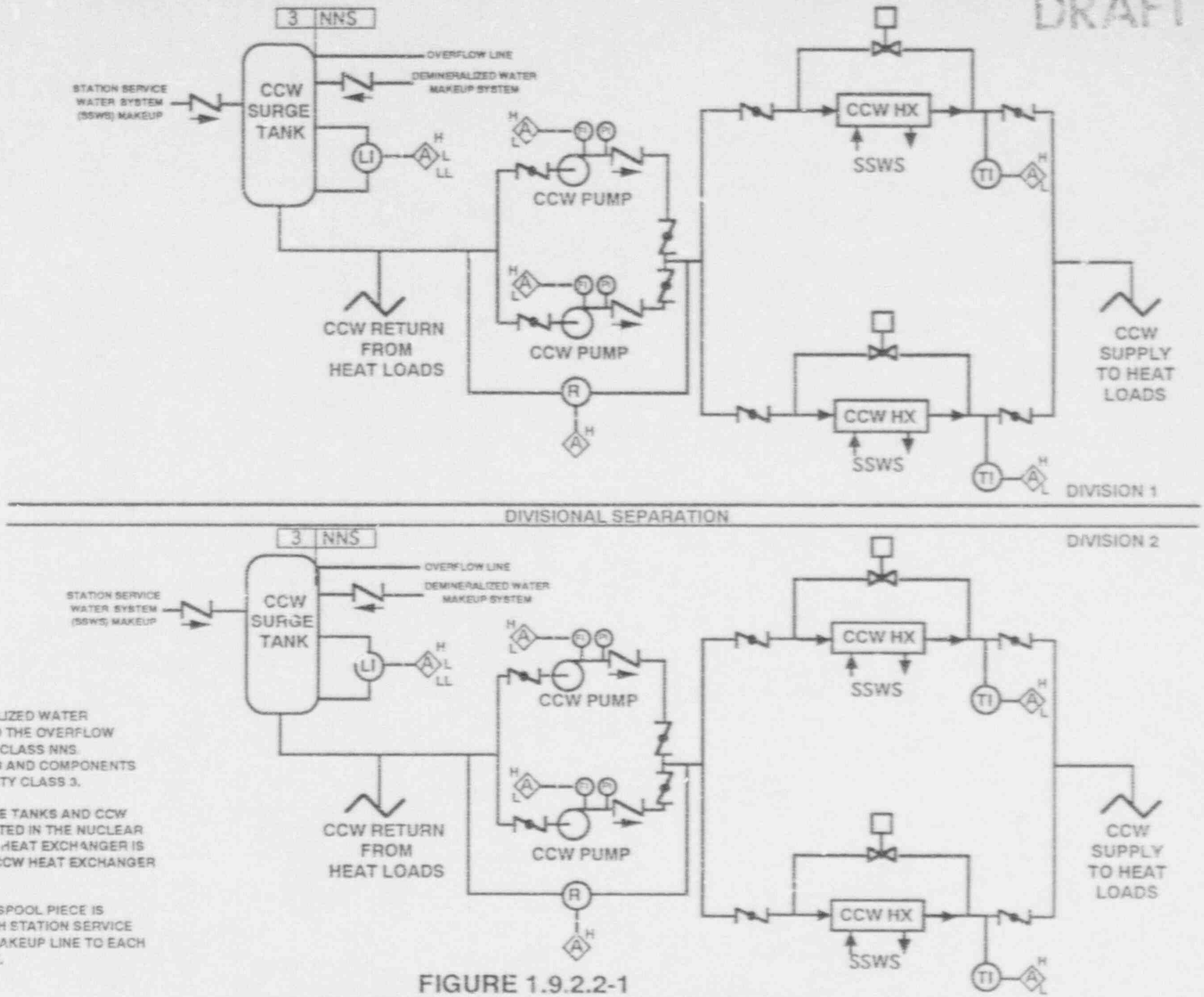

NOTES:

A. THE DEMINERALIZED WATER MAKEUP LINE AND THE OVERFLOW LINE ARE SAFETY CLASS NNS. ALL OTHER PIPING AND COMPONENTS SHOWN ARE SAFETY CLASS 3.

B. THE CCW SURGE TANKS AND CCW PUMPS ARE LOCATED IN THE NUCLEAR ANNEX. THE CCW HEAT EXCHANGER IS LOCATED IN THE CCW HEAT EXCHANGER STRUCTURE.

C. A REMOVABLE SPOOL PIECE IS LOCATED ON EACH STATION SERVICE WATER SYSTEM MAKEUP LINE TO EACH CCW SURGE TANK.

FIGURE 1.9.2.2-1
COMPONENT COOLING WATER SYSTEM

1.9.6 COMPRESSED AIR SYSTEMS

Design Description

The Compressed Air Systems (CAS) are non-safety related systems consisting of the Instrument Air System (IAS), the Station Air System (SAS), and the Breathing Air System (BAS). The Instrument Air System supplies compressed air to air-operated instrumentation, air-operated controls, and air-operated valves. The Station Air System supplies compressed air for air-operated tools, and provides compressed air for general use in the plant. The Breathing Air System supplies compressed air for breathing protection.

The Compressed Air Systems are Class NNS (Non-Nuclear Safety) with the exception of the containment isolation valves and associated piping, which are ASME Code Class 2 and Seismic Category I classification. Each containment penetration is isolatable by two independent valves.

The Compressed Air Systems are not required to achieve or maintain a safe reactor shutdown. Loss of Compressed Air Systems functions trigger alarms in the Control Room.

The IAS has four redundant trains. Each train has 100% capacity and includes an air intake filter/silencer, an air compressor, an air receiver, an air dryer/filter train, and associated piping and valves. A general conceptual illustration of the IAS is shown in Figure 1.9.6-1 (NOTE 1).

Loss of instrument air due to a failure of the IAS causes all of the pneumatically-operated, safety-related components to fail to their safe positions. Therefore, failure of the IAS will not prevent safety-related components or systems from performing safety functions.

The SAS has two redundant trains. Each SAS train has 100% capacity and includes an air intake filter/silencer, an air compressor, an air receiver, an air dryer/filter, and associated piping and valves. A general conceptual illustration of the SAS is shown in Figure 1.9.6-2 (NOTE 1).

The BAS has two trains. Each BAS train has 100% capacity and includes an air intake filter/silencer, a breathing air compressor, an air receiver, a breathing air purifier, and associated piping and valves. A general conceptual illustration of the BAS is shown in Figure 1.9.6-3 (NOTE 1).

Instrumentation is provided to monitor compressed air systems pressure and to control the systems automatically or manually under operating conditions.

The Compressed Air Systems are supplied electrical power from the off-site power source. Compressed Air Systems contair ient isolation valve actuators receive electric power from the Class 1E Auxiliary Power System. The IAS can be powered from the on-site Non-Class 1E Alternate AC Source Standby Power Supply.

The Compressed Air Systems are designed to permit inspection and testing of the air compressors, receivers, dryers, filters, piping, and valves illustrated in Figures 1.9.6-1, 1.9.6-2 and 1.9.6-3 (NOTE 1).

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.9.6-1 provides the inspections, tests, and/or analyses and their with associated acceptance criteria for the CAS.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

TABLE 1.9.6-1

COMPRESSED AIR SYSTEMS
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The general configuration of the IAS is shown in Figure 1.9.6-1 (NOTE 1).	1. Inspections of the as-built IAS configuration.	1. Actual IAS configuration, for those components shown, conforms with Figure 1.9.6-1 (NOTE 1).
2. The general configuration of the SAS is shown in Figure 1.9.6-2 (NOTE 1).	2. Inspections of the as-built SAS configuration.	2. Actual SAS configuration, for those components shown, conforms with Figure 1.9.6-2 (NOTE 1).
3. The general configuration of the BAS is shown in Figure 1.9.6-3 (NOTE 1).	3. Inspections of the as-built BAS configuration.	3. Actual BAS configuration, for those components shown, conforms with Figure 1.9.6-3 (NOTE 1).
4. The CAS operates when powered from the off-site power source.	4. CAS functional tests to demonstrate operation when powered from the off-site power source.	4. The CAS operates when supplied by the off-site power source.
5. The IAS can be powered from the Non-Class 1E Alternate AC Source Standby Power Supply.	5. An IAS functional test to demonstrate operation when powered by the Non Class 1E Alternate AC Source Standby Power Supply.	5. The IAS is capable of operating when supplied from the Non-Class 1E Alternate AC Source Standby Power Supply.

TABLE 1.9.6-1 (Continued)

COMPRESSED AIR SYSTEMS
Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. The CAS containment penetrations are isolatable by two independent valves.	6. Inspection of construction records and actual system installation.	6. The CAS containment penetrations are isolatable by two independent valves.
7. The CAS designs permit periodic inspections and testing of CAS components depicted in Figures 1.9.6-1, 1.9.6-2, and 1.9.6-3 (NOTE 1).	7. Evaluation of the CAS.	7. The CAS components depicted in Figures 1.9.6-1, 1.9.6-2, and 1.9.6-3 are accessible for periodic inspections and testing (NOTE 1).
8. The CAS containment isolation valve actuators receive electric power from the Class 1E Auxiliary Power System.	8. Inspection of installed components.	8. The CAS containment isolation valve actuators are powered from the Class 1E Auxiliary Power System.
9. Upon loss of instrument air due to a failure of the IAS, all of the pneumatically-operated, safety related components fail to their safe positions.	9. Test the function of each pneumatically-operated, safety related component with simulated loss of compressed air.	9. All of the pneumatically-operated, safety related components fail to tl r safe positions upon a simulated loss of compressed air.

NOTE 1: Such diagrams are for the prpose of illustrating the general conceptual design features of t he System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the

certified design.

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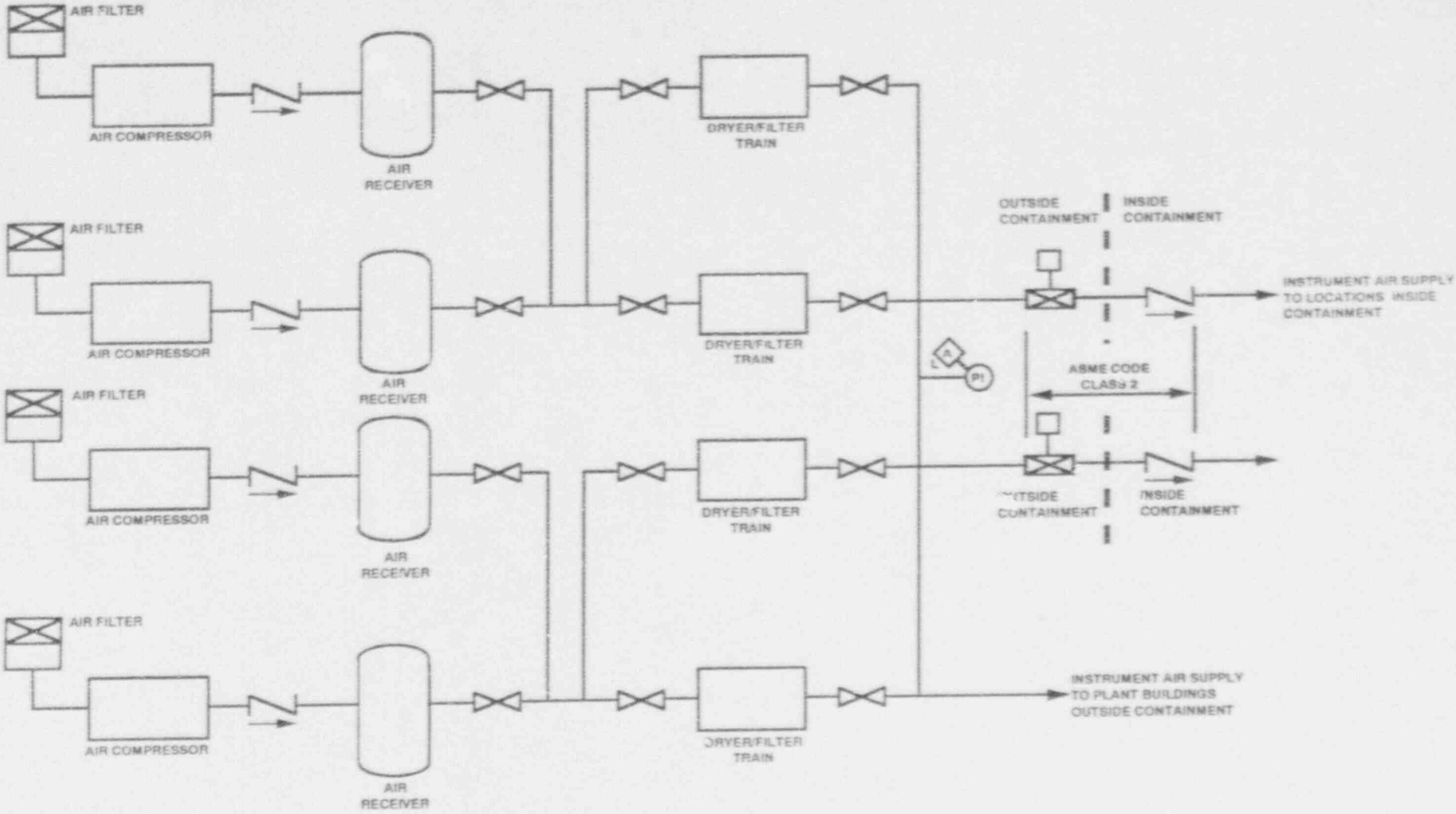

FIGURE 1.9.6-1
INSTRUMENT AIR SYSTEM

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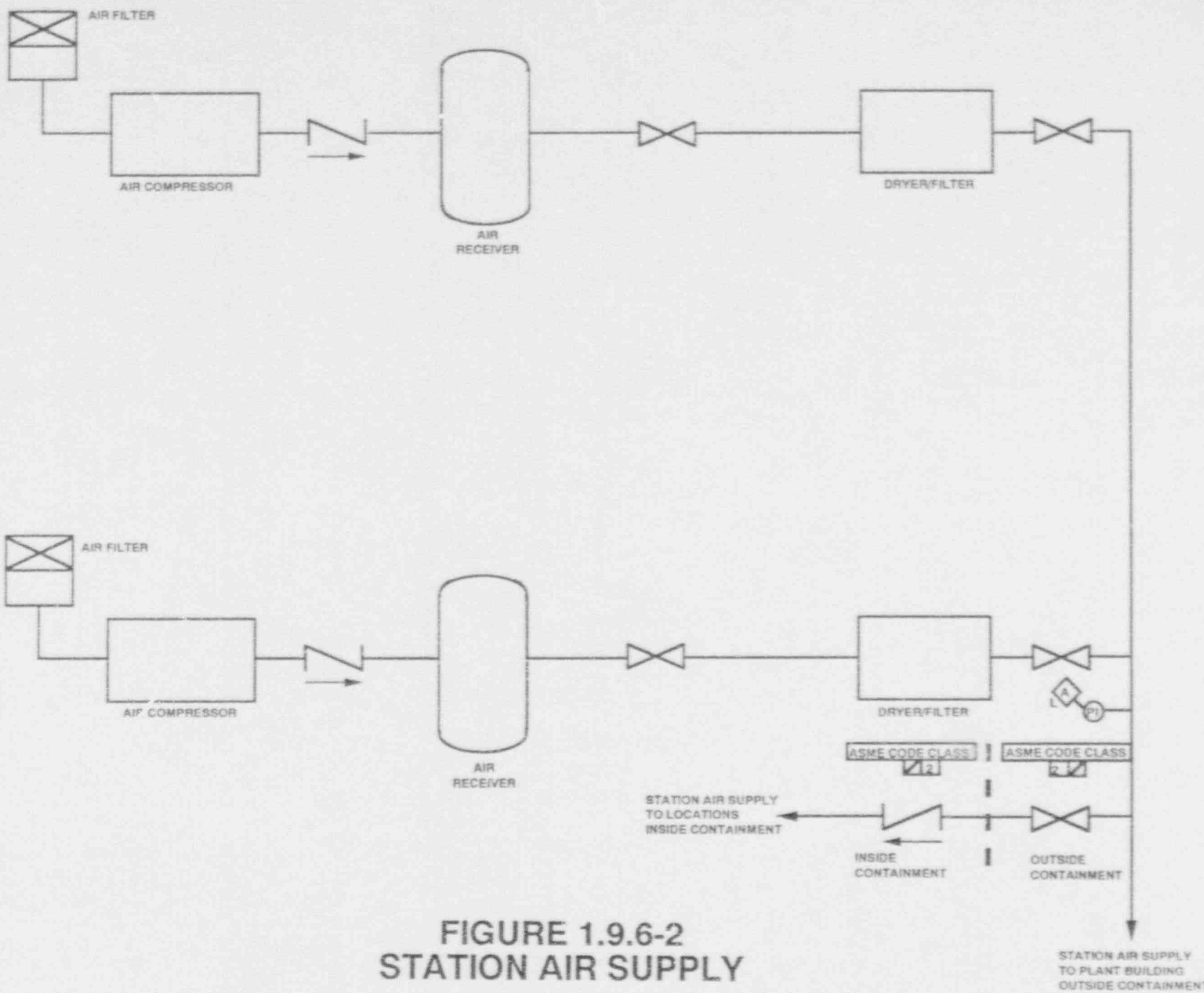

FIGURE 1.9.6-2
STATION AIR SUPPLY

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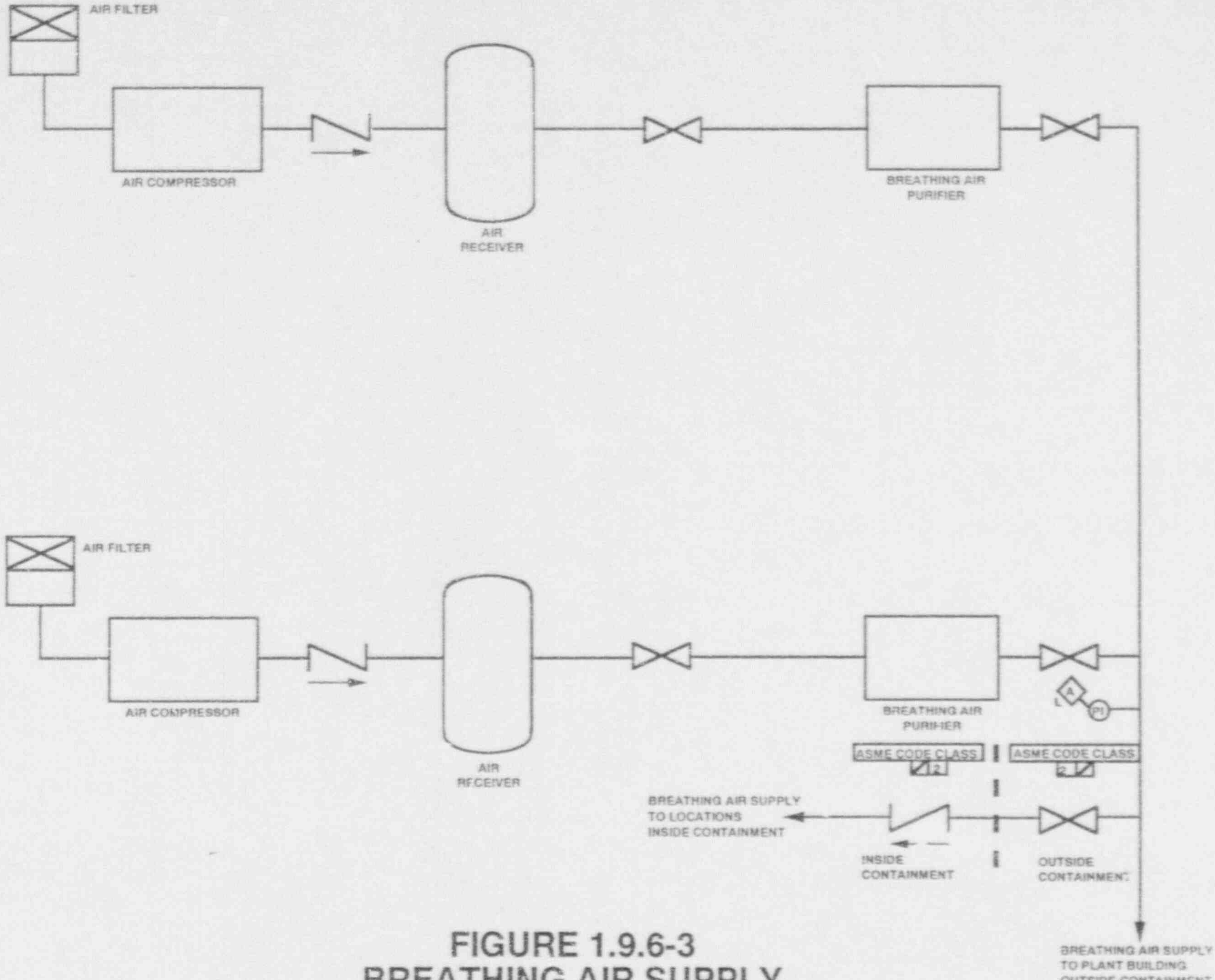

FIGURE 1.9.6-3
BREATHING AIR SUPPLY

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1.11.1 LIQUID WASTE MANAGEMENT SYSTEM

Design Description

The Liquid Waste Management System (LWMS) provides the capability to collect, segregate, store, process, sample, and monitor radioactive liquid waste. The LWMS is classified as a non-nuclear safety (NNS) system containing no safety class components except for containment isolation valves and penetrations which are of Safety Class 2. The LWMS is a non-seismic qualified system.

Radioactive liquid waste is segregated into the following categories:

1. Equipment drain waste which includes, for example, degassed reactor grade radioactive liquid waste

2. Floor drain waste which includes, for example, non-reactor grade radioactive liquid waste

3. Detergent waste which includes, for example, laundry and hot shower waste liquids

4. Chemical waste which includes, for example, non-detergent liquid waste

The waste streams are not interconnected prior to collection and processing. The LWMS is not intended to process post-accident sources of liquid wastes. Therefore, the LWMS is isolated in post-accident conditions by operator action.

The equipment drain waste subsystem provides for filtration, decontamination, batch sampling, and recirculation capability for further processing. A general conceptual illustration of the equipment drain waste subsystem is shown in Figure 1.11.1-1 (NOTE 1).

The floor drain waste subsystem provides for filtration, decontamination, batch sampling, and recirculation capability for further processing. A general conceptual illustration of the floor drain waste subsystem is shown in Figure 1.11.1-2 (NOTE 1).

The floor drain waste subsystem has the additional capability for oil/crud removal, flocculent addition to collection tanks, and pH adjustment of liquid waste systems.

The chemical waste subsystem has the capability for pH adjustment through chemical addition to the collection tank, filtration, batch sampling, and recirculation to the floor drain waste subsystem for further processing. A general conceptual illustration of the chemical waste subsystem is shown in Figure 1.11.1-3 (NOTE 1).

The detergent waste subsystem has the capability for filtration, decontamination by demineralizes, batch sampling, and recirculation to the floor drain subsystem for further processing. A general conceptual illustration of the detergent waste subsystem is shown in Figure 1.11.1-4 (NOTE 1).

This LWMS has collection and storage capacity to process the maximum expected liquid waste volumes, based on anticipated peak daily inputs produced during plant operation, refueling, plant shutdowns, maintenance, and startup operations.

LWMS sample or waste monitor tanks have volumes equivalent or greater than their associated collection tanks. The steam generator drain tank provides surge capacity only and has no associated sample tank or waste monitor tank. In addition, condensate collected in the containment cooler condensate tank is not radioactive, therefore no sample or dedicated waste monitor tank is provided. The LWMS has the capability to divert flows within the LWMS for additional processing.

The system processes radioactive liquid waste so that the concentration of the liquid effluents at the unrestricted discharge point is within the limits specified in 10CFR20, Appendix B, Table II (Date). The LWMS provides minimum decontamination factors of 1000 for radioactive isotopes, except radioactive noble gases and tritium, and a minimum dilution flow of 100 CFS at the unrestricted discharge point.

The LWMS requires that release of processed liquid waste to the environment requires an operator action. Instrumentation and controls to monitor and control LWMS parameters and discharge are provided in the control room. This LWMS can batch-sample and monitor processed liquid waste prior to release to the environment. A radiation monitor is located upstream of the plant discharge and terminates releases of liquid effluents automatically if liquid effluents will exceed the radioactive concentration limits specified in 10CFR20, Appendix B, Table II (date) at the unrestricted discharge point.

(The LWMS is housed in a Radwaste Facility. This facility provides adequate spacing for equipment to permit maintenance, testing and inspections.)

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.11.1-1 provides the inspections, tests and/or analyses and their associated acceptance criteria for the LWMS.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

TABLE 1.11.1

LIQUID WASTE MANAGEMENT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The LWMS is designed and built as follows:	1. Inspection of the as-built LWMS configuration. Inspection of vendor specification for isotope removal factors of LWMS components. Measurement of LWMS flows to unrestricted discharge points.	
a) The general configurations of the LWMS subsystems are shown in Figures 1.11.1-1 through 1.11.1-6 (NOTE 1).		1.a) Actual LWMS subsystem configuration for the components shown, conform with Figures 1.11.1-1 through 1.11.1-6 (NOTE 1).
b) Minimum decontamination factors of 1000 for radioactive isotopes except radioactive noble gases and tritium.		b) Minimum decontamination factors of 1000 ar achieved for radioactive isotopes except radioactive noble gases and tritium.
c) A minimum dilution flow at the unrestricted discharge point of at least 100 CFS.		c) A minimum dilution flow of 100 CFS is achieved.
d) R[illegible]rculation capability for a[illegible]onal processing of liquid wastes.		d) Liquid wastes can be recirculated for additional processing.

TABLE 1.11.1 (Continued)

LIQUID WASTE MANAGEMENT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
2. Each LWMS subsystem described in the Design Description has process flow and storage capacity to process the anticipated daily input produced during plant operation, refueling, plant shutdowns, maintenance, and startup operations.	2. Inspection and tests of process flows and storage capacities of as-built LWMS subsystem.	2. The LWMS subsystems process flows and storage capacities process the anticipated daily input produced during plant operation, refueling, plant shutdowns, maintenance, and startup operations.
3. The LWMS reduces the concentration of radioactive isotopes in liquid effluents to levels that conform to limits for releases to unrestricted areas that are specified in 10CFR20, Appendix B, Table II (Date).	3. Analysis of design specifications and as-built LWMS performance data.	3. The LWMS meets the Table 1.11.1-1, Certified Design Description, No. 3.
4. The LWMS can sample and monitor effluent batches prior to release to unrestricted areas. a) Sampling capability is provided for each collection tank prior to processing and for each waste monitor tank and sample tank prior to release of liquid effluent to the environment.	4. Inspection of as-built LWMS subsystems.	4.a) Sampling capabilities exist for: 1) Each collection tank prior to processing. 2) Each waste monitor and sample tank upstream of the plant unrestricted discharge point.

TABLE 1.11.1 (Continued)

LIQUID WASTE MANAGEMENT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

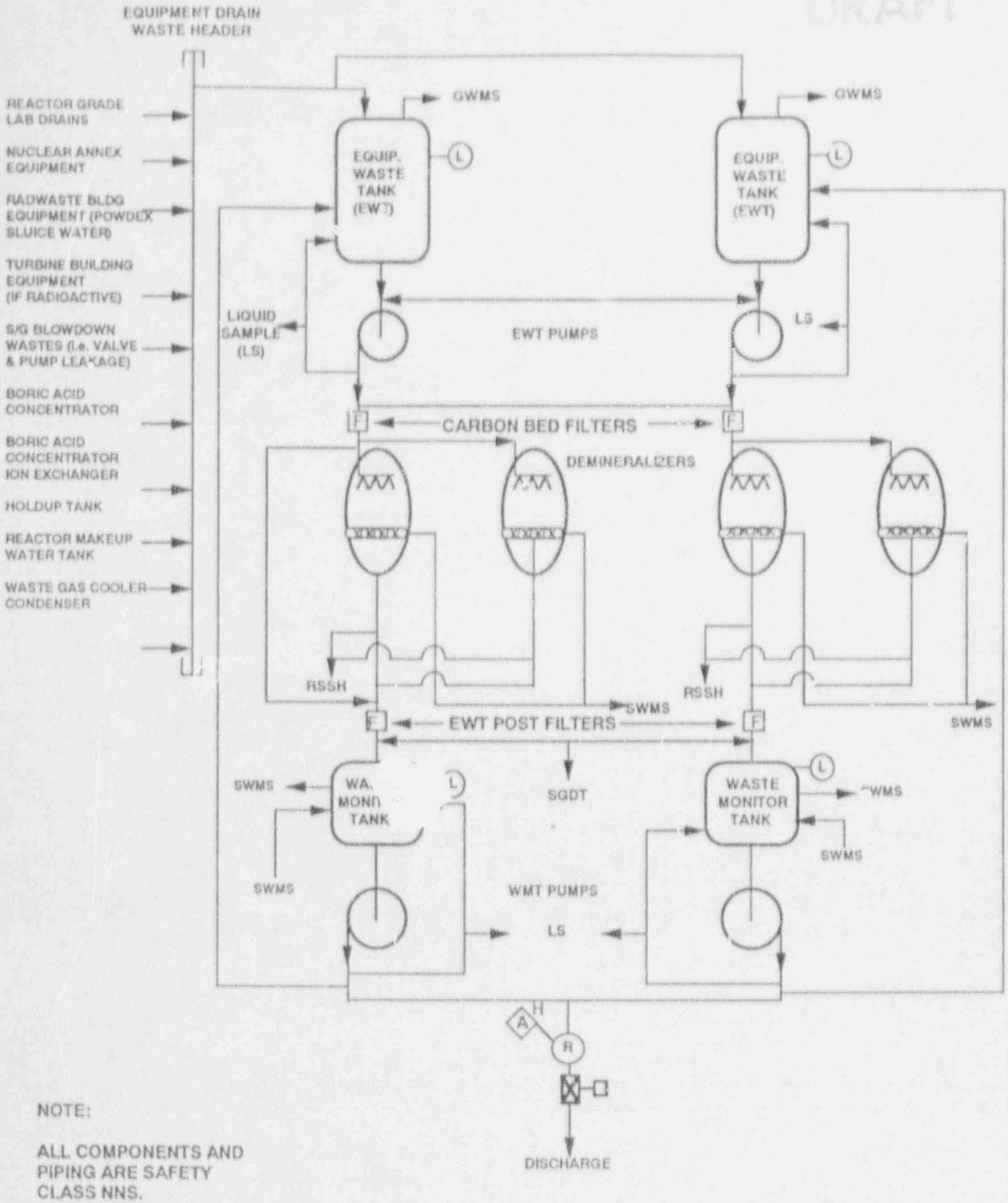
Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4.b) Radiation monitoring is provided upstream of the plant unrestricted discharge point.	4. (continued)	4.b) Radiation monitoring equipment is located upstream of the plant unrestricted discharge point.
5.a) Radioactive liquid wastes are segregated into: 1) Equipment drain waste 2) Floor drain wastes 3) Detergent wastes 4) Chemical wastes	5. Inspections of as-built systems will be performed.	5.a) Radioactive wastes are segregated into four waste streams: 1) Equipment drain waste 2) Floor drain waste 3) Detergent waste 4) Chemical waste
b) The equipment drain, the floor drain, the detergent, and the chemical waste streams are not interconnected prior to collection and processing.		b) The four waste streams are not interconnected prior to collection and processing.
6. The LWMS components shown in Figures 1.11.1-1 through 1.11.1-6 are installed, and LWMS mechanical equipment is built in accordance with ASME Section III requirements that are shown in Figures 1.11.1-1 through 1.11.1-6 (NOTE 1).	6. Inspect Code Data Reports for installation and components. Inspect the systems and components for N stamps for ASME Section III components.	6. LWMS installation and components have required ASME Section III class code stamps per the Code Classes shown in Figures 1.11.1-1 through 1.11.1-6 (NOTE 1).

TABLE 1.11.1 (Continued)

LIQUID WASTE MANAGEMENT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. The instrument indications and controls shown in Figures 1.11.1-1 through 1.11.1-6 are available in the control room with provisions to isolate the LWMS inlet waste flows (NOTE 1).	7. Inspect instrumentation indications and controls in the control room.	7.a) The LWMS instrumentation indications and controls shown in Figures 1.11.1-1 through 1.11.1-6 are located in the control room (NOTE 1). b) The LWMS subsystems inlet waste flows can be isolated with controls located in the control room.
8. Release of processed liquid waste to unrestricted areas can be initiated only by manual action.	8. Test LWMS subsystem controls.	8. Release of liquid effluents to unrestricted areas can be initiated only by manual action.
9. Liquid effluent discharge to unrestricted areas is terminated automatically when the limits of 10CFR20, Appendix B, Table II (date) will be exceeded.	9. Test of the as-built LWMS subsystems using signals that simulate excedence of limits.	9. Liquid wastes discharge to unrestricted areas is terminated automatically in response to signals that simulate excedence of limits.
10. The LWMS subsystems are accessible for periodic inspection, and testing.	10. Inspections of the as-built LWMS subsystems.	10. LMWS subsystems are accessible for inspection, and periodic testing.

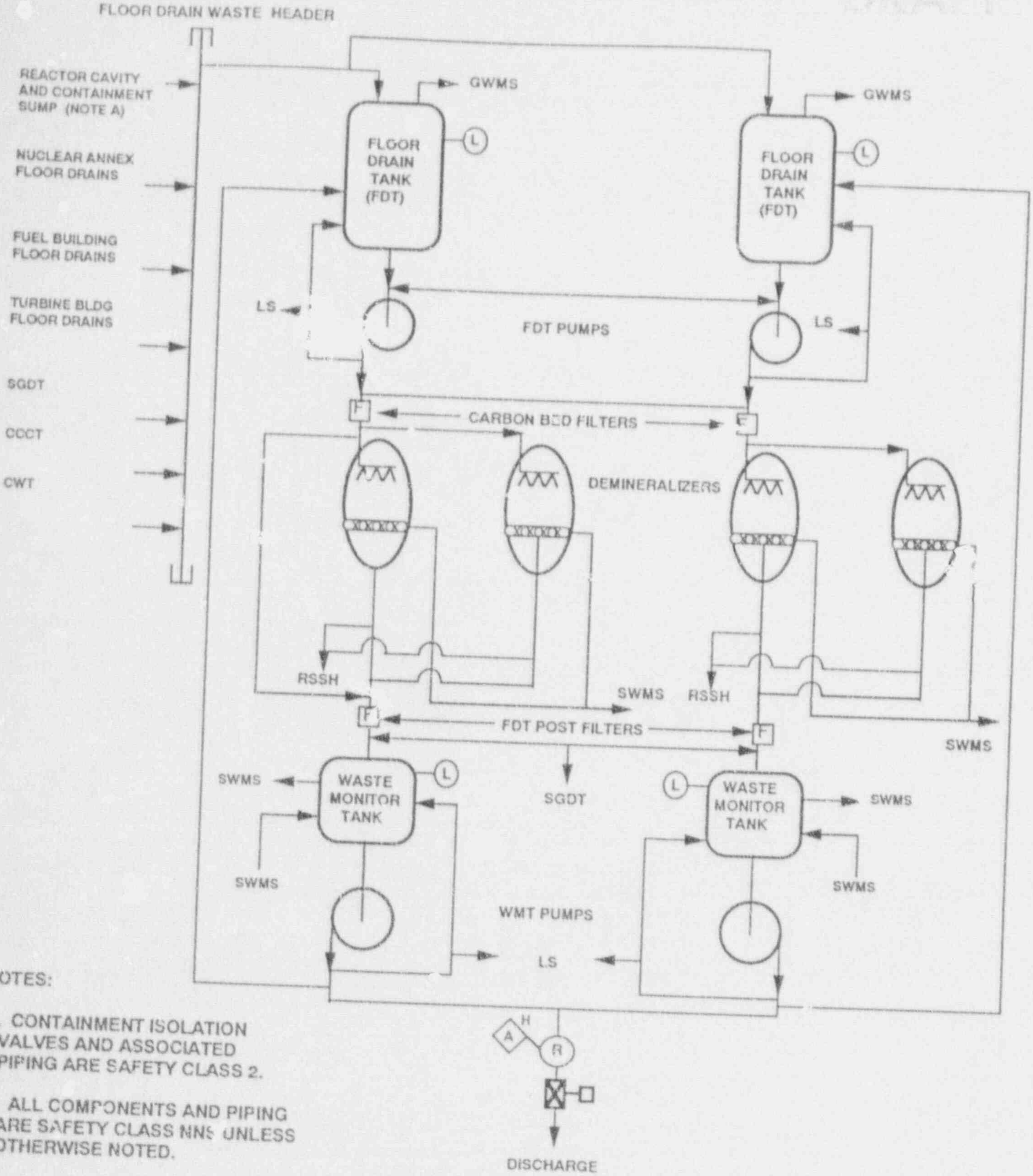
NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.



NOTE:

ALL COMPONENTS AND PIPING ARE SAFETY CLASS NNS.

FIGURE 1.11.1-1
LIQUID WASTE MANAGEMENT SYSTEM



NOTES:

A. CONTAINMENT ISOLATION VALVES AND ASSOCIATED PIPING ARE SAFETY CLASS 2.

B. ALL COMPONENTS AND PIPING ARE SAFETY CLASS NNS UNLESS OTHERWISE NOTED.

FIGURE 1.11.1-2
LIQUID WASTE MANAGEMENT SYSTEM

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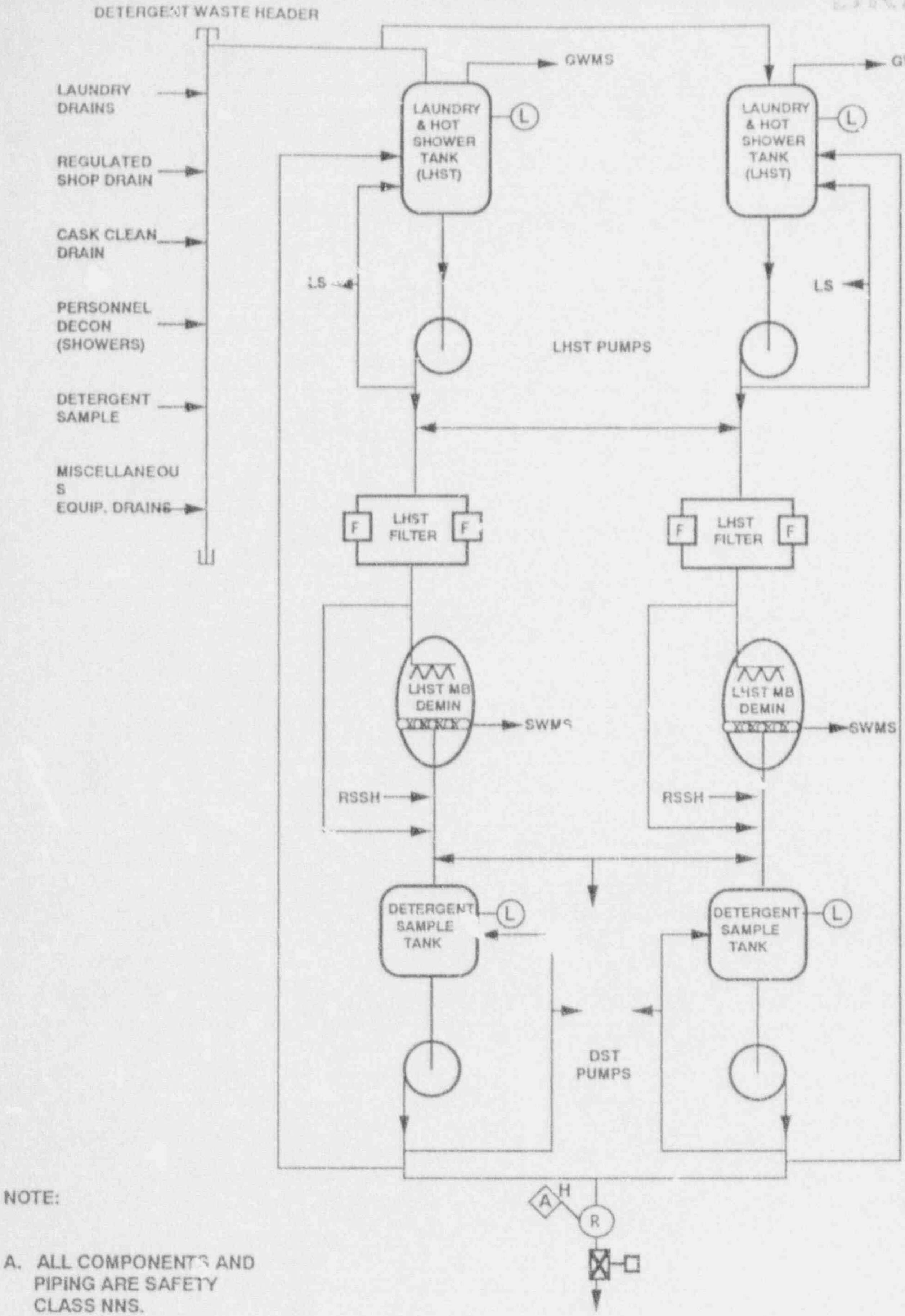


NOTE:

A. ALL COMPONENTS AND PIPING ARE SAFETY CLASS NNS.

FIGURE 1.11.1-3
LIQUID WASTE MANAGEMENT SYSTEM

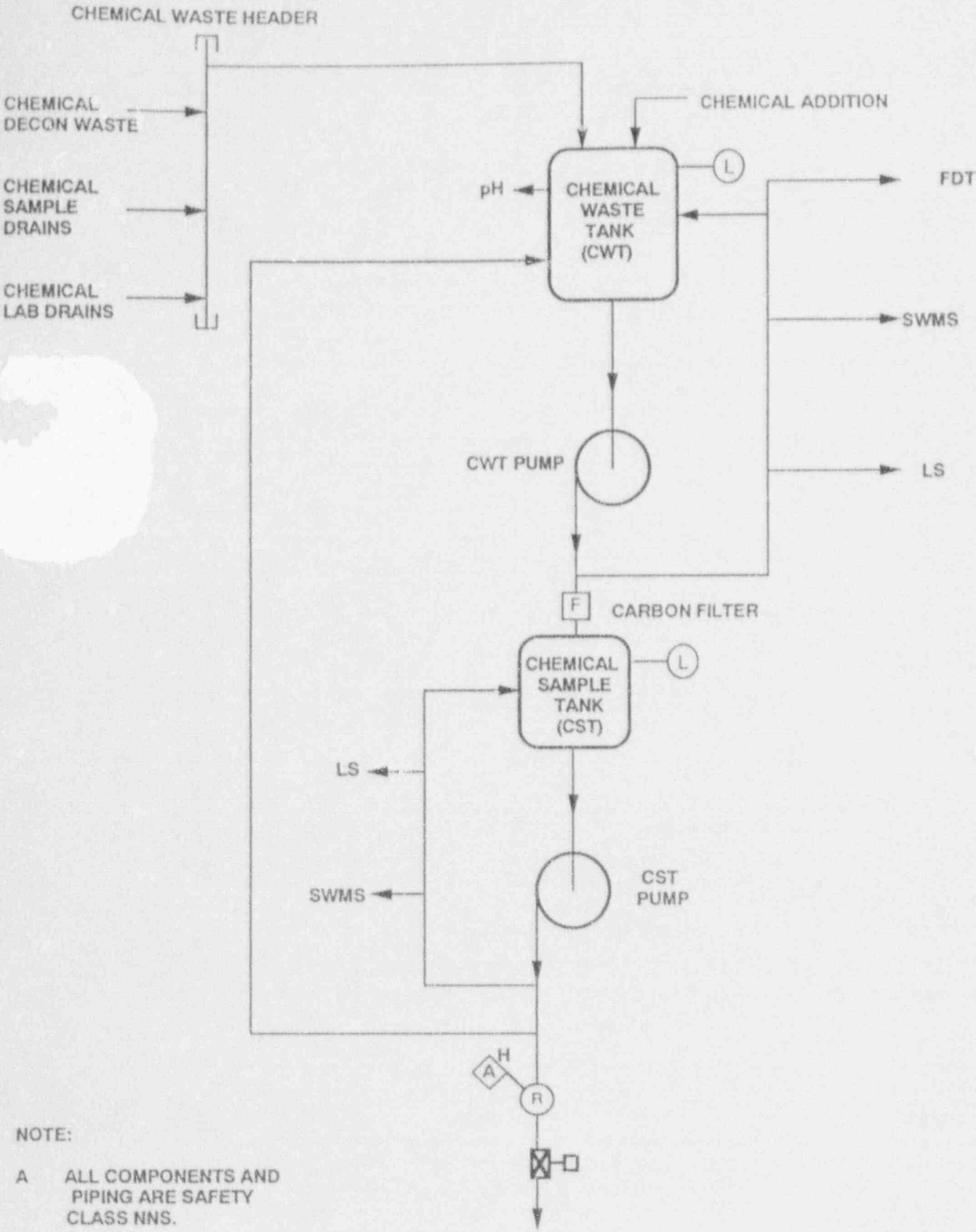
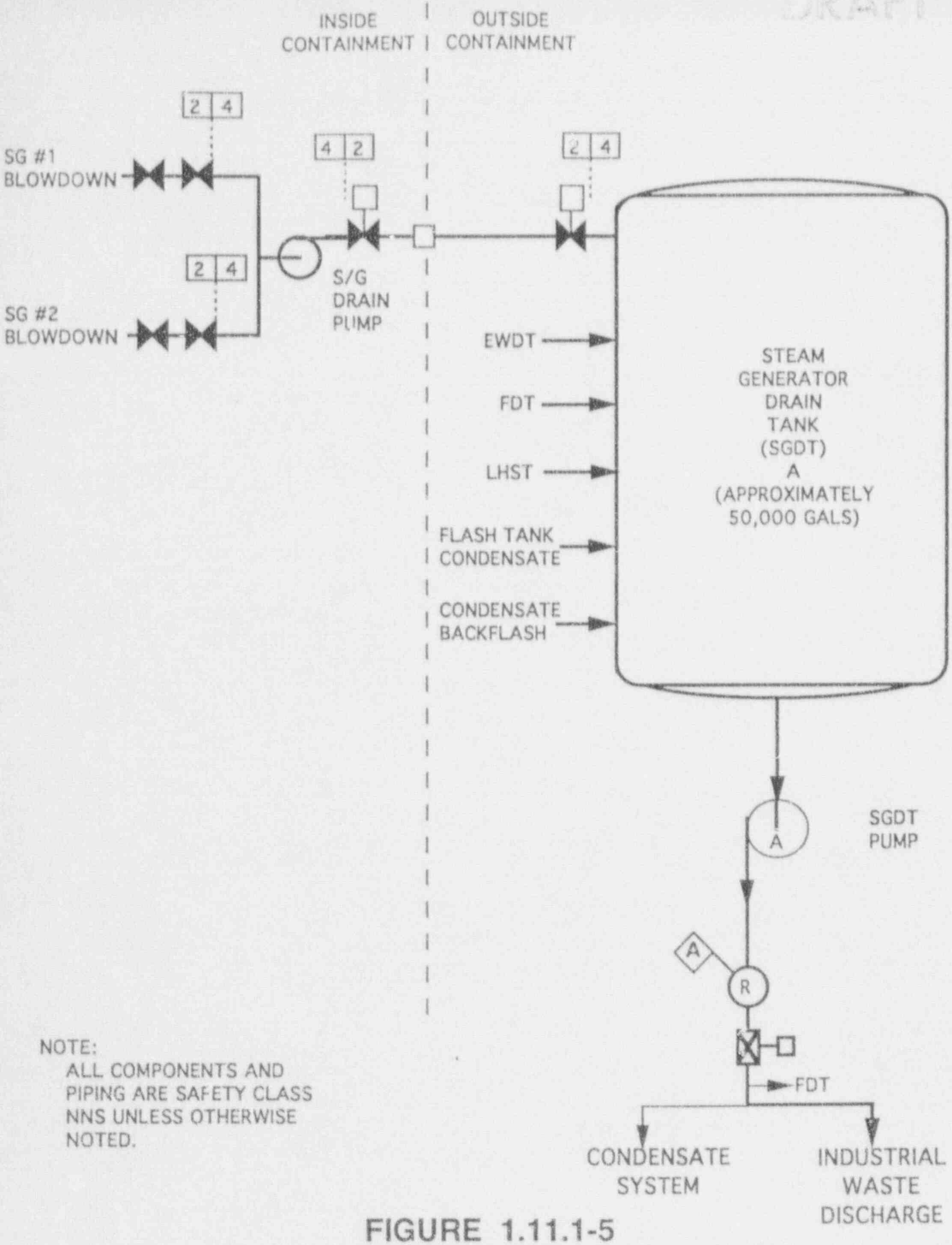


FIGURE 1.11.1-4
LIQUID WASTE MANAGEMENT SYSTEM



NOTE:
ALL COMPONENTS AND PIPING ARE SAFETY CLASS NNS UNLESS OTHERWISE NOTED.

FIGURE 1.11.1-5
LIQUID WASTE MANAGEMENT SYSTEM

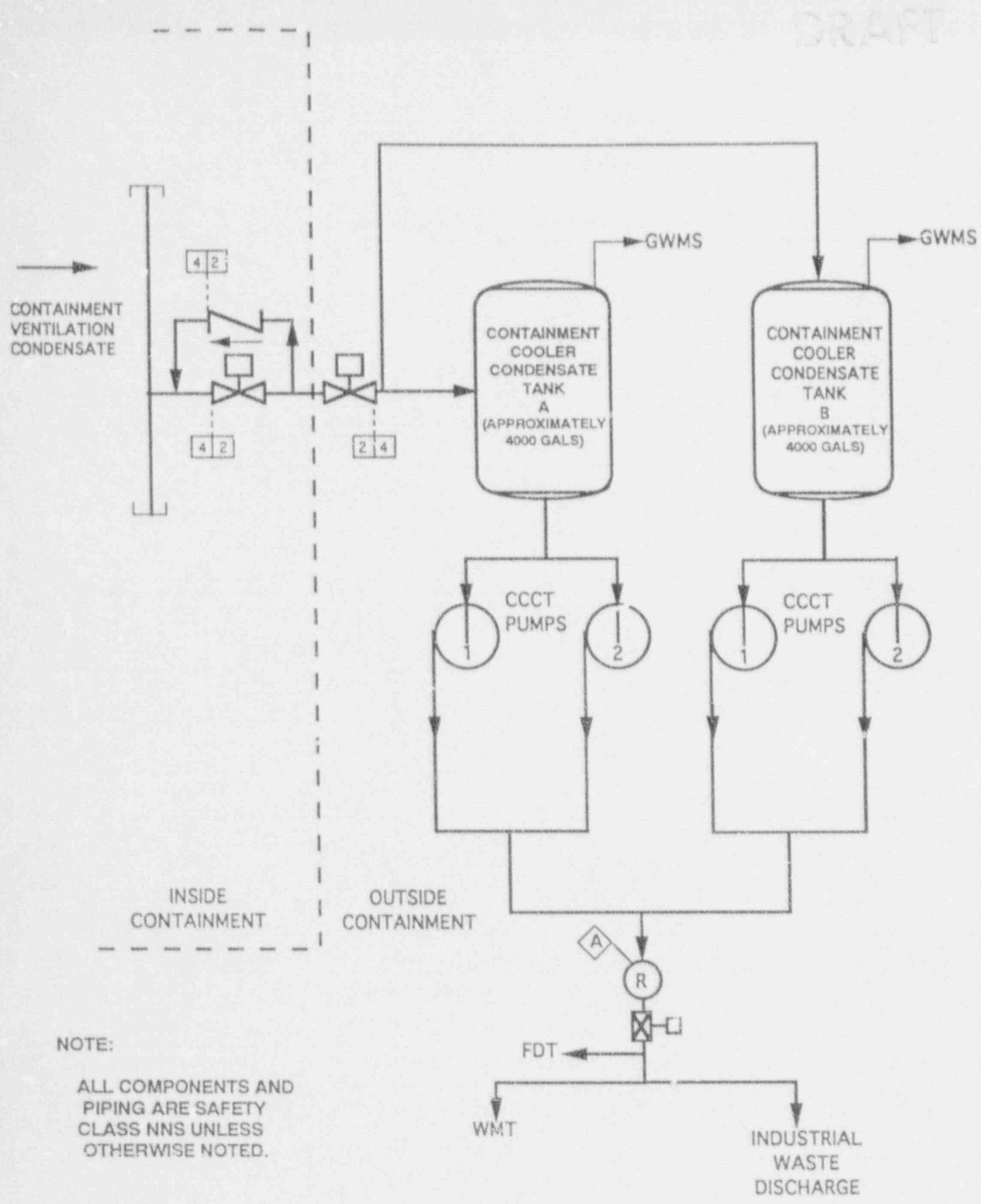


FIGURE 1.11.1-6
LIQUID WASTE MANAGEMENT SYSTEM

1.11.2 GASEOUS WASTE MANAGEMENT SYSTEM

Design Description

The Gaseous Waste Management System (GWMS) collects, stores, processes, samples, and monitors radioactive gaseous waste. The GWMS is a non-nuclear safety (NNS) system containing no safety class components except for containment isolation valves and penetrations which are Safety Class 2.

The GWMS is a charcoal delay system. The GWMS can operate continuously or periodically. The GWMS processes all radioactive gases generated by the plant systems connected to it during plant operations. This system is not intended to process post-accident sources; therefore the GWMS is isolated in post-accident conditions. A general conceptual illustration of the GWMS is shown in Figure 1.11.2-1 (NOTE 1).

The GWMS system contains conditioning equipment (including a cooler-condenser for humidity control and a charcoal guard bed) to minimize moisture and contamination in the charcoal adsorbers and charcoal adsorbers to delay passage of noble gases through the equipment.

The GWMS design precludes the buildup of an explosive mixture of hydrogen and oxygen in the GWMS. Dual gas analyzers monitor the concentration of hydrogen and/or oxygen in the GWMS. Nitrogen purges maintain the concentration of hydrogen and/or oxygen at less than 4%.

The GWMS processes radioactive gaseous waste so that the concentration of the gaseous radioactive effluents discharge to unrestricted areas is within limits specified by 10CFR20, Appendix B, Table II (Date). Effluents from the GWMS are filtered through particulate and activated charcoal filters prior to release at the unit vent to the environment.

The GWMS can continuously monitor concentrations of radioactivity in processed gaseous waste prior to release to the environment. The radiation monitor activates controls to isolate automatically the GWMS discharge if the limits of 10CFR20, Appendix B, Table II (Date) will be exceeded. Leakage rates of processing equipment of the GWMS are within limits specified in ANSI/ANS 55.4, Table 9 (Date).

(The GWMS is located in the Radwaste Facility.)

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.11.2-1 provides the inspections, tests and analyses and their associated acceptance criteria for the GWMS.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.

TABLE 1.11.2-1

GASEOUS \ 'ASTE MANAGEMENT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The GWMS reduces the concentration of radioactive constituents in the gaseous effluents to levels that conform to limits specified in 10CFR20, Appendix B, Table II (date).	1. Analyze design specifications and as-built GWMS performance data.	1. The GWMS meets the Certified Design Description, Table 1.11.2-1, No. 1.
2. The general configuration of the GWMS is shown in Figure 1.11.2-1 (NOTE 1).	2. Inspection of the as-built GWMS configuration shall be performed.	2. Actual GWMS configuration, for those components shown, conforms with Figure 1.11.2-1 (NOTE 1).
3. The GWMS has: a) Minimum carrier gas flow rate of at least 1 scfm.	3.a) Test to measure carrier gas flow rate.	3. The minimum carrier gas flow rate of the GWMS is at least 1 scfm.

TABLE 1.11.2-1 (Continued)

GASEOUS WASTE MANAGEMENT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3. (Continued)	3. (Continued)	3. (continued)
b) Minimum mass of charcoal in adsorber at least 18,000 lbm.	b) Inspect as-built GWMS configuration.	b) The minimum mass of charcoal in the adsorber is greater than 18,000 lbm.
c) Minimum charcoal adsorptivity for Krypton and Xenon of at least: 18.5 cc/gm for Krypton 330 cc/gm for Xenon	c) Inspect vendor specifications on charcoal adsorber.	c) Minimum charcoal adsorptivity for Krypton and Xenon of at least: 18.5 cc/gm Krypton 330 cc/gm Xenon
4. The GWMS precludes a buildup of an explosive mixture of hydrogen and oxygen. The GWMS has:	4.a) Inspect as-built GWMS configuration.	4.a) Dual gas analyzers are provided.
a) Dual gas analyzers for hydrogen and/or oxygen.		
b) Nitrogen purge capability to maintain the hydrogen and/or oxygen concentrations at less than 4%.	b) Test to measure nitrogen purge flow.	b) Nitrogen purge maintains hydrogen and/or oxygen concentrations at less than 4%.

TABLE 1.11.2-1 (Continued)

GASEOUS WASTE MANAGEMENT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

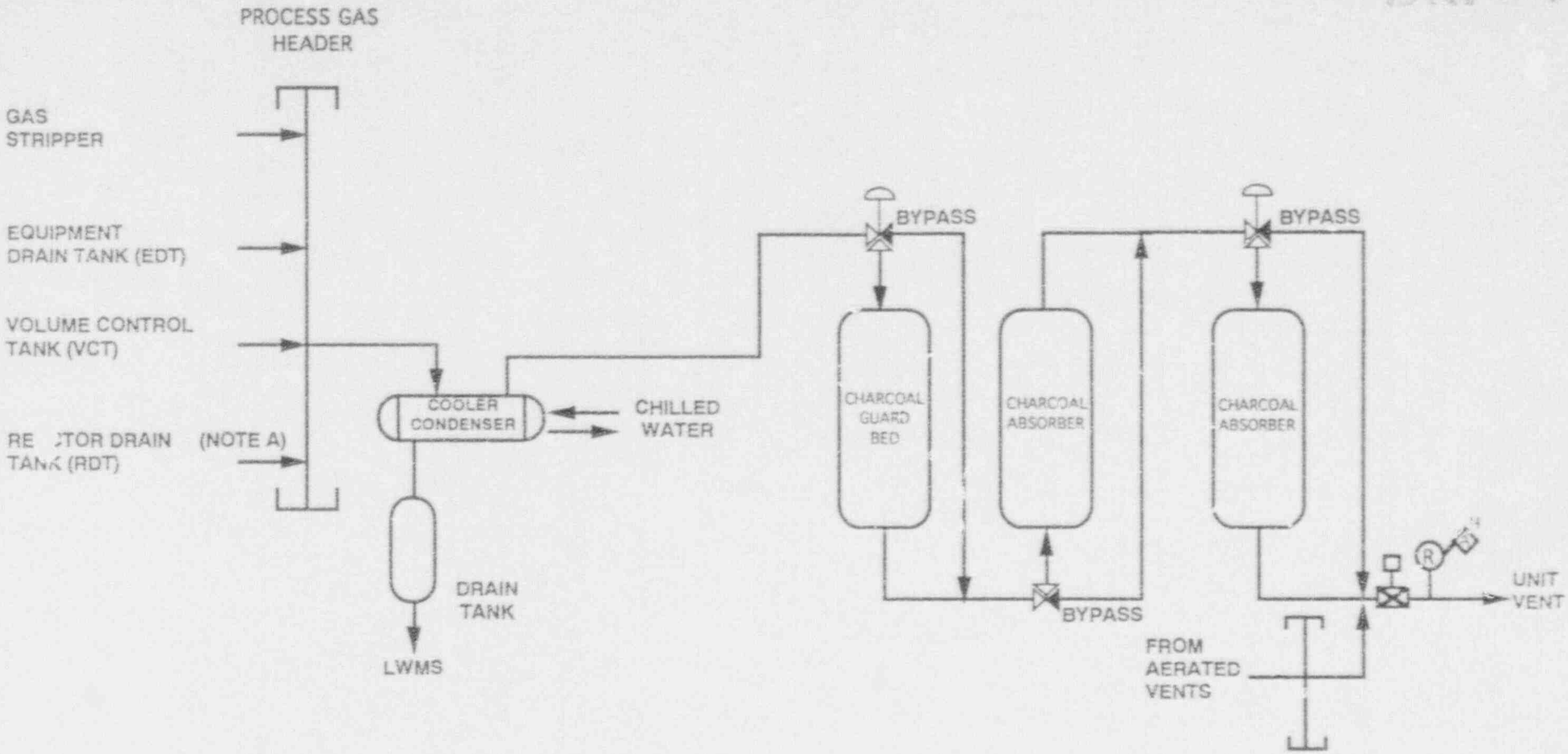
Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. The GWMS can monitor the radioactive concentration of gaseous effluents with radiation monitoring equipment located upstream of the plant unit vent.	5. Inspections of the as-built system will be performed.	5. Radiation monitoring capability is located upstream of the plant unit vent.
6. The GWMS components shown in Figure 1.11.2-1 are installed, and GWMS mechanical equipment is built in accordance with ASME Section III requirements that are shown in Figure 1.11.2-1 (NOTE 1).	6. Inspect Code Data Reports for installation and components. Inspect the systems and components for N stamps for ASME Section III components.	6. GWMS installation and components have required ASME Section III class code stamps per the Code Classes shown in Figure 1.11.2-1 for each component (NOTE 1).
7. The instrumentation indications and controls shown in Figure 1.11.2-1 are located in the control room. The inlet radioactive gaseous waste streams to the GWMS can be isolated manually from the control room (NOTE 1).	7. Inspections of the as-built system will be performed. Test inlet waste stream isolation.	7. Instrumentation indications and controls shown in Figure 1.11.2-1 are located in the control room. The GWMS inlet waste streams can be isolated by manual action (NOTE 1).

TABLE 1.11.2-1 (Continued)

GASEOUS WASTE MANAGEMENT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8. Discharges of radioactive gaseous effluents to the environment are terminated automatically if the limits of 10CFR20, Appendix B, Table II (date) will be exceeded.	8. Test isolation capability using a signal that simulates exceedence of limits.	8. The GWMS meets the Table 1.11.2-1, Certified Design Description, No. 8.
9. The GWMS is accessible for periodic inspection and testing.	9. Inspections of the as-built GWMS.	9. The GWMS components are accessible for periodic inspections and testing.

NOTE 1: Such diagrams are for the purpose of illustrating the general conceptual design features of the System 80+ systems, components, and equipment and their interrelationships. The simplified diagrams are not necessarily to scale, are not necessarily inclusive of all components and equipment, and are not intended to be exact representations of the detailed system configurations that will be utilized in any facility referencing the certified design.



NOTES:

A. CONTAINMENT ISOLATION VALVES AND ASSOCIATED PIPING ARE SAFETY CLASS 2

B. ALL COMPONENTS AND PIPING ARE SAFETY CLASS NNS UNLESS OTHERWISE NOTED.

FIGURE 1.11.2.1

GASEOUS WASTE MANAGEMENT SYSTEM FLOW DIAGRAM