REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards FSAR page changes for fuel pool cooling sys mod.
Changes will be incorporated into amend within four months.

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Washington Public Power Supply System
P.O. Box 968 3000 George Washington Way Richland, Washington 99352 (509) 372-5000

Docket No. 50-397

G02-81-328
NS-L-02-CDT-81-075
October 2, 1981

Mr. A. Schwencer
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington D.C. 20555

Dear Mr. Schwencer:

Subject: SUPPLY SYSTEM NUCLEAR PROJECT NO. 2
FUEL POOL COOLING SYSTEM MODIFICATION

Enclosed are sixty (60) copies of the WNP-2 FSAR page changes for the Fuel Pool Cooling System Modification. These changes will be incorporated into an amendment within four months.

Very truly yours,

G D Bouchey

G. D. Bouchey
Director, Nuclear Safety

Enclosure

GDB/CDT/ldm

cc: WS Chin - BPA
AD Toth - NRC Resident
NS Reynolds - Debevoise & Liberman
JC Plunkett - NUS Corporation
R Auluck - NRC DC
OK Earle - B&R RO
EF Beckett - NPI
WNP-2 Files

B001
S
1/60

c. Limit the release of radioactive materials by closing the primary containment barrier in case of a major leak from the nuclear system inside the primary containment.

1.2.2.5.12 Main Steam Line Flow Restrictors

A venturi-type flow restrictor is installed in each steam line. These devices limit the loss of coolant from the reactor vessel before the main steam line isolation valves are closed in case of a main steam line break outside the primary containment.

1.2.2.5.13 Main Steam Line Radiation Monitoring System

The main steam line radiation monitoring system consists of four gamma radiation monitors located externally to the main steam lines just outside the containment. The monitors are designed to detect a gross release of fission products from the fuel. On detection of high radiation, the trip signals generated by the monitors are used to initiate a reactor scram and to close the main steamline isolation valves.

1.2.2.5.14 Standby Service Water and HPCS Service Water Systems

The standby service water system consists of two 100 percent redundant systems. Each system consists of a spray pond and pump and piping supplying the associated residual heat removal system heat exchanger, standby diesel generator, essential HVAC coolers, RHR and LPCS pump coolers, sample coolers, and post-LOCA hydrogen recombiners.

Cooling water is supplied during a postulated loss of coolant accident to the RHR heat exchangers to remove heat when the containment cooling mode of the RHR system is placed in operation. During normal operation, standby service water is also supplied to the RHR heat exchangers for the shutdown function of the RHR system.

* See attachment

The HPCS service water system shares spray pond A with the standby service water system. The pump supplies cooling water to the HPCS diesel generator and the essential HVAC coolers for the HPCS diesel generator and HPCS pump areas.

Cooling water is supplied to all diesel generator cooling systems whenever the diesel generators are started.

In the event that the non-seismic I RCC system is unavailable, standby service water can be routed to the FPC heat exchangers to provide long term cooling and prevent fuel pool boiling and (the) any resulting ~~heating of the reactor building to over 150°F, the maximum temperature to which the reactor building located equipment is qualified~~ unacceptable into reactor building environmental conditions.

DLW

LOCA. This is accomplished by directing the leakage through the closed main steam line isolation valves to a bleed line into an area served by the SGTS. The flow is effected by a blower which directs the leakage into the reactor building and eventually through the standby gas treatment system. Thus, leakages through the MSIV will be processed by the SGTS prior to release to the atmosphere.

(* See attachment)

1.2.2.6 Power Conversion System

1.2.2.6.1 Turbine-Generator

The turbine is an 1800-rpm, tandem-compound (one double-flow high pressure turbine and three double flow low pressure turbines), reheat unit with an electrohydraulic governor for normal operation. The turbine-generator is provided with an emergency trip system for turbine overspeed. The rating of the turbine-generator is 1,154,745 kW at 2.5 in. Hg abs.

The generator is a direct-driven, three-phase, 60-Hertz, 25,000-volt, 1800-rpm, hydrogen inner-cooled, synchronous generator rated at 1,230 MVA at 0.975 power factor, 0.58 short circuit ratio at a maximum hydrogen pressure of 75 psig.

1.2.2.6.2 Main Steam System

The main steam system consists of four 26-inch diameter lines (which expand to 30-inch diameter lines inside the turbine building) extending from the outermost main steam line isolation valves to the main turbine stop valves. The use of four main steam lines permits testing of the turbine stop valves and main steam line isolation valves during station operation with only a minimum of load reduction. The design pressure and temperature of the main steam system from the outermost MSIV to the turbine stop valve is 1250 psig at 575°F. Other features include drains and parts of the turbine bypass system.

1.2.2.6.3 Main Condenser

The main condenser is a triple-pressure, single-pass, deaerating-type condenser with a divided water box. The condenser includes provisions for accepting up to 25% of the main steam flow at design conditions from the turbine bypass system and serves as a heat sink for several other flows, such as exhaust steam from the feed pump turbines, cascading heater drains, feedwater heater shell operating vents, and condensate pump suction vents.

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W.O. No. ____ Date ____ Book No. ____ Page No. ____
Drawing No. ____ Calc. No. ____ Sheet ____ Cont. on Sheet ____
By ____ Checked ____ Approved ____
Title ____

1.2.2.5.23 Fuel Pool Cooling and Cleanup System

The fuel pool cooling and cleanup system provides for the removal of decay heat from stored spent fuel and maintains specified water temperature, purity, clarity, and level. This prevents the spent fuel from overheating and controls the buildup of excessive radioactive materials in the cooling water, thereby minimizing potential radiation ~~possible~~ exposure to plant personnel.

The cooling portion of the system is designed to Seismic Category I requirements and can be isolated from the cleanup portion of the system by automatic, seismic I isolation valves which actuate on low fuel pool water level. Safety grade cooling and makeup water can be routed to the FPC system from the standby service water system (SW).

Form BR 8002-2 (5/78)

1.2.2.9.6 Gaseous Radwaste System Control

Gaseous radwastes are discharged through a reactor building elevated release point. Radiation levels of the release are continuously monitored and recorded. Isolation of the main condenser off-gas is automatically initiated prior to release should the activity of the off-gas exceed discharge limits.

1.2.2.10 Shielding

The shielding in the plant is designed to minimize exposure of plant personnel to radiation. The radiation levels during operation or shutdown conditions have been considered in determining the shielding requirements.

1.2.2.11 Fuel Handling and Storage Systems

1.2.2.11.1 New and Spent Fuel Storage

New and spent fuel storage racks are designed to prevent inadvertent criticality and load buckling. Sufficient coolant and shielding are maintained to prevent overheating and excessive personnel exposure, respectively. The design of the fuel pool provides for corrosion resistance, adherance to Seismic Category I requirements, and prevention of k_{eff} from reaching 0.90 under dry conditions or 0.95 under flooded conditions.

1.2.2.11.2 Fuel Handling System

The fuel handling equipment includes a fuel inspection stand, fuel preparation machine, a 125-ton crane, a refueling platform, a new fuel transfer basket, jib cranes, and other related tools for fuel and reactor servicing.

1.2.2.11.3 Fuel Pool Cooling and Cleanup System

The fuel pool cooling and cleanup subsystem provides the removal of decay heat from stored spent fuel and maintains specified water temperature, purity, clarity, and level. This prevents spent fuel overheat and the buildup of excessive radioactive materials in the cooling water, thereby minimizing possible exposures to plant personnel.

* See attachment

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By ______ Checked ______ Approved ______
Title ______

The cooling portion of the system is designed to Seismic Category I requirements and can be isolated from the non-seismic cleanup portion of the system by automatic, redundant, Seismic Category I isolation valves which actuate on low fuel pool water level. Safety grade cooling and makeup water can be routed to the system by remote-manual operation of redundant Seismic Category I valves to provide long-term cooling and prevent fuel pool boil off and resulting unacceptable environmental conditions.

Form BR 8002-2 (5/78)

TABLE 1.3-3 (Continued)

EMERGENCY CORE COOLING SYSTEMS (Continued)	WNP-2 BWR 5 251-764	HATCH 1 BWR 4 218-560	ZIMMER BWR 5 218-560
Standby Service Water System (See Section 9.2.7)			
Flow rate, gpm/heat exchanger	7400	8000	5000
Number of pumps	3[f]	4	4
Reactor Core Isolation Cooling System (See Section 5.4.6)			
Flow rate, gpm	600 at 1150 psid	400 at 1120 psid	400 at 1120 psid
Fuel Pool Cooling and Cleanup System (See Section 9.1.3)			
Capacity, Btu/hr	~~7.6×10^6~~ 8.0×10^6	5.7×10^6	6.6×10^6

[a] High-pressure coolant injection system utilized

[b] A mode of the RHR system

[c] Capacity during reactor flooding mode with more than one pump running

[d] Heat exchanger duty at 20 hours following reactor shutdown

[e] Flow per heat exchanger

[f] Includes HPCS Service Water Pumps

TABLE 1.3-8 (Continued)

ITEM	CHANGE	REASON FOR CHANGE	FSAR PORTION IN WHICH CHANGE IS DISCUSSED
125V, 250V DC Battery Capability	Revised supply capability from 4 hours to 2 hours	Increased dc loads	8.3.2
125V, 250V DC Charger Capability	Revised recharge capability from 8 hours to 24 hours	Increased dc loads	8.3.2
Spare 125V DC Charger	Spare charger serves as a backup for Division 1 and 2 only	Spare charger is too large to provide backup to Division 3	8.3.2
Communication Systems	The Microwave System and the commercial telephone exchange system are not redundant	Redundancy not required. (However, some plant communication functions may be served by either system)	8.2.1.5

See attachment

Item Fuel Pool Cooling and Cleanup System

Change Upgraded cooling portion of system to Seismic Category I to provide long term cooling and makeup water capability to the spent fuel pool.

Reason for Change To prevent fuel pool boiling and resultant ECCS Pump room flooding under conditions following a design basis seismic event.

FSAR Portion 9.1.3

pool water is circulated through the system, suction is taken from surge tanks, flow passes through the heat exchanger and filters, and it is discharged through diffusers at the bottom of the fuel pool. Pool water temperature is maintained below 125°F. The FPCC system can be interconnected with the RHR system to increase the cooling capacity of the FPCC system during plant shutdown.

* See attachment 1

High and low level switches indicate pool water level changes in the main control room. Fission product concentration in the pool water is minimized by use of the filter-demineralizer. This minimizes the release of radioactivity from the pool to the reactor building environment.

No special tests are required to insure system operability, except as noted below, because at least one pump, heat exchanger, and filter-demineralizer are continuously in operation while fuel is stored in the pool. Duplicate units are operated periodically to handle abnormal heat loads or to replace a unit for servicing. Routine visual inspection of the system components, instrumentation, and trouble alarms are adequate to verify system operability.

* see attachment 2

3.1.2.6.2.1.3 Radioactive Waste Systems

The radioactive waste systems provide all equipment necessary to collect, process, and prepare for disposal all radioactive liquids, gases, and solid waste produced as a result of reactor operation.

Liquid radwastes are segregated and treated as equipment drain, floor drain, chemical, detergent, sludges or concentrated wastes. Processing methods include filtration, ion exchange, neutralization, concentration, solidification, analysis, and dilution. Liquid wastes are also decanted and sludge is accumulated for disposal as solid radwaste. Wet solid wastes and concentrates are normally solidified and packaged in shielded steel containers. Dry solid radwastes are packaged in steel drums, or other suitable containers. Gaseous radwastes are monitored, processed, recorded and controlled so that radiation doses to persons outside the controlled area are below those allowed by applicable regulations.

(1) The cooling portion of the system is designed to Seismic Category I requirements and can be isolated by automatic redundant, Seismic Category I, Quality Class I isolation valves from the non-seismic cleanup portion of the system. Safety grade cooling water from the standby service water system (SW) can be supplied to the shell side of the FPC heat exchangers by remote-manual operation from the control room. Safety grade make-up water to the fuel pool is also available from the standby service water system.

(2) Service water flow to the fuel pool cooling heat exchangers and operability of the valves which intertie the SW and RCC systems are tested in conjunction with testing of the SW system.

Principal Component (1)	Scope of Supply (2)	Safety Class (3)	Location (4)	Quality Group Classification (5)	Quality Class (6)	Seismic Category (7)	Comments
.7 Valves, beyond outermost containment isolation valves	GE/P	G	R,W	C	II	II	(12)
.8 Mechanical modules	GE	G	R,W	C	II	II	
21. Fuel Pool Cooling and Clean-up System (Figure 3.2-12)							(18)
.1 Vessels, filter/demineralizers	P	G	W	C	II	II	
.2 Vessels, other	P	G	W	C	II	II	
.3 Heat exchangers	P	G	R	C	II	~~II~~ I	
.4 Piping	P	G	R,W	C	II	I/II	(10) (32)
.5 Pumps	P	G	R	C	II	~~II~~ I	
.6 Makeup System (normal)	P	G	R	C	II	II	(18)
.7 RHR Connection, ~~Makeup~~	P	3	R	C	I	I	
.8 Makeup System (emergency)	P	3	R	C	I	I	
.9 Piping, suppression pool to outer isolation valves	P	2	R	B	I	I	
22. Control Room Panels							
.1 Electrical modules, with safety function	GE	2	W	N/A	I	I	
.2 Cable, with safety function	GE/P	2	W	N/A	I	I	
23. Local Panels and Racks							
.1 Electrical modules, with safety function	GE	2	R	N/A	I	I	
.2 Cable, with safety function	P	2	R	N/A	I	I	
24. Off-gas System (Figure 11.3-2)							
.1 Tanks	GE	G	T,W	C	II	II	(16)
.2 Heat exchangers	GE	G	T,W	C	II	II	(16)
.3 Piping	P	G	T,W,O	C	II	II	(16)
.4 Pumps	GE	G	T,W	C	II	II	(16)
.5 Valves	P	G	T,W	C	II	II	(16)

TABLE 3.2-1 (Continued)

Notes (Continued)

The design and construction specifications for the HCU do invoke such codes and standards as can be reasonably applied to individual parts in developing required quality levels, but these codes and standards are supplemented with additional requirements for these parts and for the remaining parts and details. For example, (1) all welds are LP inspected, (2) all socket welds are inspected for gap between pipe and socket bottom, (3) all welding is performed by qualified welders, (4) all work is done per written procedures. Quality Group D is generally applicable because the codes and standards invoked by that group contain clauses which permit the use of manufacturer's standards and proven design techniques which are not explicitly defined within the codes of Quality Groups A, B, or C. This is supplemented by the QC techniques described above.

15. Only equipment associated with a safety action (e.g., isolation) need conform to a safety function.

16. Chapter 15 conservatively analyzes a postulated simultaneous failure of all the radwaste tanks in the radwaste building. The analysis assumes that 1 percent of the iodine is released to the atmosphere and, at the time of failure, all tanks are filled to capacity (this condition is not normally expected). The analysis evaluates the possible control room, site boundary, and low population zone exposures to the whole body and thyroid. The results of the analysis indicate, in light of the requirements of Regulatory Guide 1.29, Rev. 1, that the radwaste system is properly classified and changes are not required.

17. DELETED

18. To comply with Regulatory Guides 1.26, Rev. 3 and 1.29, Rev. 1, ~~the RHR system is interconnected to the fuel pool, thereby providing a redundant Seismic Category I sources of coolant to the fuel pool. Additionally, systems for maintaining water quality and quantity are designed so that any malfunction or a failure in such~~

See attachment

TABLE 3.2-1 (Continued)

Notes (Continued)

~~systems will not cause significant loss or inventory. In addition, a Seismic Category I makeup source which can be used as makeup as well as evaporative cooling is supplied by the standby service water system.~~

19. The main steam line extending from the outermost containment isolation valve up to but not including the turbine main steam stop valve, and connected piping of 2-1/2 inches or larger nominal pipe size up to and including the first isolation valve is designed by use of an appropriate seismic-system analysis for the SSE and OBE. The power conversion system structures are constructed in accordance with applicable codes for steam power plants. The turbine building, interacting with main steam lines and branch lines, is designed as a modified non-Category I Seismic structures as described in 3.8.4.1.3.

20. The condensate storage tanks are designed, fabricated, and tested to meet ASME Code, Section III, subsection ND-3800. In addition, the specification for this tank requires 100 percent surface examination of the side wall to bottom joint, and 100 percent volumetric examination of the side wall weld joints.

21. Not Used.

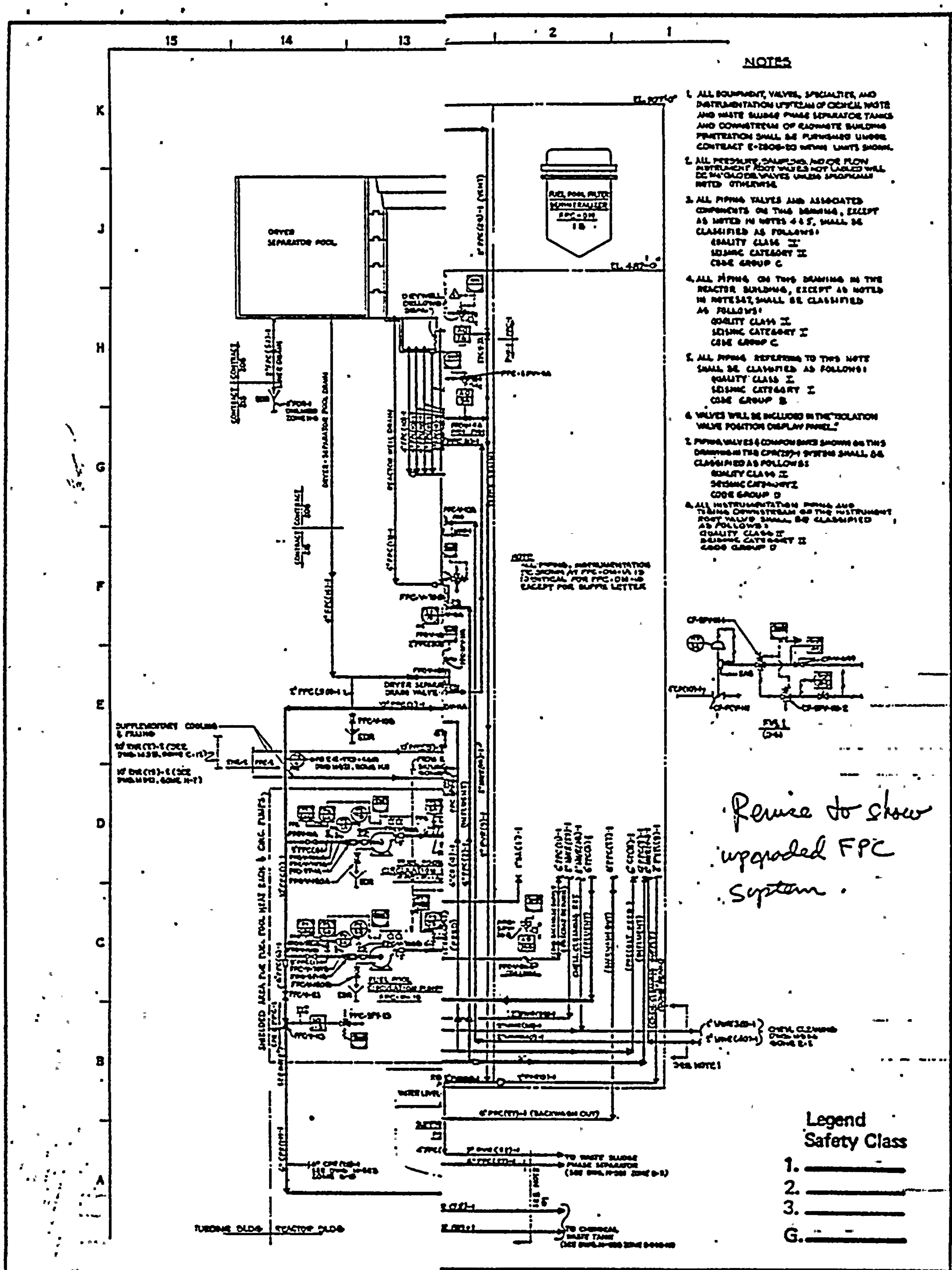
22. These lines meet the requirements of Quality Group B except that hydrostatic testing of the containment spray piping is not required.

23. The RCIC turbine exhaust line from the isolation valve to the suppression pool meets all the requirements of Quality Group B except that hydrostatic testing of this portion of piping is not required.

24. Equipment, piping and valves which are part of the radwaste system but not used for processing radioactive fluids are designed to Quality Group D standards.

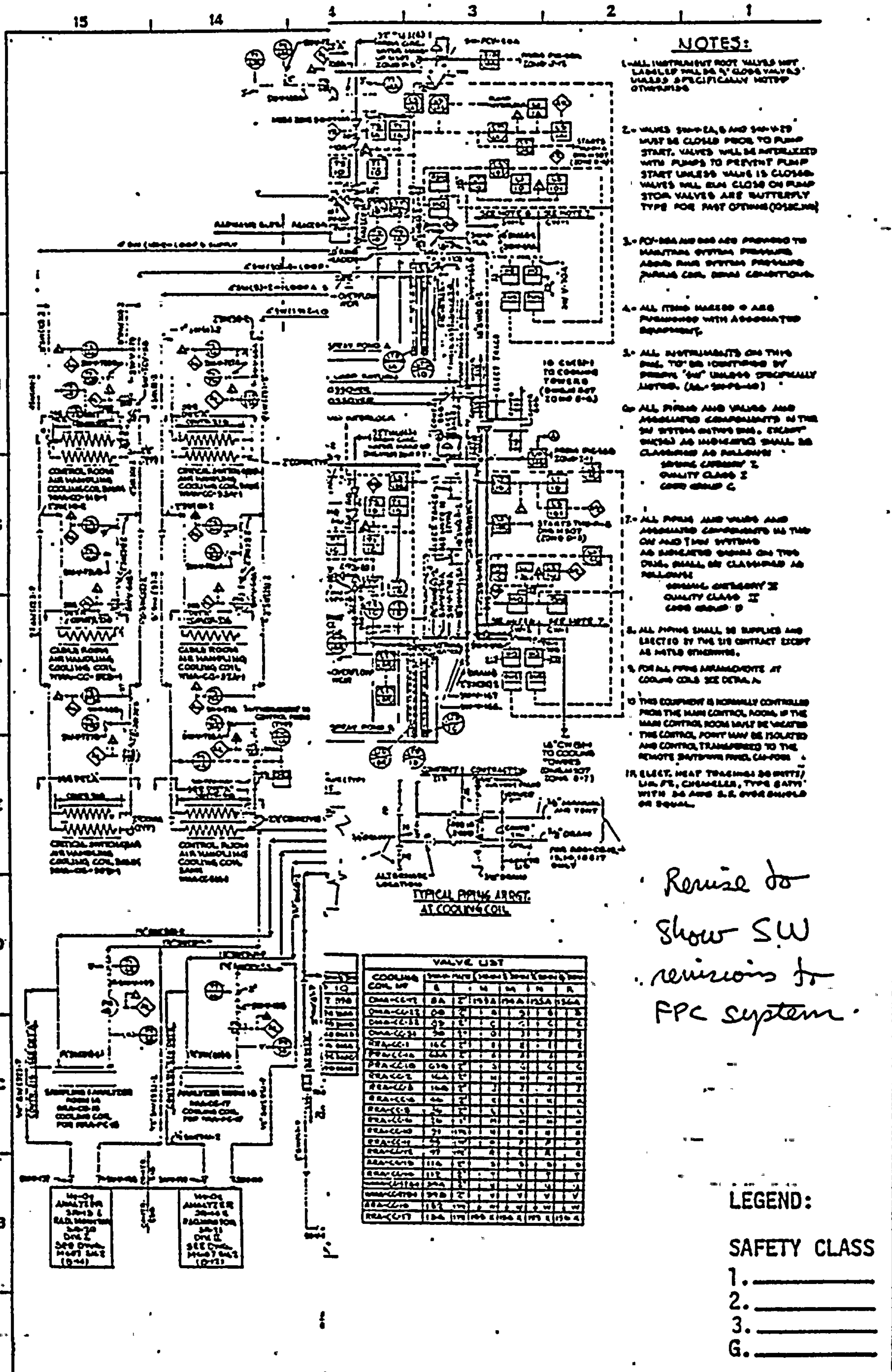
    The solid waste processing pump is a "Moyno" pump manufactured by Robbins and Meyers. This type of pump is best suited for handling sludges and is not manufactured with an "N" stamp. The hopper discharge valves are knife edge gate valves which are required due to the consistency of the hopper discharge fluid and are not manufactured with an "N" stamp.

the FPC heat exchangers can be supplied with a safety grade source of cooling water from the standby service water system (SW). The RHR system can also be connected to the FPC system, by means of removable spool pieces, to serve as an additional source of cooling during cold shutdown. The non-seismic cleanup portion of the system can be isolated from the Seismic Category I cooling portion by automatic, redundant, Seismic Category I Quality Class I isolation valves which actuate on low fuel pool water level. In addition, a safety grade makeup source is supplied to the fuel pool ~~by~~ from the standby service water system.



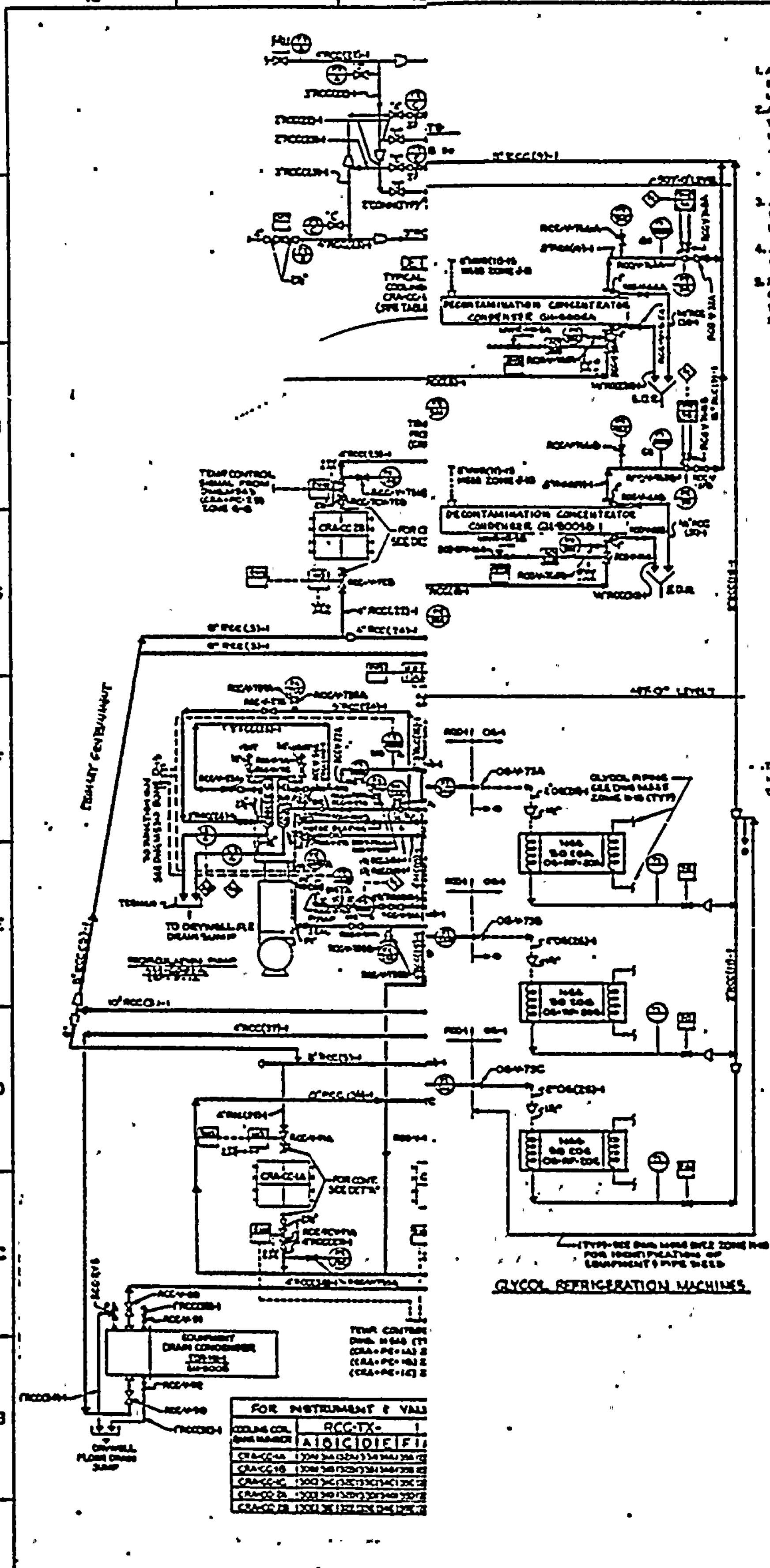
FUEL POOL COOLING AND CLEANUP SYSTEM

FIGURE



STANDBY SERVICE WATER SYSTEM

FIGURE 3.2-13



GENERAL NOTES

1. ALL TEMPERATURE WELL CONNECTION TO BE [illegible] UNLESS SPECIFICALLY NOTED OTHERWISE.
2. ALL INSTRUMENTATION ON THIS DRAWING TO BE IDENTIFIED BY PREFIX "RCC", UNLESS SPECIFICALLY NOTED OTHERWISE AS FOLLOWS: [illegible] ETC.
3. ALL INSTRUMENT ROOT VALVES NOT LABELED WILL BE 3/4" GLOBE VALVES UNLESS SPECIFICALLY NOTED OTHERWISE.
4. ALL ITEMS MARKED [illegible] ARE [illegible] WITH ASSOCIATED EQUIPMENT.
5. PIPING AND VALVES AND ASSOCIATED COMPONENTS ON THIS DRAWING SHALL BE CLASSIFIED AS FOLLOWS (BREAK POINTS ARE INDICATED ON THE FLOW DIAGRAM):
   a. INSIDE PRIMARY CONTAINMENT [illegible] ISOLATION VALVES
      SEISMIC CATEGORY I
      QUALITY CLASS II
      CODE GROUP C
   b. PRIMARY CONTAINMENT ISOLATION VALVES AND ALL PIPING AND VALVES BETWEEN THESE ISOLATION VALVES
      SEISMIC CATEGORY I
      QUALITY CLASS I
      CODE GROUP B
   c. THE RADWASTE BLDG STARTING FROM THE REACTOR BUILDING WEST WALL
      SEISMIC CATEGORY II
      QUALITY CLASS II
      CODE GROUP D
   d. ALL PIPING, VALVES AND ASSOCIATED COMPONENTS ON THIS DRAWING IN THE RCC SYSTEM, IN THE REACTOR BUILDING, SHALL BE CLASSIFIED AS FOLLOWS EXCEPT AS NOTED ABOVE:
      SEISMIC CATEGORY I
      QUALITY CLASS II
      CODE GROUP D

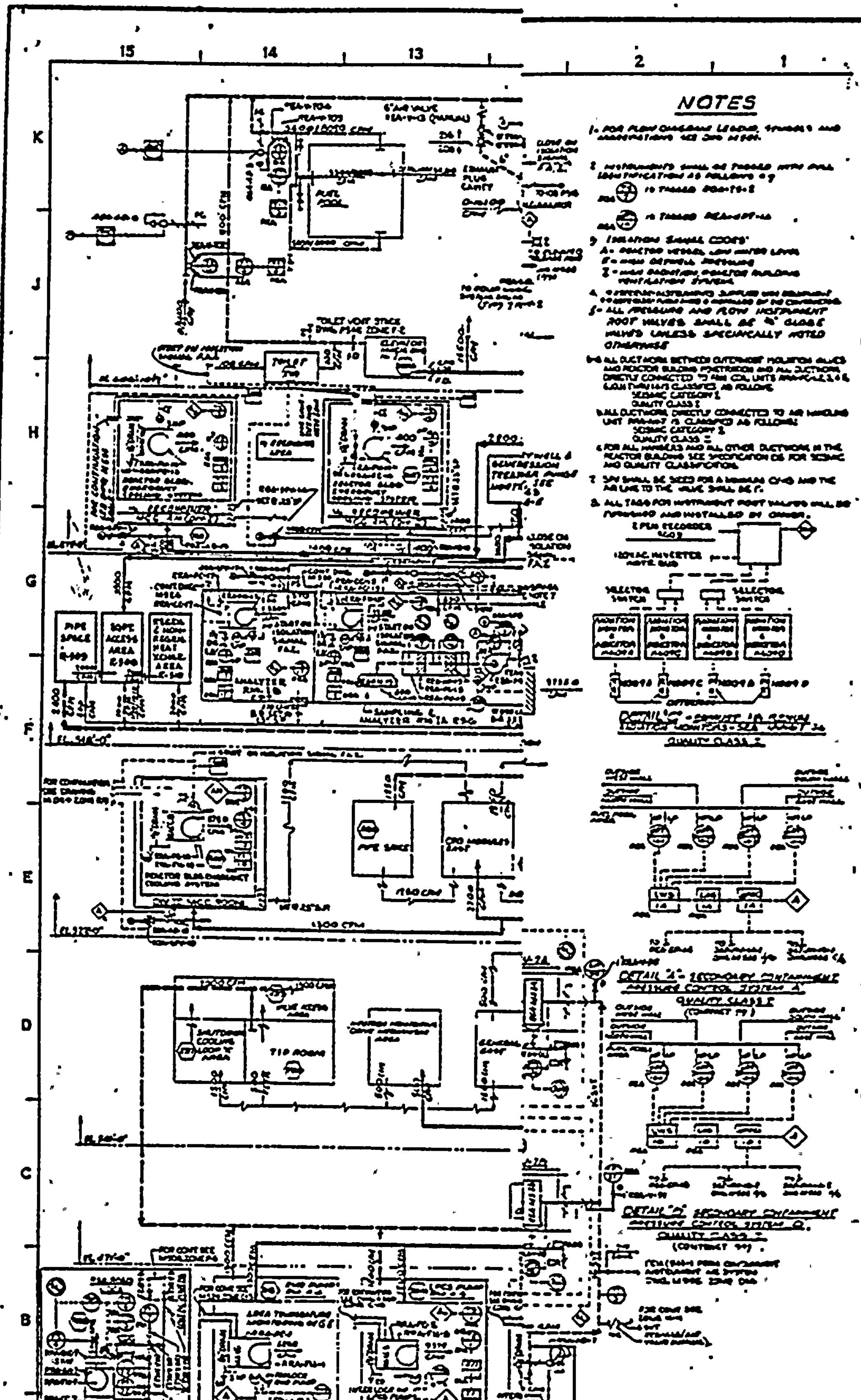
* THESE VALVES WILL BE INCLUDED IN THE "ISOLATION VALVE POSITION DISPLAY PANEL"

Revise to show S.W. tie-in to RCC.

Legend
Safety Class
1.
2.
3.
G.

CLOSED COOLING WATER SYSTEM
REACTOR AND RADWASTE BUILDING

FIGURE 3.2-14



Revise to show FPC room coolers as Safety Class 3.

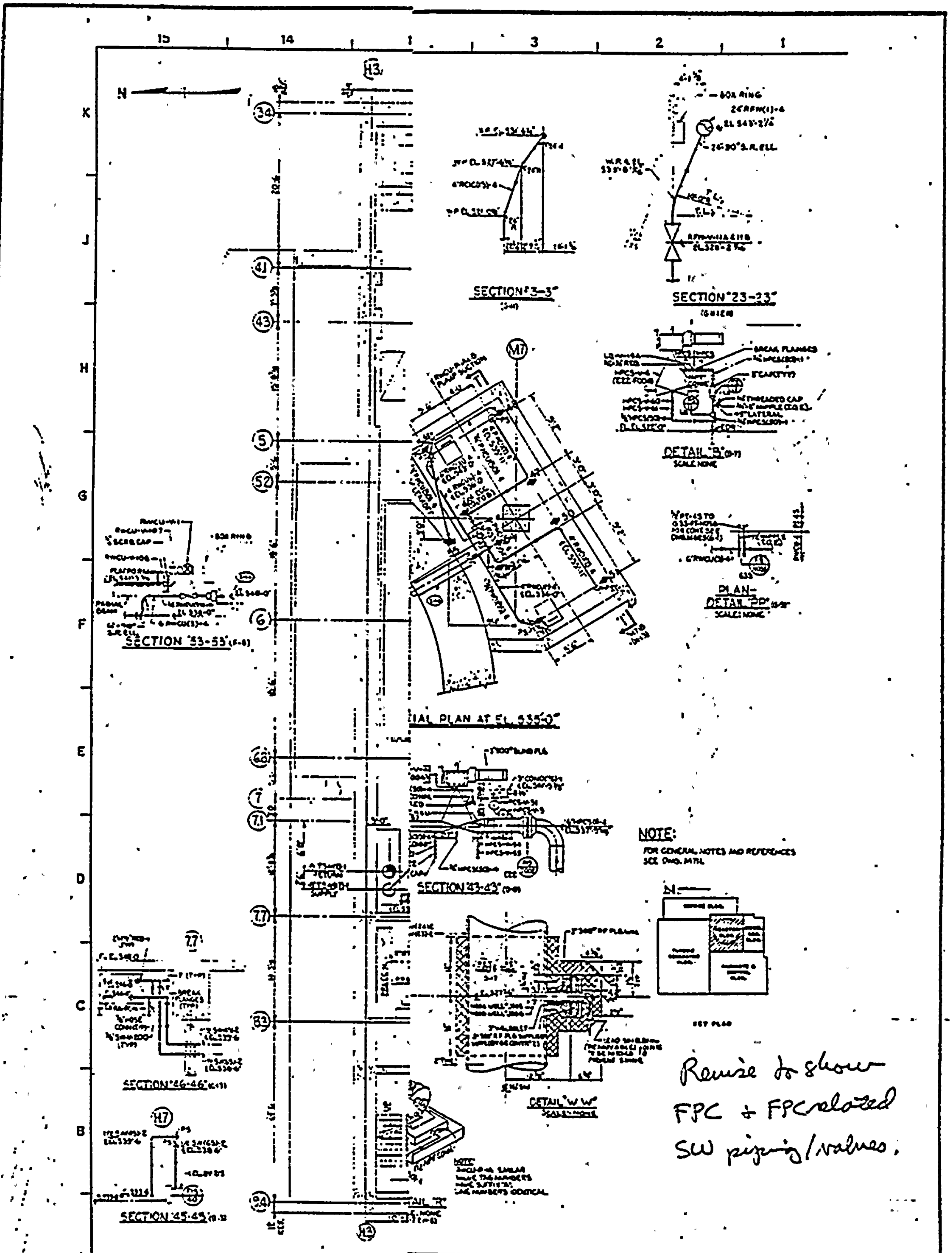
LEGEND:

SAFETY CLASS

1. ________
2. ________
3. ________
G. ________

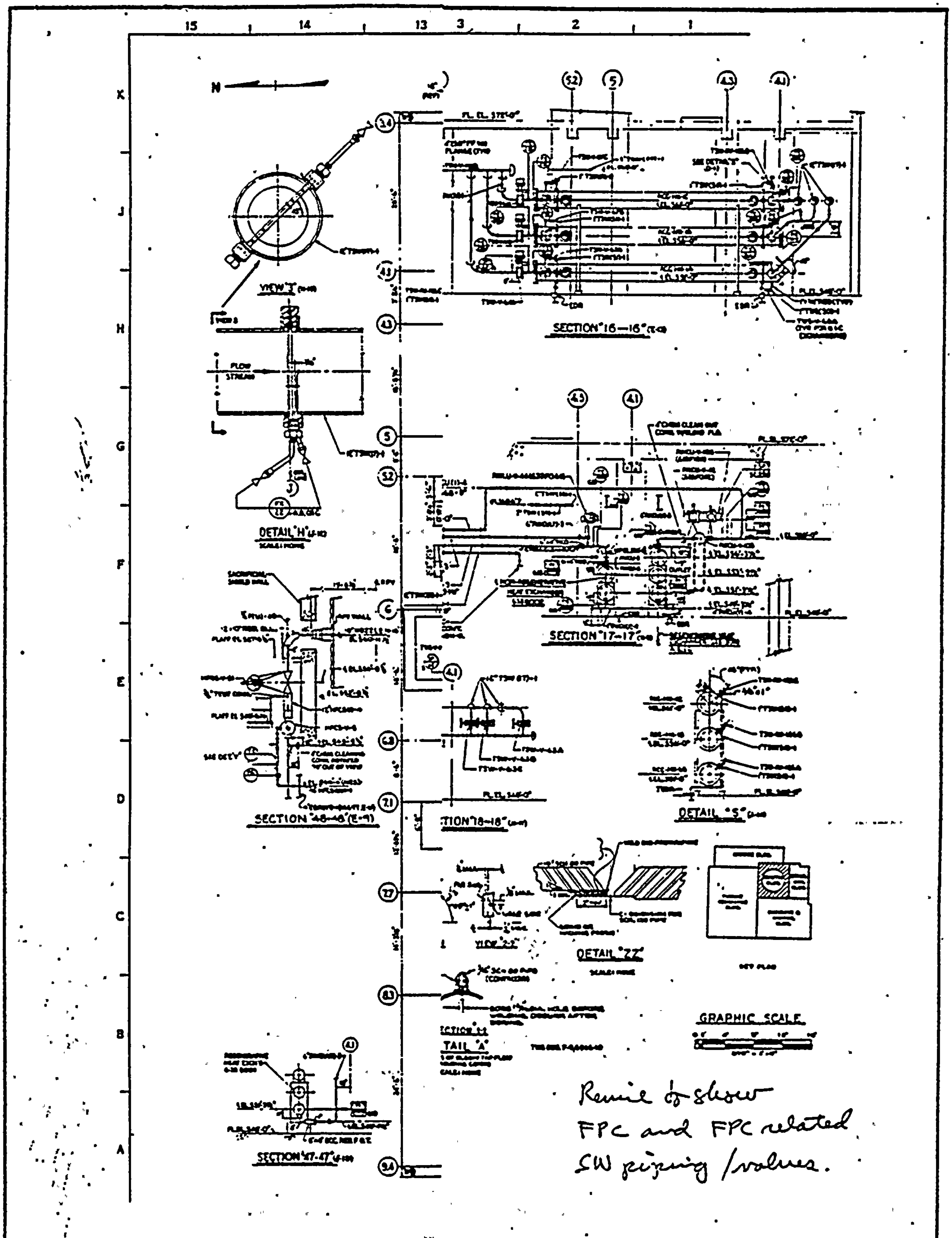
HVAC REACTOR BUILDING

FIGURE 3.2-18



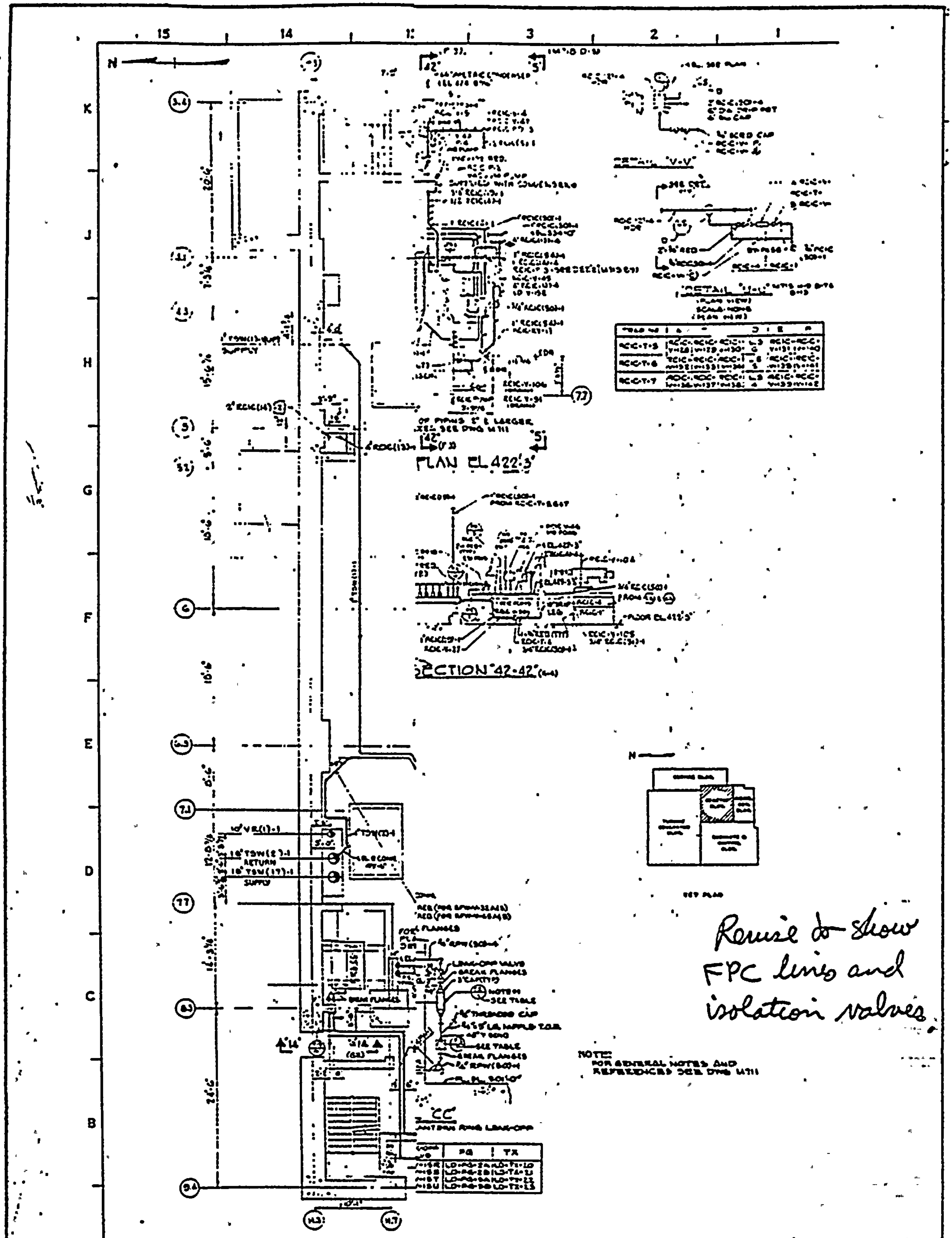
RFW, RCIC, HPCS, SW, RWCU, RRC & TSW
EL. 522' REACTOR BLDG.

FIGURE 3.6-50



-W, RCIC, HPCS, SW, RWCU, RRC & TSW
.. 548' REACTOR BLDG. (M715)

FIGURE



Revise to show FPC lines and isolation valves.

FW, RCIC, HPCS, SW, RWCU, RRC & TSW
L. 471' MISC. PLAN & SECTS. REACTOR BLDG.

FIGURE 3.6-53

The safety related functions fulfilled by each of the above structures are discussed in subsections of 3.8.4.1 that follow.

3.8.4.1.1 Reactor Building

The reactor building is located within the interior of the plant complex. The general arrangement and principal features of the reactor building are shown in Figures 1.2-1 to 1.2-7, inclusive, 3.8-1, 3.8-2 and 3.8-30 through 3.8-45, and 3.8-47, 3.8-54, 3.8-55, 3.8-60 and 3.8-61 inclusive.

The reactor building is part of the secondary containment system. The reactor building completely encloses the reactor vessel and the primary steel containment vessel and provides secondary containment when the primary containment vessel is sealed and in service. When the primary containment vessel is open, as it is during refueling periods, the reactor building also provides primary containment. The building houses the primary reactor system, reactor auxiliary and cooling systems, and facilities necessary for refueling operations.

The reactor building, as the secondary containment structure, houses safety related and other systems, equipment and components which include:

a. Refueling and reactor servicing equipment

b. New and spent fuel storage facilities, including the Fuel Pool Cooling system

c. Other reactor auxiliary and service equipment, including:

   (1) Reactor core isolation cooling system

   (2) Reactor water cleanup system

   (3) Standby liquid control system

   (4) Control rod drive system equipment

   (5) Emergency core cooling system

   (6) Electrical equipment and components

   (7) Supply and exhaust air ventilating system

   (8) Standby gas treatment system (SGTS) equipment

g. Cable room air handling units (2)

h. Control room air handling units (2)

i. RHR pump room cooling coil (3)

j. RCIC pump room cooling coil

k. LPCS pump room cooling coil

l. HPCS pump room cooling coil

m. Motor control center room cooling coils (5)

n. Diesel generator room cooling coils (7)

o. Standby service water pumphouse (2)

* See attached sheet

To cool the items of equipment listed above, the standby service water pumps take suction from the spray ponds and pump water through the various heat exchangers and coolers required for normal and emergency shutdown. The water is returned to the spray ponds through the spray distribution piping shown in Figure 1.2-14. Emergency power is provided to all equipment required for operation of the standby service water system.

The standby service water system is classified as Quality Group C as defined in Regulatory Guide 1.26, Rev. 3, and in Table 3.2-1.

The standby service water system is an ASME Section III, Class 3 system, and is designed, fabricated and constructed in accordance with Quality Class I requirements of the Quality Assurance Program.

The standby service water system, including the spray pond structures 1A and 1B and the pumphouse structures 1A and 1B, are designed to Seismic Category I requirements as defined in Regulatory Guide 1.29, Rev. 1, and in Table 3.2-1.

The spray distribution systems in each spray pond are completely redundant, and each spray distribution system is capable of providing sufficient cooling to safely shutdown the plant.

p. FPC heat exchangers (2)
q. FPC pump room cooling coils (2)

3.9.2.2.2.14 Main Steam Safety/Relief Valves

Due to the complexity of this structure and the performance requirements of the valve, the total assembly of the safety/relief valve (including electrical, pneumatic devices) was dynamically tested at seismic accelerations equal to or greater than the SSE levels determined for this plant. Satisfactory operation of the valves was demonstrated during and after the test.

3.9.2.2.2.15 Fuel Pool Cooling and Cleanup System

~~The fuel pool cooling and cleanup system pump and motor have not been analyzed as Seismic Category I equipment since this was not a requirement of the construction permit.~~

* See attachment

3.9.2.2.2.16 Balance of Plant Safety-Related Mechanical Equipment

Balance of plant Seismic Category I equipment, components and accessories are designed based on results determined analytically (see 3.9.2.2) or through dynamic testing. The dynamic program is performed to confirm the ability of the equipment to function as needed during and after an earthquake of magnitude up to and including the SSE. These test programs implement the criteria stated in 3.9.2.2, 3.9.2.2.1, 3.9.2.2.1.1, 3.9.2.2.1.2, 3.9.2.2.1.3, and 3.9.2.2.1.4. The dynamic tests met the seismic loading requirements as defined by the applicable floor response spectrum curves for the appropriate damping coefficients.

3.9.2.3 Dynamic Response of Reactor Internals Under Operational Flow Transients and Steady State Conditions

The major reactor internal components within the vessel were subjected to extensive testing coupled with dynamic system analyses to properly describe the resulting flow-induced vibration phenomena incurred from normal reactor operation and from anticipated operational transients.

In general, the vibration forcing functions for operational flow transients and steady state conditions are not predetermined by detailed analysis. Special analyses of the response signals measured from reactor internals of similar

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W.O. No. ______ Date ______ Book No. ______ Page No. ______
Drawing No. ______ Calc. No. ______ Sheet ______ Cont. on Sheet ______
By ______ Checked ______ Approved ______
Title ______

Major components of the upgraded FPC system have been analyzed to assure operation during and after a ~~—~~ design basis seismic event up to ~~[illegible]~~ an SSE. Some modifications to ~~[illegible]~~ the nozzles ~~[illegible]~~ on the FPC heat exchangers were required. The FPC pumps have been seismically analyzed and will also remain functional. Seismic Category I, Quality Class I motors are supplied ~~[illegible]~~ to drive the pumps. Seismic Category I, Quality Class I isolation valves have been supplied in order to isolate the Seismic Category I cooling portion of the system from the non-seismic cleanup portion of the system and prevent loss of ~~inventory~~ fuel pool water inventory.

The design loading combinations and limits for the pump include the following:

a. Normal plus upset loads: This includes the simultaneous effect of normal operating loads, design pressure, temperature, nozzle loads, dead weight loads including seismic due to operational basis earthquake (OBE) loads, plus torsional loads due to rotation of the component assembly.

b. Seismic loading: This equipment and supports are designed to withstand the static seismic forces applied at the mass center, assuming that the pump is flooded.

c. Stresses in the supports and the anchor bolts due to seismic loads are combined with the stresses due to other live and dead loads and operating loads. The allowable stress for this combination of loads is based on the allowable stress as set forth in the applicable codes.

d. The ASME Boiler and Pressure Vessel Code, Section III, is used as a guide in calculating the thickness of the pressure retaining parts and for sizing the cover bolting.

e. Identified thermal transients: Equipment operates between 70 - 545°F. Transient analysis is not required for Class III components in this temperature range.

Table 3.9-2(p) shows the calculated stress values and allowable stress limits for the pump.

3.9.3.1.16 Fuel Pool Cooling and Cleanup System Heat Exchangers and Pumps

~~The fuel pool cooling and cleanup heat exchangers and pumps are not part of a safety related system. They are designed to the requirements of Seismic Category II as described in 3.7.1.~~

* see attachment

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W.O. No. ____ Date ____ Book No. ____ Page No. ____
Drawing No. ____ Calc. No. ____ Sheet ____ Cont. on Sheet ____
By ____ Checked ____ Approved ____
Title ____

The cooling portion of the FPC system has been designed to Seismic Category I requirements. The FPC heat exchangers design has been analyzed by performing a response spectrum dynamic analysis for seismic ~~and hydrodynamic~~ loads. The model used to represent the heat exchangers utilized finite element and "ANSYS" program to perform the detailed calculations. For certain subcomponents such as the tube bundle, hand calculations were utilized to determine the natural frequency. The corresponding acceleration coefficients were then used to calculate the stress in the subcomponents.

The FPC pumps have been analyzed to Seismic Category I loadings.

delete "hydrodynamic" (no hydrodynamic loads outside containment) BF

Form BR 8002-2 (5/78)

9.1.3 SPENT FUEL POOL COOLING AND CLEANUP SYSTEM

9.1.3.1 Design Bases

The fuel pool cooling and cleanup system has been designed to comply with the objectives set forth in Regulatory Guides 1.13, Revision 1 and 1.26 Revision 3 to the extent specified in the following subsections. The system and equipment are designed to the classifications given in Tables 3.2-1 and 9.1-2.

During normal reactor operation the system is designed to remove the decay heat released from the spent fuel elements and maintain a specified fuel pool water temperature, water clarity, and water level by accomplishing the following:

a. Minimizing corrosion product buildup and controlling fuel pool water clarity so that fuel assemblies can be efficiently handled under water.

b. Minimizing fission product concentration in the fuel pool water thereby minimizing the release of fission products from the pool to the reactor building environment.

c. Monitoring surge tank water level to thereby maintain a pool water level above the fuel sufficient to provide shielding for normal building occupancy and to control make-up flow rate from the condensate transfer system.

d. Maintaining the fuel pool water temperature below 125°F under normal operating conditions. The maximum heat load in the fuel pool under normal operating conditions occurs at the end of the 12th refueling cycle at which time there are 2068 fuel assemblies in the high density fuel racks. The estimated refueling data is given in Table 9.1-3.

* Insert →

9.1.3.2 System Description

9.1.3.2.1 Normal Operation

The fuel pool cooling and cleanup system flow diagram is shown on Figure 9.1-4. System performance data are summarized in Table 9.1-1. Major components of the system are summarized in Table 9.1-2. The system is designed to dissipate the fuel pool heat load during equilibrium or non-equilibrim fuel cycle conditions.

Page 9.1-23 insert:

Following any seismic event or major plant disturbance, i.e., during abnormal operation, the system is designed to prevent fuel pool boiling and maintain adequate water level in the spent fuel pool by means of the following:

a. Automatic isolation ~~on~~ low fuel pool water level of the Seismic ~~I~~ Category I cooling portion of the system from the non-seismic, cleanup portion of the system.

b. Remote-manual startup from the control room of redundant, active components of the fuel pool cooling portion of the system and initiation of safety grade cooling water, i.e., standby service water (SW), to the fuel pool cooling heat exchangers.

c. Remote-manual, redundant SW system make-up to the fuel pool and fuel pool level monitoring from the control room.

If required, heat removal capacity is available for the full core removal load during either of these periods, in addition to the spent fuel load already stored. The system design heat load is based on the data given in Table 9.1-3.

The system cools the fuel storage pool by transferring the spent fuel decay heat through a heat exchanger to the reactor building closed cooling water system. Water purity and clarity in the storage pool, reactor well, and dryer-separator pit are maintained by filtering and demineralizing the pool water through a filter demineralizer. In addition to fuel pool water demineralization, the system will be used on occasion to demineralize suppression pool water.

The pool cooling and cleanup system consists of two 50% capacity circulating pumps, two 50% capacity heat exchangers, two 100% filter demineralizers, two skimmer surge tanks, and the required piping, valves, and instrumentation. The pumps circulate the pool water in a closed loop, taking suction from the surge tanks, circulating the water through the heat exchangers and filters, and discharging it through diffusers at the bottom of the fuel pool and reactor well. The water flows from the pool surface through scuppers and skimmer weirs to the surge tanks. Make-up water for the system is transferred from the condensate storage tank to a skimmer surge tank to make up evaporative losses. The fuel pool pumps and heat exchangers are located in an enclosed room on the 548 foot level of the reactor building beneath the fuel pool.

Fuel pool water is continually recirculated except when draining the reactor well and dryer-separator pit. The operating temperature of 125°F is permitted to rise to 150°F when the circulating flow is interrupted for draining the reactor well and dryer-separator pit, or when larger than normal batches of fuel are stored. The fuel pool cooling and cleanup system is interconnected with the residual heat removal system to supplement the pool cooling during refueling in the event that a larger than normal batch of fuel is stored.

To establish a circulating pattern of flow in the reactor well and storage pool, the diffusers and skimmer drains are placed to sweep particles dislodged during refueling operations away from the work area and out of the pool.

Fuel pool water clarity and purity is maintained by a combination of filtering and ion exchange. The filter demineralizer maintains a total heavy element content (Fe, Cu, Hg, Ni, etc.) of 0.1 ppm or less with a pH range of 6.0 to 7.5.

Particulate material is removed from the water by the pressure precoat filter demineralizer units. The finely divided disposable filter medium is replaced when the pressure drop is excessive or the ion exchange resin is depleted. The spent filter medium is backwashed to the waste sludge phase separator tank for processing in the solid radwaste handling system. New filter medium is mixed in a precoat tank and is transferred as a slurry by a precoat pump where the solids deposit on the filter elements. The holding pump connected to each filter demineralizer maintains circulation through the filter in the interval between the precoating operation and the return to normal system operation. A strainer is provided in the effluent stream of the filter demineralizers to limit the migration of the filter material.

The two filter demineralizer units are located separately in shielded cells in the radwaste building. Sufficient clearance is provided in the cells to permit removal of the filter elements from the vessels. Each cell contains only the filter demineralizer and its associated piping. All valves are located on the outside of one shielding wall of the cell, together with necessary piping and headers, instrument elements, and controls.

Instrumentation is provided for both automatic and remote manual operation. Indication is provided in the control room and pump room. Surge tank high and low water level switches are provided. A local level indicator is provided to monitor reactor well water level. Control of flow to or from the reactor well can be accomplished during refueling. A fuel pool high/low water level switch operates a local indicator light and sounds an alarm in the control room whenever the level is either too high or too low. The trip point is adjustable over the range of the skimmer weir adjustment.

The pumps are controlled from ~~either~~ the control room, the pump room, or the vicinity of the fuel pool filters. ~~Pump low suction pressure automatically turns off the pumps.~~ A pump low discharge pressure alarm annunciates in the control room and in the pump room. The controls for the remote controlled fuel pool discharge valves are located on a rack in the pump room and in the control room. The open or closed condition of each of these valves is indicated by a light in the pump room and in the control room.

The flow rate through the filter demineralizers is indicated by a flow indicator on the pump room panel.

A high rate of leakage through the refueling bellows assembly, drywell to reactor seal, or the fuel pool gates is indicated by lights on the operating floor instrument racks and is alarmed in the control room.

The filter demineralizers are controlled from a local panel. Differential pressure and conductivity instrumentation is provided for each unit to indicate when backwash is required. Suitable alarms, differential pressure indicators, and flow indicators are provided to moni--- the condition of the filter demineralizers.

* insert ①

9.1.3.3 Safety Evaluation

The maximum possible heat load will be the decay heat of one full core load of the fuel due to an emergency dump into the pool plus the remaining decay heat of previously discharged batches of fuel. The residual heat removal system (RHR) can be operated in parallel with the fuel pool cooling and clean-up system during this condition when the pool has a greater than normal load and when its temperature exceeds 125°F. The RHR system can be used in parallel with the fuel pool cooling system to remove abnormal heat loads, as well as during the normal refueling mode. The RHR system will not be initiated unless the reactor is in a cold shutdown condition. The operator must insert spool pieces in supply and discharge piping and open normally closed valves to permit the use of this system for supplementary cooling.

The fuel pool heat exchangers are normally cooled by the reactor building closed cooling water system to prevent contamination outside the reactor building in the event of a fuel pool heat exchanger tube failure. The system can maintain the fuel pool water temperature below 125°F when removing the nominal heat load from the pool with the reactor building closed cooling water temperature at its maximum of 95°F. The fuel pool water temperature is permitted to rise to approximately 150°F while the system water flow is diverted from the pool to drain the reactor well and dryer-separator pit, or when larger than normal batches of spent fuel are stored in the pool.

* insert ②

There are no connections to the fuel storage pool which could allow the fuel pool to be drained below the pool gate between the reactor well and the fuel pool. Two diffusers are placed in both the reactor well and the fuel pool to distribute the return water as efficiently and with as little turbulance as possible. Diffusers are placed to minimize stratification of

Page 9.1-26 inserts:

① 9.1.3.2.2 Abnormal Operation

The portion of the FPC system which is required for cooling the fuel pool is located within the reactor building and is designed to Seismic Category I criteria. The portion of the FPC system which is used for fuel pool cleanup is located within the radwaste building and is isolable from the reactor building by means of two Seismic Category I isolation valves per line located within the reactor building. The isolation valves are either check valves or motor operated gate valves. The motor operated valves close automatically on a fuel pool low water level condition.

The redundant, active components required for fuel pool cooling are powered from division 1 and 2 power sources. Following a loss of off-site power, these components can be energized from on-site emergency power. On a loss of reactor building closed cooling (RCC) to the fuel pool heat exchangers, the RCC lines to the heat exchangers can be isolated by redundant, Seismic Category I, motor operated gate valves powered from separate Class 1E power supplies. Standby service water (SW) can be supplied to the heat exchangers through motor operated valves which are normally key locked closed. Radiation detectors are located on the SW return lines. Operation and monitoring of fuel pool cooling portion of the FPC system can be done entirely from the control room.

All components required for fuel pool cooling are qualified to the reactor building accident environment or else, they are located in enclosed rooms meeting the criteria set in 3.11.4.2. The fuel pool equipment room located on the 548 foot location is provided with both division 1 and 2 reactor building emergency cooling system.

② During abnormal operation the SW system is available to cool the fuel pool heat exchangers preventing any boiling of the fuel pool. The SW pressure is higher than the fuel pool pressure; thus, any leakage will be into the fuel pool system. In addition, radiation monitors on the SW return line will detect any gross tube or tube sheet failure.

either temperature or contamination. A check valve is connected to each pipe outside the pool to prevent the pool water from being siphoned out of the pool and uncovering the spent fuel. Flow control valves at the operating floor enable the operator to achieve optimum recirculation patterns to control and maintain the specified water quality and operational conditions.

* Insert I

A make-up water valve controlled by tank level switches supplies condensate from the condensate transfer system to the pool to replace evaporative and leakage losses. The backup source of make-up water is from the Seismic Category I, Safety Class 3 standby service water system. This connection supplies makeup for long-term evaporative losses. ~~enough water to prevent the uncovering of the spent fuel. By use of the standby service water as make-up, the fuel pool will be cooled by evaporation of the pool water.~~

~~Each filter demineralizer is capable of continual performance at a fuel pool water flow rate of 100% of rated flow~~ and will maintain water conditions as specified ~~in 9.1.3.2.~~

during normal operations, operating at a maximum fuel pool water flow rate of 1000 gpm

* add notes as shown on attachment II

~~The following components of the fuel pool cooling and cleanup system (FPC) are designed to ASME Section III, Class 3: fuel pool cooling pumps, filter demineralizers, pumps, valves, and piping, FPC piping, and fuel pool heat exchanger. The system heat exchangers are also designed to the standards of the Tubular Exchangers Manufacturers Association, Class R. Piping in the reactor building is controlled and supported to Seismic Category I requirements. The water lines between the fuel pool and RHR systems are designed to ASME Section III, Class 3, Seismic Category I requirements . The FPC pumps are not designed to Seismic Category I requirements. Condensate piping in the reactor building is controlled and supported to Seismic Category I requirements.~~

A radiological evaluation of the cleanup system is presented in Chapter 12.

From the foregoing analysis, it is concluded that the fuel pool cooling and cleanup system meets its design basis and satisfies the requirements of Regulatory Guide 1.13, Revision 1 with exceptions as noted in this section.

Page 9.1-27 insert I:

All piping connecting to the fuel pool, reactor well, and dryer separator pool and their respective liner drains are Seismic Category I up to and including either the normally closed, manually operated drain valve or the normally open, redundant isolation valves which can isolate the non-seismic portion of the system. Since the fuel pool system is at low temperature and pressure (moderate energy system) postulated breaks in the Seismic Category I portion are limited to cracks.

Fuel pool cooling can be established and monitored from the control room following a design basis LOCA. Entry to the reactor building is not required. One of the two redundant trains is adequate to prevent fuel pool boiling by a large margin. Due to the large thermal capacity of the fuel pool, sufficient operator time is available after a LOCA or any other event for the operator to take action.

Attachment II for page 9.1-27

Each filter demineralizer is capable of continual performance at a normal fuel pool water flow rate of 575 gpm, or a maximum fuel pool water flow rate of 1000 gpm, and will maintain water conditions as specified in 9.1.3.2.

9.1.3.4 Testing and Inspection Requirements

No special tests except as noted below are required because at least one pump, heat exchanger, and filter demineralizer are continuously in operation while fuel is stored in the pool. Duplicate components are operated periodically to handle abnormal heat loads or to replace a unit for servicing. Routine visual inspection of the system components, instrumentation, and trouble alarms are adequate to verify system operability.

SW flow to the fuel pool heat exchangers and operability of the valves which intertie the SW and RCC systems are tested in conjunction with testing of the SW system.

TABLE 9.1-2

FUEL POOL COOLING AND CLEANUP SYSTEM EQUIPMENT DATA

Fuel Pool Heat Exchangers

Number	2
Type	Tube and Shell
Material Tube/Shell	SS/CS
Capacity, Btu/hr/heat exchanger	4.0×10^6
Cooling Water Flow, gpm/heat exchanger	575
Code and Standards	ASME/III-Class 3 and TEMA-Class R
Seismic Category	~~II~~ I

Fuel Pool Circulation Pumps

Number	2
Type	Horizontal, centrifugal
Material	SS
Flow, gpm	575
Head, Ft of H_2O	160
Motor Size hp	40
Seismic Category	~~II~~ I
Code	ASME/III-Class 3

Fuel Pool Filter Demineralizer

Number	2
Design Flow Rate, gpm	1000
Design Pressure, psig	150
Design Temperature, °F	150
Material	CS-Plastic Lined
Code	ASME/III-Class 3
Seismic ~~Class~~ Category	II

Piping and Valves

Design pressure, psig	150/300
Design Temperature, °F	220
Material	CS
Code	ASME/III-Class 3
Seismic Category	
Fuel pool cooling portion:	I
Cleanup portion:	II

Elevation differentials between the low-low level setting and the HPCS pump impeller (Elev. 420'-4½") and the RCIC pump impeller (Elev. 427'-3") provide a suction head of at least 20 feet during HPCS/RCIC operation. (Tank bottom elevation is at 443 ft.)

Thermostatically controlled tank heaters are provided to maintain water temperature in the tanks above 40°F at all times. All above ground piping that contains water is heat traced to prevent freezing.

System logic diagrams are given in Chapter 7.

9.2.7 STANDBY SERVICE WATER SYSTEM

9.2.7.1 Design Bases

a. The standby service water system (SW) is designed to remove heat from plant systems which are required for a safe reactor shutdown following a LOCA.

b. The system is designed to remove reactor decay heat from the residual heat removal system during normal plant shutdown.

c. The system is designed to perform its required cooling water function following a LOCA, assuming a single active failure.

d. The system is designed to provide a means of flooding the vessel and containment, if required during the post-LOCA period.

e.* ~~The system is designed to provide makeup source of water for ensuring fuel pool evaporative cooling following a LOCA in conjunction with a design basis earthquake.~~

* see attachment

f. The system is designed to Seismic Category I and ASME Code, Section III, Class 3 requirements with the exception of that portion to and from the plant cooling towers, which is designed to ANSI B31.1 and Seismic Category II requirements.

9.2.7.2 System Description

The standby service water system includes vertical service water pumps located adjacent to the two spray ponds in two separate pumphouses designed to Seismic Class I criteria. The pumps discharge to three independent piping systems which serve emergency core cooling system equipment, auxiliary plant equipment and reactor shutdown cooling equipment. (See Figure 9.2-10 through 9.2-13).

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W.O. No. ______ Date ______ Book No. ______ Page No. ______
Drawing No. ______ Calc. No. ______ Sheet ______ Cont. on Sheet ______
By ______ Checked ______ Approved ______
Title ______

The system is designed to provide a long term cooling and makeup source to the fuel pool cooling system following a LOCA in conjunction with a design basis seismic event.

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During normal shutdown cooling, control of biological growth is provided by the circulating water system. (See 10.4.5).

The spray ponds are provided with makeup water by the circulating water system. The makeup water system supplies Columbia River water to the cooling towers or spray pond to replace water lost during normal operation due to evaporation and drift. In addition, the makeup system is designed to replace spray pond water lost during a tornado. To ensure system availability for this mode of operation, the makeup system is designed to withstand a design basis tornado coincident with a loss of offsite power.

The standby service water system piping is carbon steel designed to 300 psig, 150°F, and with a corrosion allowance of 0.080 inches.

~~Emergency makeup water to the fuel pool can be supplied through normally locked closed valves on 2" lines upstream of both "A" and "B" RHR heat exchangers.~~

*see attachment

EQUIPMENT DESIGN PARAMETERS

Standby Service Water Pumps (SW-P-1A, SW-P-1B)

Quantity	2
Driver	Motor - AC
Design Capacity	10,500 gpm
Head	500 ft.

HPCS Service Water Pump (HPCS-P-2)

Quantity	1
Driver	Motor - AC
Design Capacity	1,200 gpm
Head	123 ft.

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W.O. No. ______ Date ______ Book No. ______ Page No. ______
Drawing No. ______ Calc. No. ______ Sheet ______ Cont. on Sheet ______
By ______ Checked ______ Approved ______
Title ______

Emergency makeup water to the fuel pool can be supplied through Seismic Category I, Quality Class I isolation valves by remote-manual operation from the control room. These valves are on 2 inch lines located upstream of both "A" and "B" RHR heat exchangers.

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9.2.7.3 Safety Evaluation

The standby service water system provides cooling for plant equipment which is essential to a safe reactor shutdown following a design basis loss-of-coolant accident. The entire system is adequately protected to withstand the following adverse environmental occurrences:

a. Design Basis Earthquake

b. Design Basis Wind Loads

c. Tornado

Redundant trains of the standby service water system are separated and protected to the extent necessary to ensure that sufficient equipment remains in operation to permit safe shutdown of the unit in the event of any of the following events:

a. Flooding or steam release from equipment failure such as pipe or tank rupture.

b. Pipe whip and jet forces resulting from pipe rupture.

c. Missiles which may result from equipment failure.

d. Fire.

The standby service water system is designed to withstand a single active failure without losing its capability to participate in the safe shutdown of the reactor following an accident.

System failure mode and effects analyses of passive and active components of the service water system is presented in Table 9.2-6. Any of the assumed failures of the service water system is detected in the main control room by indications and/or alarms from the various system instruments.

~~The standby service water is routed through the tube side of the RHR heat exchanger and through the shellside of the RHR pump seal coolers. The RHR heat exchanger and the pump seal cooler are the only potential sources of radioactive leakage to the standby service water system.~~

* see attachment

A manually set and locked control valve is provided in the return line of each of the two standby service water sub-

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W.O. No. ______ Date ______ Book No. ______ Page No. ______
Drawing No. ______ Calc. No. ______ Sheet ______ Cont. on Sheet ______
By ______ Checked ______ Approved ______
Title ______

The standby service water is routed through the tube side of the RHR heat exchanger, through the shell side of the FPC heat exchangers, and through the shellside of the RHR pump seal coolers. The RHR heat exchanger, the FPC heat exchanger, and the RHR pump seal coolers are the only potential sources of radioactive leakage to the standby service water system.

systems to maintain the pressure in the system at a level such that tube leakage in the RHR heat exchanger or pump seal cooler is from the service water system into the RHR system after the reactor is depressurized following shutdown cooling or after a LOCA. Liquid radiation monitors are provided in each of the two RHR heat exchangers outlet lines of the service water system to detect radioactivity resulting from a tube leak in one of the RHR heat exchangers or leakage from the pump seal coolers. This condition can occur only when the RHR system is operated in a mode in which the service water system pressure is lower than the RHR system pressure. Upon detection of radioactive leakage in one of the subsystems, that subsystem is isolated by operator action in the main control room and the cooling requirements are met by the redundant train. Consequently, radioactivity released to the spray ponds and/or cooling tower basins is minimized.

(* see attachment)

~~An intertie with the~~ RHR system is provided from the "B" standby service system supply header which contains two remote manually operated isolation valves. These valves can be opened from the main control room in the event primary containment flooding is required following a loss-of-coolant accident.

The standby service water pumps are provided with double valved, normally closed bypass connections for transferring water from one pond to another. Should the service water pump be unavailable for transfer purposes, an atmospheric syphon is available for backup service.

Temperature controlled and/or manually operated throttle valves are located on the return side of all standby service water system coolers and heat exchangers. The system is balanced for optimum operation and the throttle valves left in that position. The RHR heat exchanger service water outlet valve is interlocked to open on starting of a standby service water pump to prevent excess flow conditions in other portions of the system.

Redundant spray pond low level switches in each spray pond pumphouse automatically close the redundant isolation valves on the SSW return line to the cooling towers and open the isolation valve to the spray pond. The ECCS start signals also automatically perform this function to ensure that the spray ponds always maintain sufficient inventory to meet the system requirements delineated in 9.2.5.

In emergency conditions, the standby service water system can be routed through the shell side of the FPC heat exchangers to provide long term cooling. The standby service water system pressure is higher than the FPC system pressure, so any tube leakage will be into the FPC system. In addition, radiation monitors are provided in the standby service water system at a downstream location after the RHR heat exchangers.

TABLE 9.2-5

EQUIPMENT REQUIRING STANDBY SERVICE
WATER TO ENSURE PLANT SHUTDOWN

Equipment Cooled	Required Flow-gpm(1)	Design Heat Load (Btu/hr)	Calculated Heat Load (Btu/hr)
Division I			
1. Standby Service Water Pumphouse "A" Cooler	80	404,000	380,600
2. Diesel Generator "A"	1650 (2)	15,600,000	11,692,427
3. Diesel Generator Building "A" Coolers	144	716,000	716,000
4. LPCS Pump Motor Bearings	4 (3)	-	~0
5. LPCS Pump Room Cooler	56	280,000	270,860
6. RHR "A" Pump Seals	12 (2)	-	~0
7. RHR "A" Room Cooler	33	165,000	149,650
8. D.C. Motor Control Center Room Cooler	20	84,200	40,533
9. Motor Control Center Room Cooler	15	71,280	43,130
10. Control Room Cooler	120	285,000	256,500
11. Cable Spreading Room Cooler	40	160,000	74,600
12. Switchgear Room Cooler	60	370,000	327,100
13. Hydrogen Recombiner "A" MCC Room Cooler	11	52,500	36,174
14. Hydrogen Recombiner "A" Aftercooler	50	-	250,000
15. Hydrogen Recombiner "A" Scrubber	10	-	50,000
16. RHR "A" Heat Exchanger	7400 (2)	(4)	Variable
~~17. Analyzer Room Cooler~~	10	42,500	23,571
* See attachment TOTAL	~~[illegible]~~ 10,325		

1) Based on 85°F Standby Service Water Supply unless otherwise noted.
2) Design based on 95°F Standby Service Water Supply
3) Design based on 90°F Standby Service Water Supply
4) See Table 6.2-2 for design parameters

Attachment to p. 9.2-40

	Req'd Flow	Design Heat Load	Calc. Heat Load
18. Fuel Pool Pump Room Cooler RRA-CC-20	35	134,120	121,930
19. Fuel Pool "A" Heat Exchanger	575	4,000,000	Variable

TABLE 9.2-5 (Continued)

Equipment Cooled	Required Flow-gpm(1)	Design Heat Load (Btu/hr)	Calculated Heat Load (Btu/hr)
Division II			
1. Standby Service Water Pumphouse "B" Cooler	80	404,000	358,100
2. Diesel Generator "B"	1650 (2)	15,600,000	11,692,427
3. Diesel Generator Building "B" Coolers	144	716,000	716,000
4. Diesel Generator Area Cable Cooler (Corridor)	40	149,000	109,680
5. RHR "B" Pump Seals	12 (2)	-	~0
6. RHR "C" Pump Seals	12 (2)	-	~0
7. RHR "B" Room Cooler	33	165,000	145,650
8. RHR "C" Room Cooler	33	165,000	160,530
9. RCIC Pump Room Cooler	12	60,000	37,270
10. Motor Control Center Room Cooler	15	71,280	43,130
11. Control Room Cooler	120	285,000	256,500
12. Cable Spreading Room Cooler	40	160,000	74,600
13. Switchgear Room Cooler	60	320,000	305,400
14. Hydrogen Recombiner "B" Aftercooler	50	-	250,000
15. Hydrogen Recombiner "B" Scrubber	10	-	50,000
16. Hydrogen Recombiner "B" MCC Room Cooler	11	52,500	36,174
17. RHR "B" Heat Exchanger	7400 (2)	(3)	Variable
18. Analyzer Room Cooler	10	42,500	23,571
* See attachment TOTAL	~~[illegible]~~ 10,342		

1) Based on 85°F Standby Service Water Supply unless otherwise noted.
2) Design based on 95°F Standby Service Water Supply
3) See Table 6.2-2 for design parameters

Attachment to p. 9.2-41

	Req'd flow	Design Heat Load	Calc. Heat Load
19. Fuel Pool Pump Room Cooler RRA-CC-19	35	134,120	121,930
20. Fuel Pool "B" Heat Exchanger	575	4,000,000	Variable

Room	Maximum Allowable Ambient Temp. (°F)
HPCS Pump Room	148°
Div. 1 LPCS Pump Room	148°
Div. 2 RCIC Pump Room	148°
Div. 1 RHR Pump Room	148°
Div. 2 RHR Pump Rooms (2 Pump Rooms)	148°
Div. 1 MCC Room (EL. 522)	104°
Div. 2 MCC Room (EL. 522)	104°
Div. 1 D.C. MCC Room (EL. 471)	104°
Div. 1 H_2 Recombiner MCC Room (EL. 572)	104°
Div. 2 H_2 Recombiner MCC Room (EL. 572)	104°
Div. 1 Reactor Building Analyzer Room 1A	104°
Div. 2 Reactor Building Analyzer Room 1B	104°
Fuel Pool Cooling Pump Room	104°

The electrical equipment rooms are isolated from the reactor building heating and ventilating system upon a signal of building isolation.

All components of the reactor building emergency cooling system are designed as engineered safety features and are powered from the same diesel generator bus as the equipment being served. Since each separate cooling system services redundant emergency equipment systems, a failure of one cooling system will not effect the operational function of the other cooling systems or the safe shutdown of the reactor. The means of protecting the system vents and louvers from missiles is discussed in 3.5.

All ductwork connected to the fan coil units in this system is designed to Seismic Category I requirements. The system fans are constructed and rated in accordance with the applicable AMCA standards. The water cooling coils are designed and code stamped in accordance with the requirements of the ASME Code, Section III Class 3.

9.4.9.2 System Description

The reactor building emergency cooling system is depicted in Figure 9.4-2. Each of the ~~thirteen~~ fourteen rooms housing critical equipment is provided with an individual air handling unit which is fully enclosed within the room. Each air handling unit is comprised of a direct drive centrifugal or vane axial fan and a water cooling coil in a sheet metal housing. Water is supplied to the water coils by the standby service water system (see 9.2.7). During normal operation, all ~~thirteen~~ fourteen air handling units are in standby. ~~The units servicing the pump rooms start upon actuation of their associated pumps. The units servicing the MCC equipment rooms and the analyzer rooms start automatically upon any signal which isolates the reactor building.~~ add attachment I

All units recirculate the air within the room they serve, removing the heat generated in the room via the water coil, to maintain temperatures below the design limits listed in 9.4.9.1.

9.4.9.3 Safety Evaluation

Each of the ~~thirteen~~ fourteen emergency equipment rooms in the reactor building is provided with a separate, independent cooling system, all components of which are located within the room serviced. Each cooling system is powered from a Class 1E bus of the same division as the equipment it serves and is designed to withstand the effects of a safe shutdown earthquake. A failure of one cooling system will not affect the operational function of any other system or the safe shutdown of the reactor.

The air handling units serving ~~the six~~ six of seven pump rooms are interlocked electrically with the pumps they serve in such a manner that they start when the pump is started. ~~The seven air handling units serving the critical MCC rooms and the analyzer rooms are started by any of the following three isolation signals:~~ Add attachment II

a. Reactor vessel low water level

b. High drywell pressure

c. High radiation level in reactor building exhaust ventilation system

The FPC pump room coolers also start on loss of offsite power.

BURNS AND ROE, INC. Attachment I
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W.O. No. ______ Date ______ Book No. ______ Page No. ______
Drawing No. ______ Calc. No. ______ Sheet ______ Cont. on Sheet ______
By ______ Checked ______ Approved ______
Title ______

Six of the seven units servicing the pump rooms start upon actuation of their associated pumps. The units servicing the ~~FPC~~ Fuel Pool Cooling (FPC) pump room, MCC equipment rooms, and the analyzer rooms start automatically upon any signal that isolates the reactor building. The FPC pump room units also start on loss of offsite power.

~~Loss of Offsite Power~~

Form BR 8002-2 (5/78)

Attachment II

BURNS AND ROE, INC.
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W.O. No. ______ Date ______ Book No. ______ Page No. ______
Drawing No. ______ Calc. No. ______ Sheet ______ Cont. on Sheet ______
By ______ Checked ______ Approved ______
Title ______

The eight air handling units serving the FPC pump room, critical MCC rooms, and the analyzer rooms are started by any of the following three isolation signals:

Form BR 8002-2 (5/78)

9.4.9.4 Testing and Inspection Requirements

All components of the reactor building emergency cooling system are normally in standby and are accessible for out-of-service inspection. All system ductwork and components are subjected to leak tests and all piping systems are subjected to hydrostatic tests during manufacture and erection.

The cooling system is subjected to pre-operational testing at design conditions and performance shall be verified periodically by testing during unit operation.

9.4.9.5 Instrumentation Requirements

~~The six~~ Six of the seven air handling units serving the pump rooms are controlled identically. Each is electrically interlocked with the pump it serves to operate when the pump operates. Running lights for the fans are located in the main control room on the same panels as the pump switches. The standby service water system supplies the air handling unit water coil when the pump is started. A local manual switch is provided in each pump room for testing the air handling unit fan. (add attachment I)

~~The controls for each of the seven cooling systems serving the critical MCC and analyzer rooms are also identical.~~ An ON-AUTO-OFF switch (spring back from OFF to AUTO) is provided for each unit in the main control room. Normally all switches are in the AUTO position and the units are in standby. In the AUTO mode, any of the three isolation signals listed in 9.4.9.3 will cause the following operations, via electric interlocks:

a. Air handling unit fans start.

b. Standby service water system is energized when the associated emergency diesel generators start.

c. Solenoid valves associated with the air operated dampers in the reactor building ventilation system supply air ducts to the MCC and analyzer rooms are de-energized, thus isolating these rooms from the balance of the reactor building.

(add attachment II)

Temperature indicators for each of the ~~thirteen~~ fourteen equipment rooms are provided in the main control room. Separate temperature switches in each room will annunciate an alarm in the main control room in the event that temperatures exceed the design limit.

Attachment I

The controls for each of the eight cooling systems serving the FPC pump room, the critical MCC rooms, and the analyzer rooms are identical.

Attachment II

In addition, the FPC pump room coolers will start on loss of offsite power when the control switch is in the AUTO position.

TABLE 9.4-2 (Continued)

c. Reactor Building Emergency Fan Coil Units

Add notes as shown on attachment for FPC Room Coolers

1.	Tag No.	RRA-FC-1 RRA-FC-2 RRA-FC-3	RRA-FC-4	RRA-FC-5	RRA-FC-6	RRA-FC-10 RRA-FC-11
2.	No. of Units	3	1	1	1	2
3.	Air Flow per Unit (ACFM)	5208	15,625	9375	3125	5730
4.	Sensible Cooling Capacity (Btuh) per unit	165,000	500,000	280,000	60,000	71,280
5.	Total Static Pressure (inches,w.g.)	1.34	1.64	1.46	1.53	0.5
6.	Area Served	RHR Pump Rooms	HPCS Pump Room	LPCS Pump Room	RCIC Pump Room	MCC Rooms
7.	Water Supply Service	Standby Service Water	Standby Service Water	Standby Service Water	Standby Service Water	Standby Service Water
8.	Seismic Category	I	I	I	I	I

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W.O. No. ______ Date ______ Book No. ______ Page No. ______
Drawing No. ______ Calc. No. ______ Sheet ______ Cont. on Sheet ______
By ______ Checked ______ Approved ______
Title ______

1. RRA-FC-19
   RRA-FC-20

2. 2

3. 10,000

4. 134,000

5. 0.5

6. FPC Pump Room

7. Standby Service Water

8. I

Form BR 8002-2 (5/78)

For each liquid off-line detector location, a continuous sample is extracted from the liquid process pipe, passed through a liquid sample panel which contains a detection assembly for gross radiation monitoring, and returned to the process pipe. The detection assembly consists of a scintillation detector mounted in a shielded sample chamber equipped with a check source. A radiation monitor in the control room analyzes and visually displays the measured gross radiation level. The sample panel chamber and lines can be drained to allow assessment of background buildup. The panel measures and indicates sample line flow. A solenoid operated check source operated from the control room can be used to check operability of the channel.

Power is supplied from 125 VDC non-divisional buses for the control room radiation monitors and recorders, and from a 120 VAC local bus for the sample panels.

The detector's local preamplifier unit is designed to remain fully operational in their expected environment. If exposed to radiation transients which exceed the channel range, the channel maintains full scale deflection and returns to normal functioning when the transient has subsided.

Each radiation monitor, except for the turbine-generator building sump monitor, has four trip circuits: Two upscale (high-high and high), and one downscale (low), and one inoperative. Each trip is visually displayed on the affected radiation monitor. Two of these trips actuate corresponding control room annunciators: one upscale (high radiation) and the downscale for the affected liquid monitoring channel. High or low sample flow measured at the sample panel actuates a control room high-low flow annunciator for the affected liquid channel.

All alarms are annunciated in the control room. Liquid monitor systems details are given in Table 11.5-2 and the monitor arrangemets are shown in Figure 11.5-7 and 11.5-8.

11.5.2.2.2.1 Standby Service Water Radiation Monitoring System

A radiation detector is located off-line and samples the standby service piping downstream of each of the two residual heat removel (RHR) heater exchanger (loops A and B). These monitors are designed to detect any primary coolant leakage into the standby service water during operation of the RHR heat exchangers in the shutdown heat removal mode, or any leakage from the FPC heat exchangers into the standby service water system during emergency operation.

[illegible]