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POWER AUTHORITY OF THE STATE OF NEW YORK

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October 31, 1980
JPN-80-51

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DISTRIBUTION SERVICES BRANCH

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. Thomas A. Ippolito, Chief
Operating Reactors Branch No. 2
Division of Licensing

Subject: James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
Response to NRC April 22, 1980 Letter
Concerning Spent Fuel Pool (SFP) Cooling

Dear Sir:

The Authority affirms its position, as discussed in our letter of April 1, 1980, that sufficient backup to the SFP cooling system is provided by the RHR system such that SFP boiling need not be considered. Therefore, responses to Enclosure 1 to the NRC April 22, 1980 letter are enclosed.

The Spent Fuel Pool Expansion amendment application dated July 26, 1978 postulated loss of all cooling to the SFP without regard to available backup cooling methods. The Authority regrets any confusion caused by this postulation, which is in conflict with the original design basis for JAF.

The purpose of the Authority's October 10, 1979 Technical Specification amendment proposal was to preclude use of the RHR system for SFP cooling where it may interfere with the LPCI function. In the event of loss of normal SFP cooling, the Authority procedures allow prompt cooldown so that cold shutdown conditions can be reached and RHR lineup to the SFP can be accomplished in a timely manner.

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SEND Encl. to:
TERA (RETURN to Reg files
after filming)

Also enclosed are responses to Enclosure 3 to the NRC April 22, 1980 letter requesting additional economic information.

Very truly yours,

JP Bayne

J. P. Bayne
Senior Vice President
Nuclear Generation

RESPONSE TO ENCLOSURE (1) OF THE NRC LETTER OF APRIL 22, 1980

Item 1

Following a Safe Shutdown Earthquake (SSE), what components, systems or subsystems of pool cooling systems remain available? For those items assumed available, please provide design details such as the stress analysis, hydraulic analysis and applicable codes and standards used in the design procurement and installation. (In the event availability is time dependent, please provide justification for system line-up changes as they effect redundant reactor core cooling capability).

Response to Item 1

In the event of the occurrence of the Safe Shutdown Earthquake (SSE), the Category II portions of the Spent Fuel Pool Cooling System (SFPC), can no longer be considered available and therefore are assumed unable to provide cooling of the Spent Fuel Pool. In this case, Spent Fuel Pool cooling is provided by the Residual Heat Removal System (RHR) by way of valved and flanged "take down" connections between the RHR and the remaining operable Category I portions of the SFPC systems. Refer to Attachment 1, for a representation of the system line-up and arrangements used in this mode of Spent Fuel Pool Cooling. Details of the stress analysis for the remaining portions of the SFPC systems are found in the attached seismic analysis sketches 11825-MSK-113B1 through 11825-MSK-113F1 (Attachment 2), and the Listing of Category I, Remaining SFPC System Equipment (Attachment 3). Seismic analysis of the RHR system is provided in 11825-MSK-114G1 through MSK-114N1, 11825-MSK-114P1 through 11825-MSK-114P8 and 11825-MSK-114T1 through MSK0114U1 (Attachment 4).

Applicable codes and standards used in the design, procurement and installation of both the RHR and the useable portions of the SFPC systems are tabulated in Attachment 5.

Three limiting cases for loss of normal Spent Fuel Pool Cooling and use of RHR cooling were discussed in the Authority letter JPN-80-19 dated April 1, 1980. The connection of the RHR system for spent fuel cooling is time dependent for Cases 2 and 3. For Case 1, the RHR system is lined up in advance of a full core offload and isolation of the out-of-service SFPC system can be accomplished in a matter of minutes. Attachment 6 provides the results of updated heat balance calculations for spent fuel pool cooling with and without the Spent Fuel Pool Cooling System. The results show that, for loss of the normal SFPC System and using conservative heat loads, the SFP temperature would rise from 131°F up to 158°F where it would stabilize. As discussed in our letter JPN-80-19, the Authority will take appropriate steps to assure that heat loads will not be introduced into the spent fuel pool which are sufficient to cause the fuel pool temperature to exceed 150°F.

For Case 2, the actual making up of the previously mentioned flanged "take down" connections and realignment of valves can be accomplished within two hours. Attachment 6 provides the results of updated heat balance calculations for Case 2, which show that: (1) at the point in time of loss of normal spent fuel cooling, the bulk pool temperature will be 139°F, (2) that 2.5 hours will pass prior to the bulk temperature reaching 150°F and (3) that upon introduction of RHR cooling to the spent fuel pool, the pool temperature will decrease to an equilibrium value of 146°.

RHR cooling of the spent fuel pool can be accomplished with out interfering with RHR cooling of the reactor. Attachment 1 shows the interconnections between the RHR and SFPC systems. It is also expected that, for Case 2, cycling between the RHR shutdown cooling mode and SFP cooling would be feasible.

For Case 3, assuming the plant is operating when an SSE occurs, the plant can be brought to a cold shutdown condition in as quickly as six hours. An isolated cooldown is assumed using equipment described in the FSAR Section 4.8.6.3. An additional two hours is required to connect the fuel pool to the RHR system.

Attachment 6 provides results of updated heat balance calculations for spent fuel pool cooling for Case 3, which show that (1) at the point in time of loss of spent fuel cooling, the bulk pool temperature will be 124°F, (2) that 9.5 hours would pass prior to the bulk pool temperature reaching 150°F, (3) that two RHR pumps and two RHR heat exchangers are capable of simultaneously maintaining the reactor in cold shutdown and maintaining the spent fuel pool temperature below 150°F. Attachment 1 shows RHR system line up for simultaneous reactor and SFP cooling. Where feasible, cycling between the RHR shutdown cooling mode and SFP cooling may be done.

Item 2

Please provide similar information as requested in item (1) above assuming loss of off-site power.

Response to Item 2

In the event of a loss of off-site power, the RHR system would again be required to provide cooling of the Spent Fuel Pool using the same line-up as presented in response to Item 1.

RESPONSE TO ENCLOSURE (3) OF THE NRC LETTER OF APRIL 22, 1980

1. Cost of storage at other nuclear plants.

RESPONSE:

As stated in our original submittal of July 26, 1978:

> "5.1.8 Shipment to and Storage at Other Utility Storage Facilities. This scheme is not considered to be a viable alternative. Because of the lack of domestic reprocessing capability, all utilities are faced with the same storage problem. Even if other utility pools were available, the economics of such shipments would be unfavorable. Double handling would be required and would be similar to the alternative in Section 5.1.2"

2. Cost of storage at an independent facility.

RESPONSE:

As stated in our original submittal of July 26, 1978:

> "5.1.2 Shipment to Other Reprocessors or Commercial Storage Facilities. No commercial reprocessing plants are in operation, and the commercial reprocessing and recycling of spent fuel has been deferred indefinitely. Therefore, this is not a viable alternative.
>
> Only limited storage capability is available at commercial facilities. The General Electric (GE) Morris facility will be able to store about 700 tons but PASNY has no contract for this capacity.
>
> Storage at an offsite storage facility would require double handling of the spent fuel assemblies. The shipping and handling costs alone make it an economically unacceptable alternative when compared to increased storage capacity of the spent fuel pool. Although a detailed cost survey of this alternative has not been conducted, it is estimated that to ship 1,000 assemblies from 1977 through 1983 would cost in excess of $15,000,000. In addition to assuming that storage facilities would be ready, it is also assumed that appropriate shipping vehicles would be available."

3. Cost of storage at a reprocessing facility.

RESPONSE:

This was included in our response to item 2 (above) and is part of section 5.1.2 of our original submittal of July 26, 1978.

4. Daily cost of reactor shutdown.

RESPONSE:

At current rates, the Authority collects approximately $370,000/day in revenues from generation at full power at JAFNPP. This figure includes demand charges.

5. Cost of building new storage pools.

RESPONSE:

As stated in our original submittal of July 26, 1980:

> "5.1.5 Build New Storage Pools. - Additional storage capacity could be made available by building a new storage pool, either on or off-site. A detailed evaluation has not been performed, but scoping studies indicate the cost of such a facility to be $30,000,000, in addition to the cost associated with double handling of the fuel. Such a facility would require 4 to 5 years to engineer and construct, therefore it does not satisfy our near term requirements. This alternative is unacceptable because of economic, operational, and availability considerations."

The estimated cost of $30,000,000 should be increased to take into consideration the rate of inflation in the intervening years since 1978.

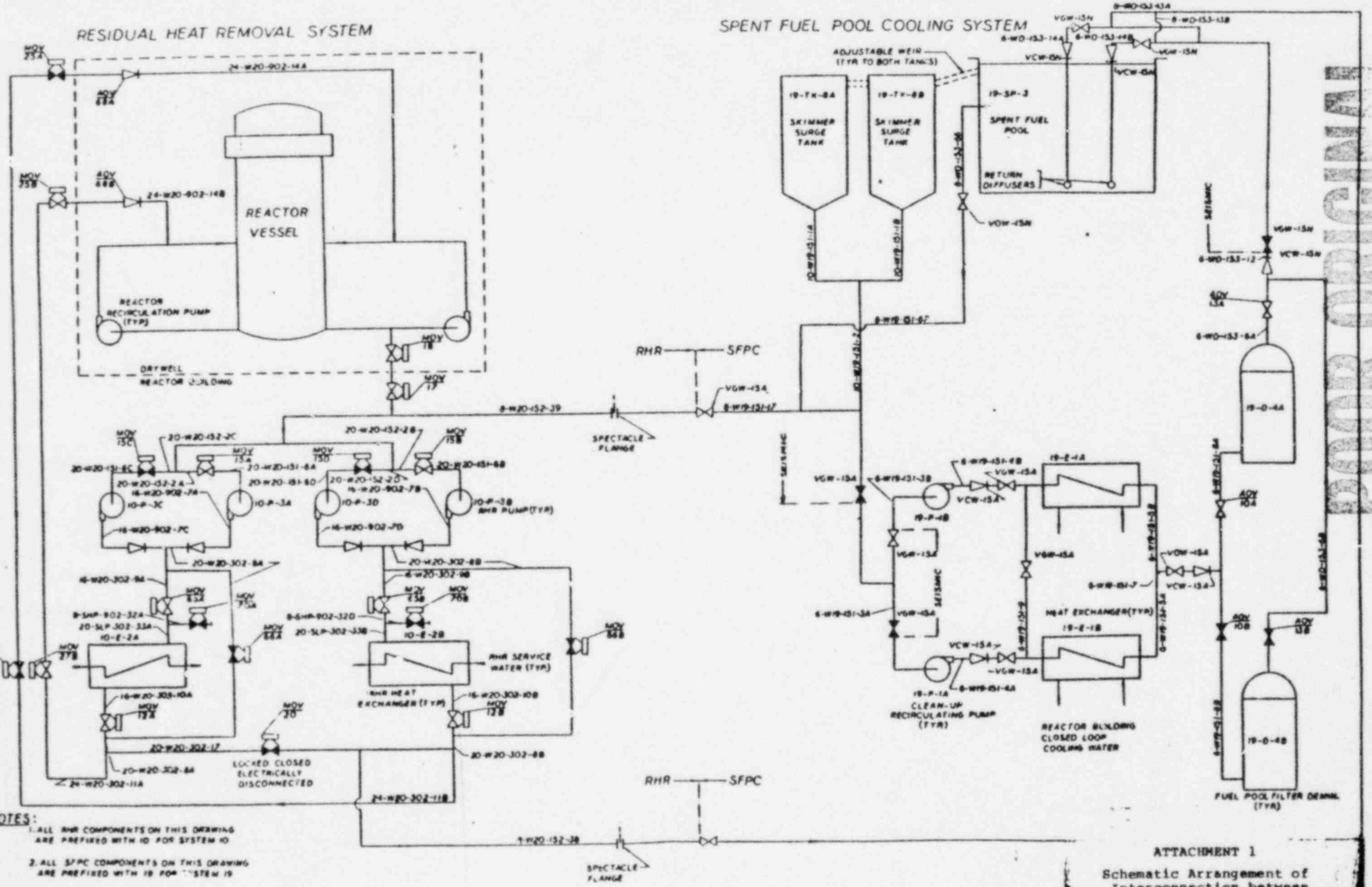
6. Cost of storage at Indian Point (Unit 3).

RESPONSE:

As stated in our original submitted of July 26, 1980:

> "5.1.6 Shipment of Spent Fuel to Indian Point No. 3 Power Station. PASNY anticipates a spent fuel storage problem at the Indian Point No. 3 Power Station and made an application in 1977 to modify the spent fuel storage facility of that unit in order to have sufficient capacity for that unit until reprocessing can become available. Therefore, it is not feasible to use the spent fuel storage at Indian Point 3 for JAFNPP fuel."

Attachment 1	Schematic Arrangement of Interconnection between RHR and SFPC Systems
Attachment 2	11825-MSK-113B1 through 11825-MSK-113F1
Attachment 3	Category I Portions, Spent Fuel Pool Cooling Systems
Attachment 4	11825-MSK-114G1 through MSK-114N1, 11825-MSK-114P1 through MSK-114P8 and 11825-MSK-114T1 through MSK-114U1
Attachment 5	Applicable Codes and Standards
Attachment 6	Process Flow Diagram for RHR/SFPC Cooling of the Spent Fuel Pool



NOTES:

1. ALL RHR COMPONENTS ON THIS DRAWING ARE PREFIXED WITH 10 FOR SYSTEM 10
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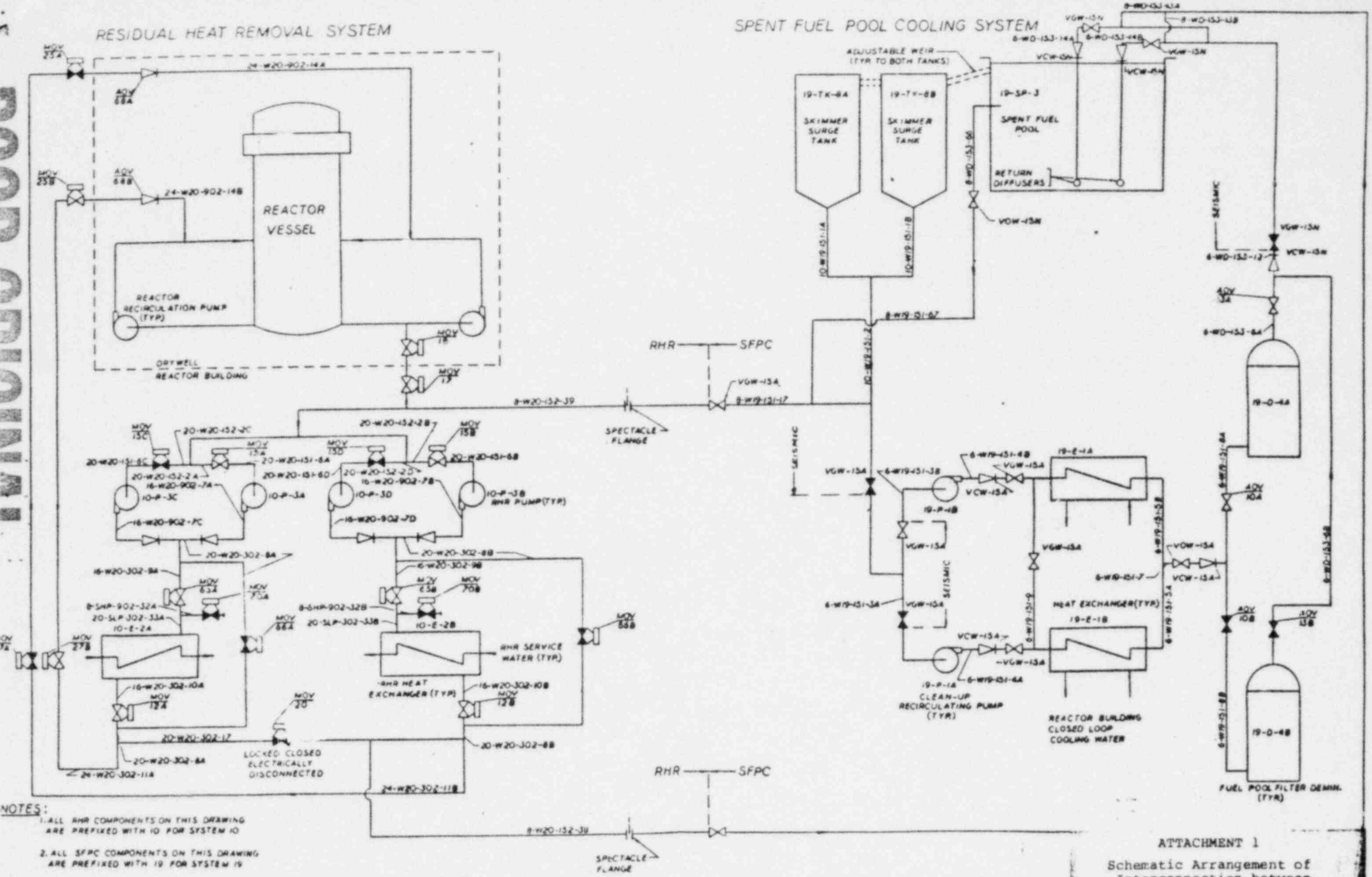

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RESPONSE:

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CATEGORY I PORTIONS

SPENT FUEL POOL COOLING SYSTEMS

1. Lines

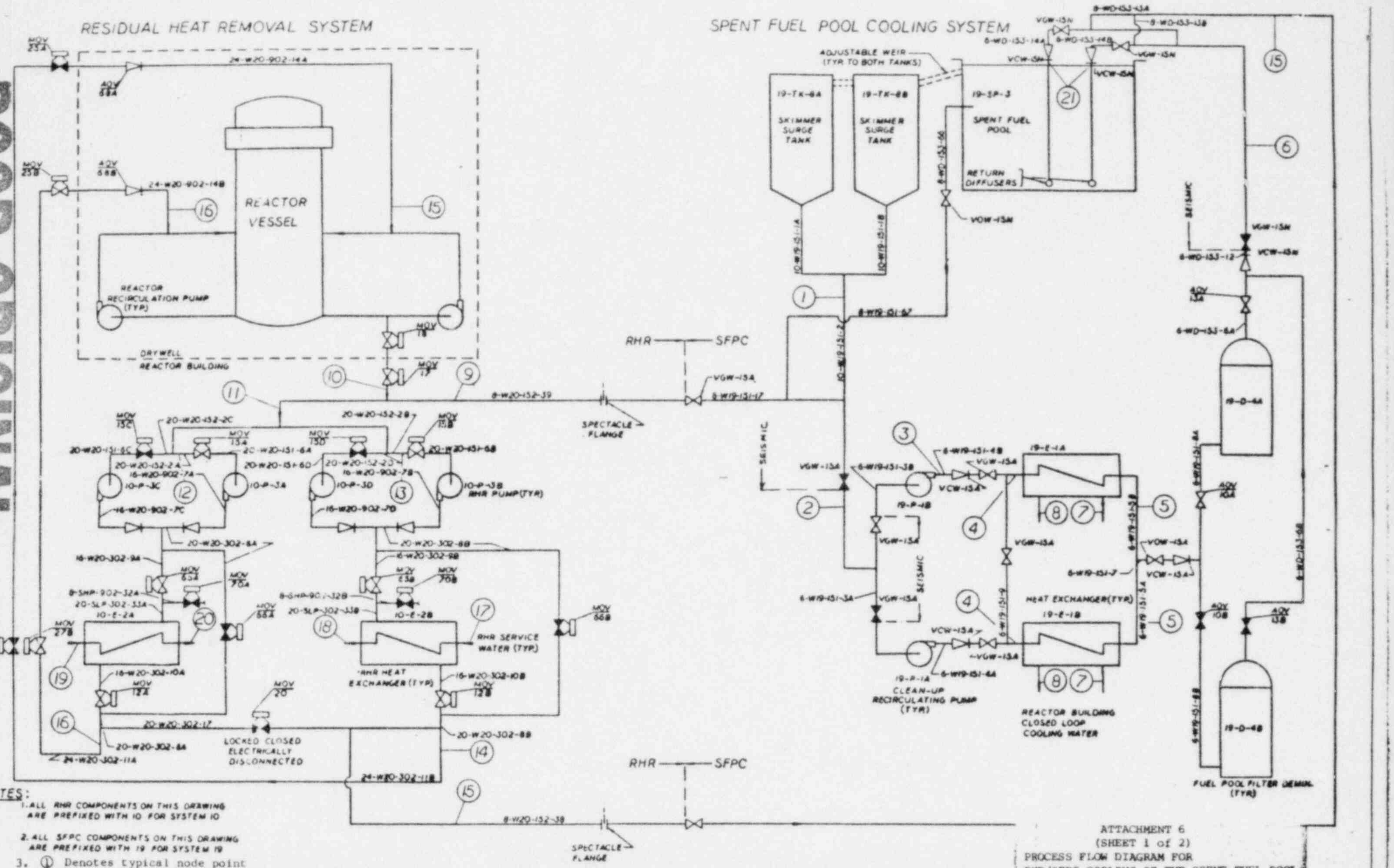
   a. 8"-W-19-151-17
   b. 10"-W-19-151-2
   c. 10"-W-19-151-1A and B
   d. 8"-W-19-151-67
   e. 8"-WD-153-66
   f. 6"-WD-153-14A and B
   g. 8"-WD-153-13A and B

2. Valves (Manual)

	Valves (Manual)	No.
a.	19-8"-VOW-15N	2
b.	19-10"-VGW-15N	3
c.	19-6"-VCW-15N	2
d.	19-8"-VGW-15A	1
e.	19-10"-VGW-15A	1

3. Equipment

   a. 19-TK 8A and B Skimmer Surge Tank



NOTES:

1. ALL RHR COMPONENTS ON THIS DRAWING ARE PREFIXED WITH 10 FOR SYSTEM 10
2. ALL SFPC COMPONENTS ON THIS DRAWING ARE PREFIXED WITH 19 FOR SYSTEM 19
3. ① Denotes typical node point for process flow conditions shown on Sheet 2.

ATTACHMENT 6
(SHEET 1 of 2)
PROCESS FLOW DIAGRAM FOR
RHR/SFPC COOLING OF THE SPENT FUEL POOL

FUEL POOL TEMPERATURE = TEMPERATURE AT NODE 1
REACTOR TEMPERATURE = TEMPERATURE AT NODE 10

CASE NUMBER	CASE DESCRIPTION & HEAT LOAD	SYSTEM ALIGNMENT PRIOR TO AND AFTER POSTULATED SSE OR LOSS OF OFFSITE POWER	PARAMETER	NODE NUMBER ①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	⑲	⑳	㉑
	-Full Core Off-load 1989 -250 Hours after shutdown $\dot{Q}$ Reactor = 0 $\dot{Q}$ Fuel Pool = 24.2 x 10^6 Btu/hr	Prior to SSE: -1 SFPC pump and 2 SFPC heat exchangers running -Spectacle flanges open -1 RHR pump and 1 RHR heat exchanger running	Flow (GPM)	1725	525	525	262.5	262.5	525	467	467	1200	6500	7700	-	7700	6500	1200	-	8000	8000	-	-	1725
			Temp. (°F)	131	131	131	131	100	100	95	113	131	104	108	-	108	104	104	-	77	81	-	-	103
			Heat Exchanger Duty (10^6 Btu/hr)			19-E.1A= 4.095 19-E.1B= 4.095				10E-2A=0 10E-2B= 16.01														
		After SSE: -Non-seismic portion SFPC system isolated -1 RHR pump and 1 RHR heat exchanger running	Flow (GPM)	1200	-	-	-	-	-	-	-	1200	6500	7700	-	7700	6500	1200	-	8000	8000	-	-	1200
			Temp. (°F)	158	-	-	-	-	-	-	-	158	118	124	-	124	118	118	-	77	83	-	-	118
			Heat exchanger Duty (10^6 Btu/hr)			19-E.1A=0 19-E.1B=0				10E-2A=0 10E-2B=24.2														
2	-1/4 Core off-load 1992 -150 Hours after shutdown $\dot{Q}$ Reactor = 20.6 x 10^6 (3/4 Core in Reactor) $\dot{Q}$ Fuel Pool = 10.11 x 10^6 Btu/hr	Prior to SSE: -1 SFPC pump and 2 SFPC Heat exchangers running -Both spectacle flanges closed -1 RHR pump and 1 RHR heat exchanger running	Flow (GPM)	525	525	525	262.5	262.5	525	467	467	-	7700	7700	-	7700	7700	-	-	8000	8000	-	-	600
			Temp (°F)	139	139	139	139	101	101	95	117	-	117	117	-	117	112	-	-	77	82	-	-	102
			Heat Exchanger Duty (10^6 Btu/hr)			19-E.1A=5.055 19-E.1B=5.055				10E-2A=0 10E-2B=20.6														
		After SSE: -Non-seismic portion of SFPC system isolated -Both spectacle flanges open -1 RHR pump and 1 RHR heat exchanger running	Flow (GPM)	1200	-	-	-	-	-	-	-	1200	6500	7700	-	7700	6500	1200	-	8000	8000	-	-	1200
			Temp (°F)	146	-	-	-	-	-	-	-	146	135	137	-	137	129	129	-	77	85	-	-	129
			Heat Exchanger Duty (10^6 Btu/hr)			19-E.1A=0 19-E.1B=0				10E-2A=0 10E-2B=30.71														
	-1/4 Core Off-load in 1992 -Reactor Back at power 6 weeks after refueling * - 9.5 Hours after shutdown due to SSE $\dot{Q}$ Reactor ≈ 69.9 x 10^6 (Assumed full core in Reactor) $\dot{Q}$ Fuel Pool = 6.2 x 10^6 Btu/hr	Prior to SSE: -1 SFPC pump and 2 SFPC heat exchangers cooling the fuel pool -Both spectacle flanges closed	Flow (GPM)	475	475	475	237.5	237.5	475	467	467	-	-	-	-	-	-	-	-	-	-	-	-	600
			Temp (°F)	124	124	124	124	98	98	95	108	-	-	-	-	-	-	-	-	-	-	-	-	98
			Heat Exchanger Duty (10^6 Btu/hr)			19-E.1A=3.1 19-E.1B=3.1				10E-2A=0 10E-2B= 0														
		After SSE: -Non-seismic portion of SFPC system isolated -Both spectacle flanges open -2 RHR pumps and 2 RHR heat exchangers running -Inlet to the heat exchangers mixed outlet separated to reactor and SFPC	Flow (GPM)	1200	-	-	-	-	-	-	-	1200	7700	8900	7700	1200	-	1200	7700	8000	8000	8000	8000	1200
			Temp (°F)	143	-	-	-	-	-	-	-	143	180	175	175	175	-	132	162	77	83	77	90	132
			Heat Exchanger Duty (10^6 Btu/hr)			19-E.1A=0 19-E.1B=0				10E-2A= 50.4 10E-2B= 25.7														

*Case 3 - Heat Balance For Other Times After SSE

Time (Hours)	$\dot{Q}$ Reactor (10^6 Btu/hr)	T Node 1 (°F)	T Node 10 (°F)
8	74.1	146	186
9	71.2	144	182
10	68.6	142	178
11	66.5	140	176

ATTACHMENT 6
(SHEET 2 of 2)
PROCESS FLOW DIAGRAM FOR
RHR/SFPC COOLING OF THE SPENT FUEL POOL

ATTACHMENT 5

FUEL POOL COOLING AND CLEANUP SYSTEM

APPLICABLE CODES AND STANDARDS

Spent Fuel Storage Pool Liner (L-3)

Material	ASTM-A240 Type 304, HRAP
Most floor steels	
Horizontal test section between floor and wall plates	ASTM-A-36
Wall plates and structural shapes welded in	ASTM-A240 Type 304, cold rolled finish on wall plates
Wall test angles and structural shapes welded on	ASTM-A-36
Service box plates and structural shapes	ASTM-A240 Type 304
Service box pipe fittings	ASTM-A312 Type 304
Service box covers - Al. pl.	ASTM-6061-T6
Service trench plates and structural shapes	ASTM-A240 Type 304
Service trench pipe fittings	ASTM-A312 Type 304
Service trench covers - Al. pl.	ASTM-6061-T6
Curb plates	ASTM-A240 Type 304
Handrails	ASTM-6061-T6
Handrail sockets-Al. casting	ASTM-B26-Alloy ZG61B

Skimmer Surge Tank (TK-8)

Materials	
Head and shell	ASTM A-283, Gr. C
Coupling	ASTM A-105, Gr. II
Carbon steel structurals	ASTM A-36
Stainless steel structurals	ASTM A-479 T304
Stainless steel plates	ASTM A-240 T304

The spent fuel storage pool liner and skimmer surge tank are designed in accordance with ASME Pressure vessel code, Section III and VIII as applicable.

Piping:

ASTM A-53 or A106, Gr. A or B

All piping is designed in accordance with ANSI B31.1.0 (1969) "Power Piping."

Valves

Fuel Pool Return Check Valves	6"-VCW-15N (2)
Fuel Pool Return Gate Valves	6"-VGW-15N (2)
Fuel Pool Return Common Stop Valve	8"-VOW-15N (1)
Fuel Pool to Skimmer Surge Tank	8"-VOW-15N (1)
Fuel Pool to Return from Demineralizer	6"-VGW-15N (1)
Surge Tank Drain Valve	10"-VGW-15A (1)
Surge Tank to RHR Stop Valve	8"-VGW-15A (1)

1) Every valve shall be hydrostatically tested by the vendor.

   a) Valve body shell test pressure shall be as specified in USAS B16.5.

   b) Valve seat tests shall be as specified in MSS SP-61.

2) Body areas in stainless steel valves shall be examined by ASTM E-165.

3) All valves shall conform to the face to face or end to end dimension of ferrous flanged and welding end valves USAS B16.10.

4) All valves shall be in accordance with USAS B31.1.0 1967 edition exclusive of all code cases.

5) Ends of screwed valves shall be in accordance with American Standard Taper Pipe Threads, (NPT) USAS B2.1.

6) Body and bonnet materials for stainless steel valves shall conform to ASTM specification A351 Grade CF8, or CF8M.

7) Valve stems for stainless steel gate and globe valves shall be forged of A182-F316 or approved equal.

8) Studs for steel valves shall be alloy steel in accordance with ASTM Specification A193, Gr. B7. Nuts shall conform to ASTM Specification A194, Class 2H.

9) Castings conforming to ASTM-A-352 Grade LCB may be used in lieu A-216 Grade WCB to meet this requirement.

10) Body and bonnet materials for steel shall conform to ASTM specification A216, Gr. WCB.

11) Valve stems for steel gate and globe valves shall be forged of 11-1/2 - 13 percent chromium steel, A1S1 Type 410 or approved equal.

12) Radiography

Piping

Methods of radiographic examination of piping are in accordance with ANSI B31.1.0 (1969). As per Quality Control Classification 20 percent of the girth butt welds, longitudinal butt welds and welded branch connections to be given a radiographic examination and also examined by either the magnetic particle or liquid penetrant method. In addition, 20 percent of the fillet and socket welds, seal welds, and attachment welds are examined by either the magnetic particle or the liquid penetrant method.

Acceptability of castings are judged by comparison with ASTM E71 and E186, as appropriate for section thickness.

Liquid Penetrant Testing

Methods, techniques, and acceptance standards for liquid penetrant testing are in accordance with ASTM-E-165, for valves.

Magnetic particle testing

Methods, techniques, and acceptance standards for magnetic particle testing are in accordance with ASTM E-109 for valves.

"Single wall" radiography shall be employed wherever possible. When, due to valve body size or other consideration, this is not possible, interpretable radiographs from "double wall" or "shadow" radiography will be acceptable.

Body areas in carbon steel valves for which no properly interpretable radiographs can be made shall be examined by the dry powder magnetic particle inspection method in accordance with ASTM E-109. The acceptance standards for various types of defects, as disclosed by magnetic particle inspection and as illustrated in ASTM E-125, shall in general be the same as those listed above for radiography. All cracks or other linear discontinuities of any size or severity shall be repaired.

RESIDUAL HEAT REMOVAL SYSTEM

APPLICABLE CODES AND STANDARDS

Heat Exchangers (F-2)

Tubes	SA-249 (tp. 304L)
Shell	SA-516
Shell cover	SA-516
Channel or Bonnet	SA-516
Tube Sheet	SA-516
Baffles	SA-285 or 516
Tube supports	SA-285 or 516
Gaskets	MUA

RHR Pump (P-3)

Material Case	ASTM A-216 Gr. WCB, Cast Steel
Impeller	ASTM A-351 Gr. CA15, R/C28-32
Case Wear Ring	ASTM A-56A TP. 630, COND. 41075
Shaft	Stainless Steel ASTM A-276 TP. 316

All heat exchangers and pressure vessles are designed in accordance with ASME Pressure Vessel Code, Section III and VIII as applicable.

Piping

ASTM A53 or A106 Gr. A or B
ASTM A376 TP-304

All piping is designed in accordance with ANSI B31.1.0, (1969) "Power Piping."

RHR Valves (Figure 1 - Sheet 1 of 2)

20"-MOV-15A, B, C, D
16"-MOV-65A and B
20"-MOV-17
20"-MOV-18
20"-MOV-20
16"-MOV-12A and B
24"-MOV-27A and B
24"-MOV-25A and B
24"-AOV-68A and B
16"-VCW-30AN
20"-MOV-66A and B

1) Every valve shall be hydrostatically tested by the vendor.

   a) Valve body shell test pressure shall be as specified in USAS B16.5.

   b) Valve seat tests shall be conducted at the nominal pressure rating for not less than the duration specified in MSS SP-61.

2) Castings conforming to ASTM-A-352 Grade LCB may be used in lieu of A-216 Grade WCB to meet this requirement.

3) Coupons shall be prepared and tested in accordance with General Provisions of N331 and N332 of Section III of the ASME Boiler and Pressure Vessel Code.

4) All valves shall conform to the face to face or end to end dimensions of Ferrous Flanged and Welding End Valves USAR B16.10 and the Pressure-Temperature Ratings in USAS B16.5.

5) All valves shall be in accordance with USAS B31.1.0 latest edition including summer and winter addenda.

6) Ends of screwed valves shall be in accordance with American Standard Taper Pipe Threads, (NPT) USAS B2.1.

7) Flanged end valves shall be faced and drilled to USAS B16.5.

8) Body and bonnet materials shall conform to the ASTM A216, Gr. WCB.

9) Studs for steel valves shall be alloy steel in accordance with ASTM Specification A193, Gr. B7 for services below 850 F. Nuts shall conform to ASTM Specification A194, Class 2H.

10) All motors shall be totally enclosed with Class H insulation and shall conform in all respects to the latest standards of USAS.

11) Radiography

Piping

Methods of radiographic examination of piping are in accordance with ANSI B31.1.0 (1969). As per Quality Control Classification 20 percent of the girth butt welds, longitudinal butt welds and welded branch connections to be given a radiographic examination and also examined by either the magnetic particle or liquid penetrant method. In addition, 20 percent of the fillet and socket welds, seal welds, and attachment welds are examined by either the magnetic particle or the liquid penetrant method.

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