## SERVICE WATER SYSTEM FLOW REQUIREMENTS (gpm)[3]

| Component Name | Normal Operation (Nominal) | Shutdown Operation (Nominal) | DBA Operation SW = 85°F |
|---|---|---|---|
| Critical Service Water Header | | | |
| Containment Air Coolers | 2000-7500 | 2000-7500 | 4800[7] |
| CCW Heat Exchangers[2] | <6000 | <6000 | 4214[8] |
| | | | 4286[12] |
| Engineered Safeguards Room Coolers | 400[4] | 400[4] | 70[9] |
| Emergency Diesel Generators | - | - | 214[10] |
| Control Room Air Conditioning | 12[5] | 12[5] | 39[11] |
| Instrument Air Compressors (C-2A, C-2C) | 16 | 16 | 16[14] |
| Alternate to Replenish SFP[13] | - | 40 | - |
| Noncritical Service Water Header[6] | | | |
| Hydrogen Coolers | 2610[1] | - | - |
| Exciter Air Coolers | 370[1] | - | - |
| Turbine Lube Oil Coolers | 2510[1] | - | - |
| Seal Oil Cooler | 125 | - | - |
| EHC Oil Coolers[5] | 20 | - | - |
| Isophase Bus Cooler[5] | 35 | - | - |
| Instrument Air Compressor C-2B Aftercooler | 8 | 8 | - |
| Main Feedwater Pump Lube Oil Cooler | 78 | - | - |
| Main Feedwater Pump Gland Cooler | 40 | - | - |
| Heater Drain Pump Cooling | 50 | - | - |
| Blowdown Heat Exchanger (E-31) | 60-420 | - | - |
| Circ Water and Intake Basin Chlorinator | 50 | 50 | - |
| Hydrogen Dryer | 2 | - | - |
| Cooling tower Pump Seal and Bearing Water | 95 | - | - |
| Makeup Raw Water Supply (Intermittent) | 150-500 | 150-500 | - |
| Condensor Vacuum Pump | - | 10 | - |
| Aux Building Addition Air Conditioning Unit | 28.8 | 28.8 | - |
| Ventilation Equipment Room Air Cooling Unit | 28.8 | 28.8 | - |
| Radwaste Area Compressor | 20 | 20 | - |
| Auxiliary Building Condensing Unit | 130 | 130 | - |
| FWP Air Compressor | 65.2 | 65.2 | - |
| C-42 Panel and Sample Coolers | 84 | - | - |
| FWS Sample Cooler SCI-0710-C (to M-97(B)) | 40 | - | - |
| Condensate Pumps | 16 | - | - |
| CD Bldg Boiler Sample (measured) Cooler | 1.6 | 1.6 | - |
| Radiation Monitors | 10 | - | - |

## SERVICE WATER SYSTEM FLOW REQUIREMENTS (gpm)[3]

NOTES:

(1)- Flow is temperature controlled.

(2)- DBA Requirement for Post-RAS mode only, flow is temperature controlled prior to RAS.

(3)- The flows listed for DBA operation are required flows at that SW temperature, the actual flow to each component is set periodically by Technical Specification Surveillance Test RO-216, which balances the system flows.

(4)- SW flows continuously to the ESGR Coolers. There is minimum heat load in the rooms during normal operation and slightly more heat load (SDC System) during shutdown operation. The 400 gpm is not a cooling requirement but is the approximate indicated flow.

(5)- Only one unit (or set of coolers) is operated at one time.

(6)- Flows listed here are from original Bechtel figures and have not been verified.

(7)- EA-LOCA-2001-01, Rev 1, Total of 4800 gpm to VHX-1,2,3 in D/G 1-1 failure case.

(8)- EA-LOCA-2001-01, Rev 1, Total of 4214 gpm to both E-54A,B in D/G 1-2 failure case.

(9)- EA-D-PAL-93-272F-01 Rev 1.

(10)- EA-EC28106-03 Rev 0 and EA-EC28106-04 Rev 0.

(11)- EA-D-PAL-93-272E-02 Rev 0.

(12)- EA-LOCA-2001-01, Rev 1, Total of 4286 gpm to E-54A,B in D/G 1-1 failure case.

(13)- Provisions exist to allow the Service Water System to replenish the Spent Fuel Pool (SFP) if SFP inventory is used as makeup to the Primary Coolant System in the event that the Safety Injection Refueling Water (SIRW) Tank is unavailable (see Section 1.8.5).

## SERVICE WATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

1. Service Water Pumps

| | |
|---|---|
| Type | Vertical Turbine With Water Lubrication |
| Number | 3 |
| Capacity (Each) | 8,000 gpm* |
| Head | 140 ft* |
| Pump Accelerating Time | 4 Seconds @ 70% Voltage |
| Material | |
| Bowls | Cast Iron or Cast Steel or Cast Stainless Steel |
| Discharge Head | Carbon Steel |
| Bowl Shaft | 416 SS |
| Line Shaft | 1045 CS or 416 SS |
| Discharge Column | Carbon Steel |
| Impeller | Bronze or Stainless Steel |
| Motor | 350 hp, 3 Ph, 60 Hz, 2,300 V |
| Codes | Standards of Hydraulic Institute, NEMA, ASA and ASTM |

* The FSAR requirement of 8000 gpm and 140 ft of head is a design characteristic that was supplied to the vendor for individual pump performance.

## SERVICE WATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

2. Basket Strainers

| | |
|---|---|
| Type | Simplex Multi-Basket |
| Number | 3 |
| Design Flow (Each) | 9,000 gpm |
| Design Pressure | 150 psig |
| Design Temperature | 70°F |
| Screen Mesh | 3/16 in Perforation |
| Material | |
| Body | Cast Steel |
| Baskets | 304 SS |

3. Piping, Fittings and Valves

| | |
|---|---|
| Material | Carbon Steel, Bronze, Stainless Steel, or Cast Iron & Ductile Iron (non-safety related only) |
| Design Pressure | 100 psig |
| Design Temperature | 300°F |
| Piping and Fittings(a) | 2-1/2 in and Larger - Butt- Welded Except at Flanged Equipment(a) |
| | 2 in and Smaller - Socket Welded Except at Flanged Equipment or Threaded |
| Valves(a) | 2-1/2 in and Larger - Butt-Welded 150 lb(a) |
| | 2 in and Smaller - Socket Welded 600 lb or Threaded 200 lb or Flanged 150 lb Class |
| Code | ASA B31.1-1955<br>ASA B16.5-1961 |

(a) These are considered to be classified as flanged equipment.

## REACTOR PRIMARY SHIELD COOLING SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

1. Shield Cooling Coils

| | |
|---|---|
| Length (Each Coil) | Approx 24 ft |
| Spacing of Coils | 9 in Center-to-Center |
| Number of Coil Sections in Each Set | 3 |
| Coil Diameter | 3/4 in |
| Material | Seamless Carbon Steel |
| Design Pressure | 75 psig |
| Design Temperature | 220°F |
| Code | ASA B31.1 |

2. Shield Cooling Pumps

| | |
|---|---|
| Type | Horizontal Centrifugal With Mechanical Seals |
| Number | 2 |
| Capacity (Each) | 154 gpm |
| TDH | 79 ft |
| Material | |
| Case | Cast Iron |
| Impeller | CD4MCU (Stainless Steel) |
| Shaft | Stainless Steel (Solid) |
| Motor | 7.5 hp, 3 Ph, 60 Hz, 460 V, 1750 r/min |
| Codes | Standards of Hydraulic Institute, NEMA, ASA and ASTM |

## REACTOR PRIMARY SHIELD COOLING SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

3. Shield Cooling Heat Exchanger

| | | |
|---|---|---|
| Type | Horizontal Counterflow, Shell With Straight Tubes Rolled Into Fixed Tube Sheets | |
| Number | 1 | |
| Original Design Duty | 200,000 Btu/h | |
| Original Heat Transfer Area | 77 $ft^2$ | |
| | Shell Side | Tube Side |
| Design Pressure | 150 psig | 125 psig |
| Design Temperature | 200°F | 200°F |
| Fluid | Component Cooling Water | Shield Cooling Water |
| Temperature In | 90°F | 100°F |
| Temperature Out | 93.2°F | 96.8°F |
| Material | | |
| Shell | Carbon Steel | |
| Tubes | Admiralty | |
| Channels | Carbon Steel | |
| Tube Sheets | Aluminum Bronze | |
| Codes | ASME B&PV Code, Section III, Class C and ASME B&PV Code, Section VIII, Par UW-2 (a); TEMA Class C | |

## REACTOR PRIMARY SHIELD COOLING SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

4. Shield Cooling Surge Tank

| | |
|---|---|
| Type | Vertical |
| Number | 1 |
| Design Pressure | 50 psig |
| Design Temperature | 200°F |
| Volume | 1,700 Gallons (Based on Total Change in System Water Volume as a Result of Maximum Possible Change in Water Temperature From a Cold Start Condition at 60°F to 212°F) |
| Material | Carbon Steel |
| Code | ASME B&PV Code Section III, Class C and ASME B&PV Code, Section VIII, Par UW-2 (a) |

## REACTOR PRIMARY SHIELD COOLING SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

5. Piping, Fittings and Valves

| | |
|---|---|
| Material | Seamless Carbon Steel |
| Design Pressure | 125 psig |
| Design Temperature | 360°F |

| Construction | Not Embedded in Concrete | Embedded in Concrete |
|---|---|---|
| Pipe, 2-1/2 in and Larger | Butt-Welded Except at Flanged Equipment | None |
| Pipe, 2 in and Smaller | Screwed Except at Flanged Equipment | Socket Welded |
| Valves, 2-1/2 in and Larger | Cast Iron, Flanged 125# | None |
| Valves, 2 in and Smaller | Bronze, Screwed 200# and Carbon Steel, flanged 150# | None |
| Code | ASA B31.1 | |

## COMPONENT COOLING SYSTEM HEAT LOADS
**(x $10^6$ Btu/hr)**

| Component and (Number) | Normal | Shutdown Cooling | | DBA | |
|---|---|---|---|---|---|
| | | Initial | +30 h | SI | Post-RAS* |
| Shutdown Cooling HXs (2) | - | 147.39 (max) | 46.13 | - | 95 (max) |
| Primary and Auxiliary Systems Sample Cooling Coils (9) | 0.3 | 0.15 | Negligible | - | - |
| Letdown HX (1) | 11.8 | 1.54 | Negligible | 11.8 | - |
| CRDM Seal Coolers (45) | .07 | .07 | .07 | .07 | - |
| Charging Pumps (3) | 0.20 | 0.12 | 0.12 | 0.20 | 0.20 |
| Primary Coolant Pumps (4) | 2.47 | 1.32**** | - | 2.47 | - |
| LPSI Pumps (2) | - | 0.09 | 0.09 | 0.09 | *** |
| HPSI Pumps (2) | - | - | - | 0.11 | 0.11 |
| Containment Spray Pumps (3) | - | - | - | | 0.08 |
| Spent Fuel Pool HX (1) | 9.2 | 9.2 | 9.2** | - | - |
| Reactor Shield Cooling HX (1) | 0.2 | 0.2 | 0.2 | 0.2 | - |
| Waste Gas Compressors (3) | 0.01 | 0.01 | 0.01 | - | - |
| Vacuum Degasifier Pump Seal Water Cooler (1) | 0.08 | 0.08 | 0.08 | - | - |
| Radwaste Evaporators (2) | 23.52 | 11.76 | 11.76 | - | - |
| Total | 47.85 | 171.93 | 67.66 | 14.77 | 95.39 |

* With containment high pressure

** Maximum heat load at 7 days after shutdown = 12.5 for 1/3 core off load

*** An additional Post-RAS heat load of up to $0.09X10^6$ Btu/hr could exist if LPSI pumps are used for post accident. However, LPSI pumps are not normally operating Post-RAS.

**** Heat load with P-50D being one of the two operating primary coolant pumps. heat load would be $1.15x10^6$ Btu/hr if P-50D is not one of the two operating pumps.

## COMPONENT COOLING WATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

1. Component Cooling Pumps

| | |
|---|---|
| Type | Horizontal Centrifugal With Mechanical Seals |
| Number | 3 |
| Capacity (Each) | 6,000 gpm (Based on Shut-down Cooling Requirements), Including Approximately 10% Wear Margin |
| Head | 164 ft |
| Material | |
| Case | Carbon Steel |
| Impeller | Bronze |
| Shaft | Alloy Steel |
| Temperature Transient | Designed To Withstand Increase of 25°F in 1-1/2 Minutes. This May Occur When System Switches to Shutdown Cooling or Post-DBA Cooling From Normal Operation. |
| Motor | 300 hp, 3 Ph, 60 Hz, 2,300 V |
| Time Required To Accelerate Pump to Full Speed at 70% Voltage | 4 s |
| Codes | Standards of Hydraulic Institute, NEMA, ASA and ASTM |

## COMPONENT COOLING WATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

2. Component Cooling Heat Exchangers

| | | |
|---|---|---|
| Type | Horizontal, Counterflow, Shell Straight Tubes, Tubes Rolled Into Tube Sheets | |
| Number | 2 | |
| Original Design Duty (Each) | $50.5 \times 10^6$ Btu/h (Normal)<br>$94.8 \times 10^6$ Btu/h (At Start of Shutdown Cooling)<br>$43.2 \times 10^6$ Btu/h (24 Hours After Shutdown Cooling)<br>$85.0 \times 10^6$ Btu/h (Post-DBA) | |
| Original Heat Transfer Area (Each) | 7,840 $ft^2$ | |
| | Shell Side | Tube Side |
| Design Pressure | 150 psig | 125 psig |
| Design Temperature | 200°F | 200°F |
| Design Capacity (Each) | 4700 gpm (Ref 13 and 14) | |
| Temperature Transient | Designed To Withstand Increase of 25°F in 1-1/2 Minutes. This May Occur When System Switches to Shutdown Cooling or Post-DBA Cooling From Normal Operation. | |
| Material | | |
| Shell Side | Carbon Steel, Firebox Quality | |
| Tube Side | Admiralty | |
| Tube Sheet | Carbon Steel With Aluminum Bronze Overlay | |
| Codes | ASME B&PV Code, Section III, Class C, 1965 and ASME B&PV Code, Section VIII, Par UW-2 (a); TEMA Class C | |

## COMPONENT COOLING WATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

3. Surge Tank

| | |
|---|---|
| Type | Vertical |
| Number | 1 |
| Design Pressure/Temperature | 25 psig @ 140°F |
| Design Temperature | 140°F |
| Volume | 1,230 Gallons (Based on Total Change in System Water Volume as Result of Maximum Possible Change in Water Temperature From Cold Start Conditions at 60°F to 140°F) |
| Material | Carbon Steel |
| Code | ASME B&PV Code, Section III, Class C, 1965 |

4. Piping, Fittings and Valves

| | |
|---|---|
| Piping Material | Carbon Steel, Seamless and Seam Welded (Seam Weld 100% Radiographed) |
| Design Pressure | 150 psig |
| Design Temperature | 165°F |

## COMPONENT COOLING WATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

| | Outside Containment | Inside Containment |
|---|---|---|
| Construction | | |
| Pipe, 2-1/2 in and Larger | Butt-Welded Except at Flanged Equipment, 10% of Circumferential Welds Examined by Radiography | Butt-Welded Except at Flanged Equipment |
| Pipe, 2 in and Smaller | Socket Welded Except Flanged Equipment | Screwed Except-at Flanged Equipment |
| Valves (Except Butterfly), 2-1/2 in and Larger | Carbon Steel, Butt Weld Ends, 150# | Cast Iron, Flanged Ends, 125# |
| Butterfly Valves, 2-1/2 in and Larger | Carbon Steel, Flanged Ends, 150# | Carbon Steel, Flanged Ends, 150# |
| Valves, 2 in and Smaller | Carbon Steel, Socket Welded Ends, 600# | Bronze, Screwed Ends, 200# |
| Code | ASA B31.1-1955 ASA B16.5-1961 | ASA B31.1-1955 ASA B16.5-1961 |

## COMPONENT COOLING SYSTEM REQUIRED FLOW RATES (GPM)

| | | Shutdown Cooling | | DBA | |
|---|---|---|---|---|---|
| Component and (Number) | Normal | Initial | +30 h | SI | Post-RAS* |
| Shutdown Cooling HXs (2) | - | 5,000 | 5,000 | - | 4480 |
| Primary and Auxiliary System Sample Cooling Coils (9) | 20 | 20 | 20 | - | - |
| Letdown HX (1)** | 1,000 (max) | 70 | - | 1,000 (max) | - |
| CRDM Seal Coolers (45) | 68 | 68 | 68 | 68 | - |
| Charging Pumps (3) ### | 32 | 22-32 | 22-32 | 32 | 32 |
| Primary Coolant Pumps (4) ### | 410 | 230 | 230 | 410 | - |
| LPSI Pumps (2) # | 8 | 8 | 8 | 8 | 8 |
| HPSI Pumps (2) # | 29 | 29 | 29 | 29 | 29 |
| Containment Spray Pumps (3) # | 24 | 24 | 24 | 24 | 24 |
| Spent Fuel Pool HX (1) *** | 650 | 650 | 650*** | - | - |
| Shield Cooling HX (1) | 126 | 126 | 126 | 126[(a)] | - |
| Waste Gas Compressors (3) | 6 | 6 | 6 | - | - |
| Vacuum Degasifier Pump Seal Water Cooler (1) | 8 | 8 | 8 | - | - |
| Radwaste Evaporators (2) | 2,136 | 1,068 | 1,068 | - | - |
| Total | 4,517 | ##7,329 | ##7,259 | 1,697 | 4573 |

* With containment high pressure, loss of EDG 1-1/EDG 1-2.

** Flow set by temperature control

*** Increases to 1334 gpm at 7 days after shutdown for 1/3 core off load.

**** These values are for bounding heat loads. (Reference 73, 74)

\# The required flow rates are based on operation of the pumps under the worst case conditions. Actual flow requirements to prevent component degradation will vary upon operating conditions.

## Total flow rate assumes 22 gpm for charging pumps.

### Charging Pumps P-55B and P-55C can operated up to 72 hours without cooling water flow to the oil coolers. Reference 36.

#### CCW flowrate for P-50A, B & C is 90 gpm. CCW flowrate for P-50D is 140 gpm.

(a) This component still receives cooling water flow in an SI System alignment. However, there is no minimum flow requirement as the component is not required to function during a DBA.

(Reference 29)

## SPENT FUEL POOL COOLING SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

1. Fuel Pool Cooling Pumps

| | |
|---|---|
| Type | Horizontal Centrifugal With Mechanical Seals |
| Number | 2 |
| Capacity (Each) | 1,700 gpm |
| TDH | 64 ft |
| Temperature Transient | Designed To Withstand an Increase from 60°F to 212°F in 5 Seconds |
| Material | Stainless Steel |
| Motor | 40 hp, 460 V, 60 Hz 3 Ph, |
| Code | Motor, NEMA; Pump, Standards of Hydraulic Institute |

2. Spent Fuel Pool Cooling Heat Exchange Unit

| | |
|---|---|
| Type | Horizontal Counterflow, With Straight Tubes Rolled Into Tube Sheets |
| Number | 2 Shells in Series |
| Original Duty (Total) | $23 \times 10^6$ Btu/h |
| Original Heat Transfer Area | 4,080 $ft^2$ |
| Component Cooling Water Temperature: In/Out | 90/115°F |
| Spent Fuel Cooling Water Temperature: In/Out | 125/110°F |
| Temperature Transient | Designed To Withstand an Increase From 60°F to 212°F in 5 Seconds |

**SPENT FUEL POOL COOLING SYSTEM**
**DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS**

| | |
|---|---|
| Material | |
| Shells | Carbon Steel |
| Tubes | Stainless Steel |
| Tube Sheets | Stainless Steel With SS 308L Weld Overlay |
| Codes | ASME B&PV Code, Section III, Class C and ASME B&PV Code, Section VIII, Par UW2 (a); TEMA Class C |

3. Fuel Pool Recirculation Booster Pump

| | |
|---|---|
| Type | Horizontal Centrifugal With Mechanical Seals |
| Number | 1 |
| Capacity | 160 gpm |
| TDH | 160 ft |
| Temperature Transient | Designed To Withstand Increase From 60°F to 212°F in 5 Seconds |
| Material | Type 316 Stainless Steel |
| Motor | 15 hp, 3 Ph, 60 Hz 460 V |
| Code | Motor, NEMA; Pump, Standards of Hydraulic Institute |

## SPENT FUEL POOL COOLING SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

4. Fuel Pool Filter

| | |
|---|---|
| Type | Cartridge With Replaceable Filter Element |
| Number | 1 |
| Design Flow | 150 gpm |
| Design Pressure | 200 psig |
| Design Temperature | 250°F |
| Temperature Transient | Designed for Increase From 60°F to 212°F in 5 Seconds |
| Filter Rating | 25 Microns Nominal |
| Material | Stainless Steel |
| Codes | ASME B&PV Code, Section III, Class C and ASME B&PV Code, Section VIII, Par UW2 (a) |

5. Fuel Pool Demineralizer

| | |
|---|---|
| Type | Mixed Bed |
| Number | 1 |
| Design Flow | 150 gpm |
| Design Pressure | 200 psig |
| Design Temperature | 220°F |
| Temperature Transient | Design for an Increase From 60°F to 212°F in 5 Seconds |
| Resin | Equivalent Capacity Mixture of Nuclear Grade Cation and Anion |
| Material | Type 304 Stainless Steel for Vessel and Integral Parts |

## SPENT FUEL POOL COOLING SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

| | |
|---|---|
| Codes | ASME B&PV Code, Section III, Class C and ASME B&PV Code, Section VIII, Par UW2 (a) |
| 6. Piping, Fittings and Valves | |
| Material | Stainless Steel |
| Design Pressure | 125 psig |
| Design Temperature | 150°F |
| Joints, 2 in and Larger | ButtWelded Except at Flanged Equipment |
| 1-1/2 in and Smaller | Socket Welded Except at Flanged Equipment |
| Valves, 2 in and Larger | Stainless Steel, Butt Weld Ends, 150# |
| 11/2 in and Smaller | Stainless Steel, Socket Weld Ends, 150# |
| Butterflies, All Sizes | Stainless Steel Flanged, 150# |
| Code | ASA B31.1 |
| Welds | 100% Radiographically Checked |
| 7. Spent Fuel Pool | |
| Volume of Empty SFP Cavity | 21,885 $ft^3$ |
| Volume of Empty North Tilt Pit Cavity | 4,095 $ft^3$ |

## INSTRUMENT AIR SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

1. Instrument Air System

a. Air Compressors

| | |
|---|---|
| Type | Rotary Screw, Oil Free, Air Cooled |
| Number | 3 |
| Design Capacity (Each) | 288 scfm |
| Design Pressure | 125 psig |
| Main Motor (Compressor) | 75 hp, 3 Ph, 60 Hz, 460 V |
| Fan Motor | 5 hp, 3 Ph, 60 Hz, 460 V |
| Code | Motor, NEMA |

b. Aftercoolers

| | |
|---|---|
| 1. Type | Shell and Tube |
| Number | 3 (1 per Compressor) |
| 2. Type | Cooling Coil |
| Number | 3 (1 per Compressor - onboard) |

c. Air Receivers

| | |
|---|---|
| Type | Vertical |
| Number | 3 |
| Design Pressure | 125 psig |
| Capacity | 57 $ft^3$ |
| Code | ASME B&PV Code, Section VIII |

## INSTRUMENT AIR SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

d. Air Dryer

| | |
|---|---|
| Type | Silica Gel Absorbent, Electric Heater Reactivated |
| Number | 1 |
| Capacity | 205 scfm |
| Outlet Moisture Content With Saturated Air Inlet | -40°F Dew Point at 100 psig |
| Code | ASME B&PV Code, Section VIII |

e. Piping and Valves

| | |
|---|---|
| Upstream of Dryer | Carbon Steel Piping and CI, or Bronze Valves |
| Downstream of Dryer | Copper Piping and Bronze or Stainless Steel Valves Except at Containment Penetration and at Isolation Valves (Carbon Steel) |
| Code | ASA B31.1 |

2. High Pressure Air System

a. Air Compressors

| | |
|---|---|
| Type | Single Acting, Air Cooled |
| Number | 3 |
| Design Capacity (Each) | 22.3 scfm |
| Design Pressure | 325 psig |
| Motor | 10 hp, 440 V, 3 Phase |
| Code | Motor, NEMA |

## INSTRUMENT AIR SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

| | | |
|---|---|---|
| b. | Air Dryer | |
| | Type | Desiccant |
| | Number | 3 (1 per Compressor) |
| | Capacity (Each) | 35 scfm |
| | Dewpoint | -40 °F at 350 psig |
| | Code | ASME B&PV Code, Section VIII |
| c. | Air Receivers | |
| | Type | Horizontal |
| | Number | 3 (1 per Compressor) |
| | Design Pressure | 350 psig |
| | Capacity | 60 $ft^3$ |
| | Code | ASME B&PV Code, Section VIII |
| d. | Aftercoolers | |
| | Number | 3 (1 per Compressor) |
| | Type | Air Cooled |
| e. | Piping | |
| | Material | Carbon Steel |
| | Code | ASA B31.1 (Seismic Class I Supported From Receivers to Operators on Engineered Safe-guards Systems) |

## INSTRUMENT AIR SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

3. Feedwater Purity Air System

| | |
|---|---|
| a. Air Compressors | |
| Type | Two stage air screw, oil free |
| Number | 2 |
| Design Capacity (Each) | 297 scfm |
| Design Pressure | 117 psi |
| Motor | 75 hp, 460 V, 3 Phase |
| Air Dryer (Integral to Compressor) | |
| Type | Refrigerant |
| Power Consumption (at full load) | 1.6 kW |
| Pressure | 102 psig |
| Dew Point | 37.4°F @ 68°F/100% RH |
| c. Aftercooler | |
| Number | 2 |
| Type | Air Cooled |
| d. Receiver | |
| Type | Vertical |
| Number | 1 |
| Design Pressure | 150 psig |
| Design Temp | 100°F |
| Capacity | 1060 gal |
| Code | ASME B&PV Code, Section VIII |

## INSTRUMENT AIR SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

4. Nitrogen Backup Stations

   a. Nitrogen Bottles

| | |
|---|---|
| Pressure (nominal) | 2400 psig |

## EFFECT OF LOSS OF AIR TO AIR-OPERATED VALVES

| No | Valve Description | Safety Position | Position After Loss of Air |
|---|---|---|---|
| **Primary Coolant System** | | | |
| CV-0101 | Flange Leak Drain | C | C |
| CV-0155 | Quench Tank Spray | C | C |
| **Chemical and Volume Control System** | | | |
| CV-2009 | Letdown Containment Isolation | C | C |
| CV-2083 | PCP Bleedoff Containment Isolation | C | C |
| CV-2099 | PCP Bleedoff Containment Isolation | C | C |
| CV-2111 | Charging Line Stop | O | O |
| CV-2113 | Loop 1A Charging Line Stop | O/C | O |
| CV-2115 | Loop 2A Charging Line Stop | O/C | O |
| CV-2117 | Pressurizer Auxiliary Spray | O/C | C |
| CV-2130 | Boric Acid Recirculation Control | C | C |
| CV-2136 | Boric Acid Recirculation Control | C | C |
| CV-2155 | Makeup Stop | C | C |
| CV-2191(g) | PCP Bleedoff Relief Stop | O | C |
| **Safety Injection, Containment Spray and Shutdown Cooling** | | | |
| CV-3001(b) | Containment Spray Isolation | O/C/T | O |
| CV-3002(b) | Containment Spray Isolation | O/C/T | O |
| CV-3003 | SI Tank Fill and Drain | C | C |
| CV-3004 | SI Tank Fill and Drain | C | C |
| CV-3006 | Shutdown HX Bypass | O | O |
| CV-3018(a)(f) | HPSI Pump Dischg (Redundant) | C | C |
| CV-3025 | Shutdown HX Discharge | C | C |
| CV-3027(a)(b) | Pump Mini-Flow Stop | O/C | As Is |
| CV-3029(c) | Containment Sump Suction | O/C | As Is |
| CV-3030(c) | Containment Sump Suction | O/C | As Is |

O Open
C Closed
T Throttled
N No Safety Related Function Position

(a) Air supplied by high-pressure air system.
(b) Nitrogen bottle backup.
(c) Air supplied from high-pressure air system with backup from instrument air.
(e) Bulk nitrogen backup.
(f) Manually operated air bottle backup.
(g) Accumulator installed.
(h) Handwheels credited for safety position.

## EFFECT OF LOSS OF AIR TO AIR-OPERATED VALVES

| No | Valve Description | Safety Position | Position After Loss of Air |
|---|---|---|---|
| CV-3031(c) | SIRW Tank Isolation | O/C | As Is |
| CV-3036 | HPSI Dischg (Redundant) | O | O |
| CV-3037(a) | HPSI Dischg (Normal) | C | C |
| CV-3038 | SI Line Pressure Control | C | C |
| CV-3039 | SI Tank Fill and Drain | C | C |
| CV-3040 | SI Tank $N_2$ Supply | C | C |
| CV-3042 | SI Line Pressure Control | C | C |
| CV-3043 | SI Tank Fill and Drain | C | C |
| CV-3044 | SI Tank $N_2$ Supply | C | C |
| CV-3046 | SI Line Pressure Control | C | C |
| CV-3047 | SI Line Pressure Control | C | C |
| CV-3048 | SI Tank $N_2$ Supply | C | C |
| CV-3050 | SI Tank $N_2$ Supply | C | C |
| CV-3051 | SI Tank Purge | C | C |
| CV-3055(a) | LPSI Pump Dischg Crossover | C | As Is |
| CV-3056(a)(b) | Pump Mini-Flow Stop | O/C | As Is |
| CV-3057(c) | SIRW Tank Isolation | O/C | As Is |
| CV-3059(a) | HPSI Dischg (Normal) | O | O |
| CV-3063 | SI Tank Purge | C | C |
| CV-3065 | SI Tank Purge | C | C |
| CV-3067 | SI Tank Purge | C | C |
| CV-3069 | Check Valve Leakage Drain | C | C |
| CV-3070(b) | Cooled Suction HPSI Pump | O/C | C |
| CV-3071(b) | Cooled Suction HPSI Pump | O/C | C |
| CV-3084 | HPSI Hot Leg Drain Isolation | C | C |
| CV-3085 | HPSI Hot Leg Drain Isolation | C | C |
| CV-3212 | Shutdown HX Isolation | O | As Is |
| CV-3213 | Shutdown HX Isolation | O | As Is |
| CV-3223 | Shutdown HX Isolation | O | As Is |
| CV-3224 | Shutdown HX Isolation | O | As Is |

O Open
C Closed
T Throttled
N No Safety Related Function Position

(a) Air supplied by high-pressure air system.
(b) Nitrogen bottle backup.
(c) Air supplied from high-pressure air system with backup from instrument air.
(e) Bulk nitrogen backup.
(f) Manually operated air bottle backup.
(g) Accumulator installed.
(h) Handwheels credited for safety position.

## EFFECT OF LOSS OF AIR TO AIR-OPERATED VALVES

| No | Valve Description | Safety Position | Position After Loss of Air |
|---|---|---|---|
| **Feed and Condensate System** | | | |
| CV-0701 | Feedwater Regulating Valve | C | As Is |
| CV-0703 | Feedwater Regulating Valve | C | As Is |
| CV-0727(b) | Auxiliary Feed Control | O/C | O |
| CV-0734 | Main Feedwater Bypass | C | As Is |
| CV-0735 | Main Feedwater Bypass | C | As Is |
| CV-0736 | Auxiliary Feed Control Bypass | C | C |
| CV-0736A(h) | Auxiliary Feed Control | O/C | O |
| CV-0737 | Auxiliary Feed Control Bypass | C | C |
| CV-0737A(h) | Auxiliary Feed Control | O/C | O |
| CV-0749(b) | Auxiliary Feed Control | O/C | O |
| CV-2008(h) | Primary Sys Makeup Tank Outlet | O | C |
| CV-2010(h) | Condensate Storage Tank Inlet | O/C | C |
| **Service Water System** | | | |
| CV-0821 | CCW Heat Exchanger Temp Control | C | C |
| CV-0822 | CCW Heat Exchanger Temp Control | C | C |
| CV-0823 | Component Cool HX Dischg | O | O |
| CV-0824(b) | Return From Containment Coolers | O/C | O |
| CV-0825 | Eng Safe Room Cooler Supply | O | O |
| CV-0826 | Component Cool HX Dischg | O | O |
| CV-0844 | Critical Service Wtr Header Iso | O | O |
| CV-0845 | Critical Service Wtr Header Iso | O | O |
| CV-0846 | Critical Service Water Header Cross Connect | O | O |
| CV-0847(b) | Supply to Containment Coolers | O | O |
| CV-0857 | Critical Service Water Header Cross Connect | O | O |
| CV-0861 | 8" Return From Cont Coolers | O | O |
| CV-0862 | Containment Cooler Supply | O | O |
| CV-0864 | 8" Return From Cont Coolers | O | O |

O Open
C Closed
T Throttled
N No Safety Related Function Position

(a) Air supplied by high-pressure air system.
(b) Nitrogen bottle backup.
(c) Air supplied from high-pressure air system with backup from instrument air.
(e) Bulk nitrogen backup.
(f) Manually operated air bottle backup.
(g) Accumulator installed.
(h) Handwheels credited for safety position.

## EFFECT OF LOSS OF AIR TO AIR-OPERATED VALVES

| No | Valve Description | Safety Position | Position After Loss of Air |
|---|---|---|---|
| CV-0865 | Containment Cooler Supply | O | O |
| CV-0867 | 8" Return From Cont Coolers | O | O |
| CV-0869 | Containment Cooler Supply | C | C |
| CV-0870 | Containment Cooler Supply | O | O |
| CV-0873 | 8" Return From Cont Coolers | O | O |
| CV-0876 | Diesel Generator Cool Supply | O | O |
| CV-0877 | Diesel Generator Cool Supply | O | O |
| CV-0878 | Eng Safe Room Cooler Supply | O | O |
| CV-0879 | Backup Cool Safeguards Pumps | C | C |
| CV-0880 | Backup Cool Safeguards Pumps | C | C |
| CV-0884 | Diesel Generator Cool Supply | O | O |
| CV-0885 | Diesel Generator Cool Supply | O | O |
| CV-1318 | Service Water Pump Header Iso | O | O |
| CV-1319 | Service Water Pump Header Iso | O | O |
| CV-1359 | Noncritical Service Water Header Isolation | C | C |
| CV-1655 | Control Room HVAC Service Water | O | O |
| CV-1656 | Control Room HVAC Service Water | O | O |
| Component Cooling System | | | |
| CV-0910(g) | Component Cool to Cont Isolation | C | O |
| CV-0911(g) | Component Cool From Cont Isolation | C | O |
| CV-0913 | Supply Safeguards Pumps | O | O |
| CV-0915 | Comp Cool Surge Tank Vent | C | C |
| CV-0937 | Supply to Shutdown HX | O | O |
| CV-0938 | Supply to Shutdown HX | O | O |
| CV-0940(g) | Component Cool From Cont Isolation | C | O |
| CV-0944 | Supply to Radwaste Evaporator | C | C |
| CV-0944A | Supply to Spent Fuel HX | C | C |
| CV-0945 | Supply to Comp Cool HX | O | O |
| CV-0946 | Supply to Comp Cool HX | O | O |

O Open
C Closed
T Throttled
N No Safety Related Function Position

(a) Air supplied by high-pressure air system.
(b) Nitrogen bottle backup.
(c) Air supplied from high-pressure air system with backup from instrument air.
(e) Bulk nitrogen backup.
(f) Manually operated air bottle backup.
(g) Accumulator installed.
(h) Handwheels credited for safety position.

## EFFECT OF LOSS OF AIR TO AIR-OPERATED VALVES

| No | Valve Description | Safety Position | Position After Loss of Air |
|---|---|---|---|
| CV-0947 | Supply to Safeguards Pumps | O | O |
| CV-0948 | Supply to Safeguards Pumps | O | O |
| CV-0949 | Supply to Safeguards Pumps | O | O |
| CV-0950 | Return From Safeguards Pumps | O | O |
| CV-0951 | Return From Safeguards Pumps | C | C |
| CV-0977B | Return From Radwaste Evaporator | C | C |
| Main Steam, Main and Auxiliary Turbine Systems | | | |
| CV-0501(g) | Main Steam Isolation Valve | C | C |
| CV-0510(g) | Main Steam Isolation Valve | C | C |
| CV-0522B(b) | Steam to Aux Feed Pump Turbine | O/C | C |
| CV-0738 | Steam Generator Recirculation | C | C |
| CV-0739 | Steam Generator Recirculation | C | C |
| CV-0767 | Steam Generator Bottom Blowdown | C | C |
| CV-0768 | Steam Generator Bottom Blowdown | C | C |
| CV-0770 | Steam Generator Bottom Blowdown | N | C |
| CV-0771 | Steam Generator Bottom Blowdown | N | C |
| CV-0779(e) | Atmospheric Steam Dump | C | C |
| CV-0780(e) | Atmospheric Steam Dump | C | C |
| CV-0781(e) | Atmospheric Steam Dump | C | C |
| CV-0782(e) | Atmospheric Steam Dump | C | C |
| Instrument Air Systems and Miscellaneous Gas | | | |
| CV-1211(b) | Instrument Air to Containment | N | O |
| CV-1358 | Nitrogen to Containment | C | C |
| Process Sampling System | | | |
| CV-1910 | PCS Sampling Isolation | C | C |

O Open
C Closed
T Throttled
N No Safety Related Function Position

(a) Air supplied by high-pressure air system.
(b) Nitrogen bottle backup.
(c) Air supplied from high-pressure air system with backup from instrument air.
(e) Bulk nitrogen backup.
(f) Manually operated air bottle backup.
(g) Accumulator installed.
(h) Handwheels credited for safety position.

## EFFECT OF LOSS OF AIR TO AIR-OPERATED VALVES

| No | Valve Description | Safety Position | Position After Loss of Air |
|---|---|---|---|
| CV-1911 | PCS Sampling Isolation | C | C |
| Radioactive Waste Treatment System | | | |
| CV-1001 | Primary System Drain Tank Recirc | C | C |
| CV-1002 | Primary System Drain Tank Outlet | C | C |
| CV-1004 | Degasifier Pump Discharge | C | C |
| CV-1007 | Primary System Drain Tank Outlet | C | C |
| CV-1036 | Pump P-70 Inlet | C | C |
| CV-1037 | Clean Waste Tank Recirc | C | C |
| CV-1038 | Pump P-70 Inlet | C | C |
| CV-1044 | Pump P-69 A/B Suction | C | C |
| CV-1045 | Pump P-69 A/B Suction | C | C |
| CV-1064 | Clean Waste Tank Vent | C | C |
| CV-1065 | Clean Waste Tank Vent | C | C |
| CV-1101 | Waste Gas Surge Tank Vent | C | C |
| CV-1102 | Waste Gas Surge Tank Vent | C | C |
| CV-1103 | Containment Sump Drain | C | C |
| CV-1104 | Containment Sump Drain | C | C |
| Shield Cooling System | | | |
| CV-0939 | Shield Cooling Tank Inlet | C | C |

O Open
C Closed
T Throttled
N No Safety Related Function Position

(a) Air supplied by high-pressure air system.
(b) Nitrogen bottle backup.
(c) Air supplied from high-pressure air system with backup from instrument air.
(e) Bulk nitrogen backup.
(f) Manually operated air bottle backup.
(g) Accumulator installed.
(h) Handwheels credited for safety position.

## FIRE DETECTION INSTRUMENTATION

| | INSTRUMENT LOCATION | DETECTORS | TYPE OF DETECTORS |
|---|---|---|---|
| 1. | Cable Spreading Rm, Col M-28 | 1 | Water Flow Sw (WFS-2B) |
| 2. | 1-D Switchgear Rm, Col G-28; Col G-22; Col G-22 | 4 | Water Flow Sw (WFS-2B1, WFS-2B2, WFS-2B3, WFS-2D) |
| 3. | 1-1 Diesel Generator Rm , Col J-28 | 1 | Water Flow Sw (WFS-2G1) |
| 4. | 1-2 Diesel Generator Rm , Col M-28 | 1 | Water Flow Sw (WFS-2G2) |
| 5. | Turbine Bldg 590', Col H-9 | 1 | Water Flow Sw (WFS-2I) |
| 6. | Control Room (Room 325) | 8 | Smoke |
| 7. | Control Room Adj Offices Rms 324 & 320 | 2 | Smoke |
| 8. | Cable Spreading, Room 224 | 13 | Smoke |
| 9. | Refueling & Spent Fuel Area, Rm 220 | 4 | Smoke |
| 10. | 1-D Switchgear Rm, Rm 223 | 9 | Smoke |
| 11. | North Penetration, Rm 332 | 2 | Smoke |

## FIRE DETECTION INSTRUMENTATION

| | INSTRUMENT LOCATION | DETECTORS | TYPE OF DETECTORS |
|---|---|---|---|
| 12. | 1-C Switchgear Rm, Rm 116A | 2 | Smoke |
| 13. | Southwest Cable Penetration, Rm 250 | 2 | Smoke |
| 14. | Engineered Safeguards Panel Area, Rm 121 | 3 | Smoke |
| 15. | Stairwell Outside Engineered Safeguards Panel Area, Rm 016 | 2 | Smoke |
| 16. | Component Cooling Pump, Rm 123 | 2 | Smoke |
| 17. | Safeguard Area, Rm 4 | 3 | Smoke |
| 18. | Safeguard Area, Rm 5 | 2 | Smoke |
| 19. | Corridor 106 on 590' Elevation, Rm 106 | 6 | Smoke |
| 20. | Charging Pump, Rm 104 | 2 | Smoke |
| 21. | Containment, Interior North Penetration Area, Rm 332 | 3 | Smoke |
| 22. | Containment, Interior SW Penetration Area, Rm 141, 250 | 3 | Smoke |
| 23. | Containment Instrument Air Room | 3 | Smoke |
| 24. | Auxiliary Feed Pump Room 570' Level of Turbine Bldg, Rm 007 | 3 | Smoke |
| 25. | Battery Rm 225A | 1 | Smoke |

## FIRE DETECTION INSTRUMENTATION

| | INSTRUMENT LOCATION | DETECTORS | TYPE OF DETECTORS |
|---|---|---|---|
| 26. | Battery Rm 225B | 1 | Smoke |
| 27. | HVAC Equipment Rooms & Chase: | | Smoke |
| | West Mechanical Equipment Room 300 | 1 | Smoke |
| | East Mechanical Equipment Room 300A | 1 | Smoke |
| | Duct Chase, Rm 300B | 1 | |
| 28. | Air Handling Unit V-95 & V-96 Inlet Ducts, Rm 300, 300A | 2 | Smoke |
| 29. | Electrical Equipment Room, Rm 725 | 6 | Smoke |
| 30. | Technical Support Center, Rm 320A | 2 | Smoke |
| 31. | Intake Structure, Room 136 | 11 | Ultraviolet |
| 32. | Charging Pump Rooms 104, 104A, and 104B | 1 | Water Flow Sw (WFS-2J) |
| 33. | Diesel - Driven Auxiliary Feedwater Pump Shed | 2 | Fire & Flame Det. |
| | | 1 | Water Flow Sw |

## FIRE PROTECTION SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

1. Fire Pump, Motor Driven

| | |
|---|---|
| Type | Vertical Turbine |
| Number | 1 |
| Capacity | 1,500 gpm |
| Discharge Pressure | 125 psig |
| Material | |
| Discharge Head | Cast Iron |
| Impeller | Bronze |
| Motor | 150 hp, 460 V, 3 Ph, 60 Hz |
| Codes | Underwriters Lab Label Motor, NEMA; Pump, Standards of Hydraulic Institute |

2. Fire Pump, Diesel Engine Driven

| | |
|---|---|
| Type | Vertical Turbine |
| Number | 2 |
| Capacity | 1,500 gpm |
| Discharge Pressure | 125 psig |
| Material | |
| Discharge Head | Cast Iron |
| Impeller | Bronze |
| Gear Drive | Reduction Ratio 1:1, 200 hp Rating |
| Diesel Engine | 150 hp |
| Codes | Underwriters Lab Label Diesel Engine, NEMA; Pump, Standards of Hydraulic Institute |

## FIRE PROTECTION SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

3. Fire System Jockey Pump

| | |
|---|---|
| Type | Vertical Turbine |
| Number | 1 |
| Capacity | 50 gpm |
| Discharge Pressure | 117 psig nominal |
| Material | |
| Discharge Head | Fabricated Steel |
| Impellers | Bronze |
| Motor | 7-1/2 hp, 460 V, 3 PH, 60 Hz |
| Codes | Motor, NEMA; Pump Standards of Hydraulic Institute |

4. Piping, Fittings and Valves

a. To Auxiliary Feedwater Pump Suction Header and Critical Service Waterlines

| | |
|---|---|
| Material | Seamless Carbon Steel |
| Design Pressure | 125 psig |
| Design Temperature | 100°F |
| Construction | Butt-Welded Except at Flanged Equipment |
| Valves | Carbon Steel, Butt-Weld Ends, 150#, or Cast Iron, Flanged End, 175#, Underwriters lab Label |

## FIRE PROTECTION SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

b. To Spent Fuel Pool Blind Flange and Normal Fire Protection Service

| | | Underground | Aboveground |
|---|---|---|---|
| Material | Original- | Cast Iron (150# Class) | Carbon Steel |
| | Replacement- | Ductile Iron (350# Class) | |
| Design Pressure | | 150 psig | 125 psig |
| Design Temperature | | 100°F | 100°F |
| Construction | Original- | Mechanical Joint | Butt-Welded Except at Flanged Equipment |
| | Replacement- | Push-on Joint | |
| Valves | Original- | Cast Iron, Mechanical Joint, 175#, Underwriters Lab Label | Cast Iron, Flanged End, 175#, Underwriters Lab Label |
| | Replacement- | Ductile Iron, Mechanical Joint, 250#, UL Listed, FM Approved | |

## AUXILIARY FEEDWATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

1. Motor-Driven Auxiliary Feedwater Pump (P-8A)

| | |
|---|---|
| Type | Horizontal Centrifugal, With Packed Glands |
| Number | 1 |
| Capacity | 415 gpm |
| Head | 2,730 ft |
| Material | |
| Case | 4.6% Chrome Alloy Steel |
| Impeller | Bronze |
| Shaft | 11%-13% Chrome Alloy Steel |
| Motor | 450 hp, 3 Ph, 60 Hz, 2,300 V |
| Codes | Motor, NEMA; Pump, Standards of Hydraulic Institute, 11th Edition, 1965 |

2. Turbine-Driven Auxiliary Feedwater Pump (P-8B)

| | |
|---|---|
| Type | Horizontal Centrifugal, With Packed Glands |
| Number | 1 |
| Capacity | 415 gpm |
| Head | 2,730 ft |
| Material | |
| Case | 4.6% Chrome Alloy Steel |
| Impeller | Bronze |
| Shaft | 11%-13% Chrome Alloy Steel |

## AUXILIARY FEEDWATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

| | |
|---|---|
| Turbine | Single Stage, Axial Flow, Exhaust to Atmosphere, 450 hp |
| Codes | Turbine, NEMA; Pump, Standards of Hydraulic Institute, 11th Edition, 1965 |

3. Motor Driven Auxiliary Feedwater Pump (P-8C)

| | |
|---|---|
| Type | Horizontal Centrifugal, With Mechanical Seals |
| Number | 1 |
| Capacity | 330 gpm |
| Head | 2260 ft |
| Material | |
| Case | 18 Cr, 8 Ni Stainless Steel |
| Impeller | 12 Cr Stainless Steel |
| Shaft | 12 Cr, 0.6 Mo Stainless Steel |
| Motor | 400 hp, 3 Ph, 60 Hz, 2,300 V |
| Codes | Motor, NEMA; Pump, Standards of Hydraulic Institute, 11th Edition, 1965 |

4. Piping and Valves for P-8A, P-8B, and P-8C

a. Pump Suction

| | Underground | Aboveground |
|---|---|---|
| Material | 304 Stainless Steel | Carbon Steel |
| Design Pressure (Minimum) | 50 psig | 50 psig |
| Design Temperature (Minimum) | 100°F | 100°F |
| Construction | Welded Except at Flanged Equipment Connections | |

## AUXILIARY FEEDWATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

| | | |
|---|---|---|
| Valves 2-1/2 in and Larger | - | Carbon Steel, Butt-Welded, 150# |
| Valves 2-1/2 in and Smaller | - | Carbon Steel, Socket Welded, 600# |
| Code | ASA B31.1-1955<br>ASA B16.5-1961 | ASA B31.1-1955<br>ASA B16.5-1961 |

b. Pump Discharge

| | Underground | Aboveground | |
|---|---|---|---|
| Material | 304 Stainless Steel | Carbon Steel | |
| | | Upstream of FW Control Valve | Downstream of FW Control Valve |
| Design Pressure (Minimum) | 1,440 psig | 1,337psig | 1,100psig |
| Design Temperature (Minimum) | 100°F | 100°F | 100°F |
| Construction | Welded Except at Flanged Equipment Only | | |
| Valves 2-1/2 in and Larger | - | Carbon Steel, Butt-Welded, 600# | |
| Valves 2-1/2 in and Smaller | - | Carbon Steel, Socket Welded, 600# | |
| Code | ASA B31.1-1955<br>ASA B16.5-1961 | ASA B31.1-1955<br>ASA B16.5-1961 | |

## AUXILIARY FEEDWATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

c. Auxiliary Turbine Steam Supply

| | |
|---|---|
| Design Pressure | 1,000 psig |
| Design Temperature | 550°F |

Piping and Valves Same as for Aboveground Pump Discharge Piping

5. Diesel-Driven Auxiliary Feedwater Pump (P-8D)

| | |
|---|---|
| Type | Horizontal Centrifugal, with Mechanical Seals |
| Number | 1 |
| Capacity | 510 gpm |
| Head | 3148 ft |
| Diesel Engine (K-17) | 800 hp, Starter with Storage Batteries |
| Codes | NFPA 20, NFPA 37, UL 1247 |

6. Piping and Valves for P-8D

a. Pump Section

| | Underground | Aboveground |
|---|---|---|
| Material | 304 Stainless Steel | Carbon Steel |
| Design Pressure | 150 psig | 150 psig |
| Design Temperature | 130$^{o}$F | 130$^{o}$F |
| Construction | Welded Except at Flanged Equipment Connections | |
| Valves 2-1/2 in and Larger | | Carbon Steel, Butt-Welded, 150# |
| Valves 2-1/2 in and Smaller | | Carbon Steel, Butt-Welded, 600# |
| Code | ASA B31.1 1-2012 for procurement<br>ASA B31.1 1-1973 for qualification | |

## AUXILIARY FEEDWATER SYSTEM
## DESIGN RATINGS AND CONSTRUCTION OF COMPONENTS

b. Pump Discharge

| | Underground | Aboveground | |
|---|---|---|---|
| Material | 304 Stainless Steel | Carbon Steel | |
| Design Pressure (Minimum) | 1,750 psig | Upstream of Control Valve | Downstream of Control Valve |
| | | 1,750 psig | 1,200 psig |
| Design Temperature | 34/120°F | 34/120°F | 34/120°F |
| Construction | Welded, Except Flanged at Material Transition | | |
| Valves 2-1/2 in and Larger | | Carbon Steel, Butt-Welded, 900# | |
| Valves 2-1/2 in and Smaller | | Carbon Steel, Butt-Welded, 1500# | |
| Code | B31.1 (1973) | B31.1 (1973) | |

## DESIGN BASIS AMBIENT CONDITIONS

| Location | HVAC Original Design | | | | Maximum Bulk Air Temperature (°F) Allowed During Normal Operation (Ref. 70, except as noted) | EEQ Average Arrhenius Temp. (°F) (Ref. 70 except as noted) (Note 6) | |
|---|---|---|---|---|---|---|---|
| | Winter, °F | | Summer, °F | | | | |
| | Outside | Inside | Outside | Inside | | Normal Operation | Cold Shutdown |
| Turbine Building | | | | | | | |
| Operating Floor (EEQ Harsh Area) | -10 | 50 | 95 | 104 | 130 | 110 | 80 |
| Auxiliary Feedwater Pump Room (EEQ Harsh Area) | --- | --- | --- | --- | 104 | 104 | 90 |
| Piping Area (EEQ Harsh Area) | -10 | 50 | 95 | 110 | 130 | 110 | 80 |
| Shops and Offices | -10 | 65 | 95 | 104 | --- | --- | --- |
| | | | | | | | |
| Auxiliary Building (Non-EEQ Harsh Areas) | | | | | | | |
| Radwaste Area and Radwaste Area Addition | -10 | 50 | 95 | 110 | --- | --- | --- |
| Fuel Handling Area and Fuel Handling Area Addition | -10 | 50 | 95 | 104 | --- | --- | --- |
| Office Area | -10 | 75 | 95 | 75 | --- | --- | --- |
| Room 116 (1-1 Diesel Generator Room) (Note 8) | --- | --- | --- | --- | 102 (Ref. 65 & 66) | --- | --- |
| Room 116B (1-2 Diesel Generator Room) (Note 8) | --- | --- | --- | --- | 102 (Ref. 65 & 66) | --- | --- |
| | | | | | | | |
| Auxiliary Building (EEQ Harsh Areas) | | | | | | | |
| Room 123 (590’ Component Cooling) (Note 3) | -10 | 50 | 95 | 104 | 110 | 100 | 100 |
| Room 238 (607’-6” Containment Purge Exhaust) (Note 3) | -10 | 50 | 95 | 104 | 145 | 115 | 105 |
| Room 338 (625’ Containment Purge Air Fan) (Note 3) | -10 | 50 | 95 | 104 | 150 | 130 | 110 |
| Room 001 (Dirty Waste Tank T-60) | --- | --- | --- | --- | 90 | 90 | 90 |
| Room 004 (East Engineered Safeguards) (Note 4) | --- | --- | --- | --- | 90 | 90 | 90 |
| Room 005 (West Engineered Safeguards) | --- | --- | --- | --- | 95 (Ref. 64) | 90 | 90 |
| Room 106 (590’ Corridor) | --- | --- | --- | --- | 100 | 90 | 90 |
| Room 118 (590’ Receiver Tank and Pump Room) | --- | --- | --- | --- | 100 | 90 | 90 |
| Room 120 (Degasifier Vacuum Pumps) | --- | --- | --- | --- | 100 | 90 | 90 |
| Room 121A (South Pipeway Doghouse) (Note 4) | --- | --- | --- | --- | 125 | 110 | 110 |
| Room 121B (Hydrogen Monitor EC-161) | --- | --- | --- | --- | 100 | 90 | 90 |
| Room 150 (602’ Pipeway) | --- | --- | --- | --- | 110 | 92 | 92 |

## DESIGN BASIS AMBIENT CONDITIONS

| Location | HVAC Original Design | | | | Maximum Bulk Air Temperature (°F) Allowed During Normal Operation (Ref. 70 except as noted) | EEQ Average Arrhenius Temp. (°F) (Ref. 70 except as noted) (Note 6) | |
|---|---|---|---|---|---|---|---|
| | Winter, °F | | Summer, °F | | | | |
| | Outside | Inside | Outside | Inside | | Normal Operation | Cold Shutdown |
| Containment Building (EEQ Harsh Area) (Note 1) | -10 | 50 | 95 | 104 | 140 (Note 5) | (Note 2) | (Note 2) |
| | | | | | | | |
| Control Room (Non-EEQ Harsh Area) (Note 7) | -10 | 75 | 95 | 75 | --- | --- | --- |
| | | | | | | | |
| Condensate and Makeup Demineralizer Building – Non-EEQ Harsh Areas | | | | | | | |
| Process and Equipment Area | -10 | 50 | 90 | 104 | --- | --- | --- |
| Covered Receiving and Loading Area | -10 | 50 | 90 | 104 | --- | --- | --- |
| Boiler Room | -10 | 50 | 90 | 104 | --- | --- | --- |
| Pipe Gallery | -10 | 50 | 90 | 104 | --- | --- | --- |
| Instrument Room | -10 | 75 | 90 | 90 | --- | --- | --- |

Note 1: Original equipment design was based on these conditions. To allow for elevated service water temperatures a higher building design temperature was specified for the containment air coolers. Chapter 14 contains containment temperature assumptions for analyzed accident situations.
Note 2: Temperatures are dependent on elevation and location (References 71 and 72).
Note 3: Rooms 123, 238 and 338 have a design temperature of 120°F per M-391, Specification for Installation of Ventilation Equipment and Ductwork Penetration and Fans Rooms.
Note 4: The combined East Engineered Safeguards and South Pipeway Doghouse room can be maintained less than or equal to 135°F post-accident with the initial temperatures in room 004 and room 121A at 95°F (Reference 70).
Note 5: Reference FSAR Section 14.18. The Technical Specifications restrict bulk air temperature to 140°F (LCO 3.6.5).
Note 6: Maximum allowed post-accident temperature profiles in EEQ harsh areas outside containment are maintained by the EEQ program.
Note 7: The relative humidity in the control room is 50%.
Note 8: Actual rooms can be maintained less than or equal to 120°F with a diesel generator operating with the initial room temperature and outside air temperature of 102°F (Ref. 65).

## CONTROL ROOM HVAC SYSTEM
## MAJOR COMPONENT DESIGN DATA

Makeup/Recirculation Air Filter Units

| | |
|---|---|
| Quantity | Two - 100% Capacity Each |
| Capacity | 3,200 $ft^3$/min |
| Filters (per Filtering Unit) | |
| Prefilter | |
| Quantity | 3 |
| Media | Glass Fiber or Knitted Pad |
| HEPA Filter | |
| Quantity | 3 Upstream Filters<br>3 Downstream Filters |
| Media | Glass Fiber |
| Charcoal Filter Trays | |
| Quantity | 18 [2 Banks of 9] |
| Media | Activated Carbon, 4 in. Bed Depth<br>(Two-2 inch deep Trays in Series) |
| Fan Type | Vaneaxial |
| Fan Static Pressure at Rating, in wg | 10 in |
| Motor | 20 hp, 460 V, 3 Ph |
| Filter Test Efficiency | |
| HEPA | 99.97% of Particulate |
| Carbon Adsorber | 99.9% of Elemental Iodine |
| Electric Heating Coil | |
| Type | Nickel/Chromium |
| Capacity | 15 kW, 480 V, 3 Ph |
| Air Filter Unit Assembly | |
| $\Delta$P of wg | 8.00 in (Maximum) |

NOTE: All electrical equipment is Class 1E unless otherwise noted.

## CONTROL ROOM HVAC SYSTEM
## MAJOR COMPONENT DESIGN DATA

Air Handling Unit V-95 or V-96

| | |
|---|---|
| Type | Package (Filter, Cooling Coil, Fan) |
| Capacity | 12,500 $ft^3$/min |
| Cooling Coil | |
| Type | Direct Expansion Refrigerant |
| Capacity (Total) | 603,500 Btu/h |
| Heating Coil (Nonclass 1E) | |
| Type | 80% Nickel and 20% Chromium |
| Capacity | 177 kW, 480 V, 3 Ph |
| Fan | |
| Type | Centrifugal |
| Total Pressure, wg | 3.85 in |
| Motor | 25 hp, 460 V, 3 Ph |
| Filter Type, Media | 6 in Thick Moderate Efficiency Prefilter |
| $\Delta$P of wg (Clean) | 0.25 in |

Refrigerant Condensing Unit

| | |
|---|---|
| Type | Water-Cooled Reciprocating |
| Refrigerant | R-22 |
| Compressor | |
| Type | Reciprocating, 4 Cylinder |
| Motor | 60 hp, 460 V, 3 Ph |
| Capacity | 554,400 Btu/h @ 85 °F, 39 gpm Service Water |
| Condenser Water Flow | Set per RO-216 |

NOTE: All electrical equipment is Class 1E unless otherwise noted.

## CONTROL ROOM HVAC SYSTEM
## MAJOR COMPONENT DESIGN DATA

| | |
|---|---|
| Smoke Purge Exhaust Fan V-94 (Nonclass 1E) | |
| Type | Vaneaxial |
| Capacity | 7,800 $ft^3$/min |
| Motor | 7-1/2 hp, 460 V, 3 Ph |
| Exhaust Fan V-16 (Existing) (Nonclass 1E) | |
| Type | Centrifugal |
| Capacity | 160 $ft^3$ /min |
| Motor | 1/12 hp, 120 V, 1 Ph |
| Humidifiers VH-12 and VH-13 (Nonclass 1E) | |
| Type | Steam Generator |
| Capacity | 50 lb/h (17 kW, 480 V, 3 Ph) |

NOTE: All electrical equipment is Class 1E unless otherwise noted.

## VENTILATION DAMPERS: FUNCTIONS AND POSITIONS FOR VARIOUS MODES OF PLANT OPERATION

| Damper | Description | Normal Position | Shutdown Position | Position After Auto Actuation | Position After Loss of Air |
|---|---|---|---|---|---|
| Control Room (see Figure 7-24) | | | | | |
| D-1 | Normal Outside Air - Train A | Open - Train A<br>Close - Train B | Open - Train A<br>Close - Train B | Close on CHP or CHR | Close |
| D-2 | Normal Outside Air - Train A | Modulate - Train A<br>Close - Train B | Modulate - Train A<br>Close - Train B | Close on CHP or CHR | Close |
| D-3 | Normal Recirc Air - Train A | Open | Open | Open on CHP or CHR | Open |
| D-4 | Supply Air Back Draft Dampers - Train A | Open - Train A<br>Close - Train B | Open - Train A<br>Close - Train B | Open - Train A<br>Close - Train B<br>on CHP or CHR | NA<br>(Back Draft) |
| D-5 | Charcoal Filter Unit Supply Air - Train A | Close | Close | Open - Train A<br>Close - Train B<br>on CHP or CHR | NA<br>(Back Draft) |
| D-6 | Charcoal Filter Unit Return Air - Train A | Close | Close | Open - Train A<br>Close - Train B<br>on CHP or CHR | Open |

## VENTILATION DAMPERS: FUNCTIONS AND POSITIONS FOR VARIOUS MODES OF PLANT OPERATION

| Damper | Description | Normal Position | Shutdown Position | Position After Auto Actuation | Position After Loss of Air |
|---|---|---|---|---|---|
| D-7 | Charcoal Filter Unit Outside Air - Train A | Close | Close | Open - Train A, (Manual Close Avail) Close - Train B on CHP or CHR | NA (Elect Op FAI) |
| D-8 | Normal Outside Air - Train B | Open - Train B Close - Train A | Open - Train B Close - Train A | Close on CHP or CHR | Close |
| D-9 | Normal Outside Air - Train B | Modulate - Train B Close - Train A | Modulate - Train B Close - Train A | Close on CHP or CHR | Close |
| D-10 | Normal Recirc Air - Train B | Open | Open | Open on CHP or CHR | Open |
| D-11 | Supply Air Back Draft Damper - Train B | Open - Train B Close - Train A | Open - Train B Close - Train A | Open - Train B Close - Train A on CHP or CHR | NA (Back Draft) |
| D-12 | Charcoal Filter Unit Supply Air - Train B | Close | Close | Open - Train B Close - Train A on CHP or CHR | NA (Back Draft) |

## VENTILATION DAMPERS: FUNCTIONS AND POSITIONS FOR VARIOUS MODES OF PLANT OPERATION

| Damper | Description | Normal Position | Shutdown Position | Position After Auto Actuation | Position After Loss of Air |
|---|---|---|---|---|---|
| D-13 | Charcoal Filter Unit Return Air - Train B | Close | Close | Open - Train B Close - Train A on CHP or CHR | Close |
| D-14 | Charcoal Filter Unit Outside Air - Train B | Close | Close | Open - Train B, (Manual Close Avail) Close - Train A on CHP or CHR | NA (Elect Op FAI) |
| D-15 | Purge Fan Isolation | Close | Close | Close on CHP or CHR | Close |
| D-16 | Purge Fan Isolation | Close | Close | Close on CHP or CHR | Close |
| D-17 | Exhaust Fan V-16 Isolation | Open | Open | Close on CHP or CHR | Close |
| D-18 | Exhaust Fan Isolation | Open | Open | Close on CHP or CHR | Close |
| D-19 | Number Not Used | - | - | - | - |

## VENTILATION DAMPERS: FUNCTIONS AND POSITIONS FOR VARIOUS MODES OF PLANT OPERATION

| Damper | Description | Normal Position | Shutdown Position | Position After Auto Actuation | Position After Loss of Air |
|---|---|---|---|---|---|
| D-20 | Charcoal Filter Flow Control - Train A | Open | Open | Modulate - Train A Open - Train B on CHP or CHR | Open |
| D-21 | Charcoal Filter Flow Control - Train B | Open | Open | Modulate - Train B Open - Train A on CHP or CHR | Open |
| Radioactive Waste Area and Engineered Safeguards Rooms | | | | | |
| PO-3010 | Fresh Air Supply | Open | Open | Close on Trip of Fan V-10 | Close |
| PO-1809 | Radwaste Area Supply | Open | Open | Close (RE-1809) | Close |
| PO-1839 | Radwaste Area Exhaust | Open | Open | Close on Trip of Fan V-14A | Close |
| PO-1840 | Radwaste Area Exhaust | Open | Open | Close on Trip of Fan V-14B | Close |
| PO-1817 | East Safeguards Room Supply | Open | Open | Close (RE-1810) | Close |
| PO-1810 | East Safeguards Room Exhaust | Open | Open | Close (RE-1810) | Close |

## VENTILATION DAMPERS: FUNCTIONS AND POSITIONS FOR VARIOUS MODES OF PLANT OPERATION

| Damper | Description | Normal Position | Shutdown Position | Position After Auto Actuation | Position After Loss of Air |
|---|---|---|---|---|---|
| PO-1812 | West Safeguards Room Supply | Open | Open | Close (RE-1811) | Close |
| PO-1811 | West Safeguards Room Exhaust | Open | Open | Close (RE-1811) | Close |
| Auxiliary Building Addition Radwaste Area Ventilation System | | | | | |
| PO-8006 | Fresh Air Supply | Open | Open | Close on Trip of Fan V-67 | Close |
| PO-8016A | Radwaste Add Exhaust | Open | Open | Close on Trip of Fan V-68A | Close |
| PO-8016B | Radwaste Add Exhaust | Open | Open | Close on Trip of Fan V-68B | Close |

## VENTILATION DAMPERS: FUNCTIONS AND POSITIONS FOR VARIOUS MODES OF PLANT OPERATION

| Damper | Description | Normal Position | Shutdown Position | Position After Auto Actuation | Position After Loss of Air |
|---|---|---|---|---|---|
| Fuel Handling Area | | | | | |
| Damper PO-3007 is normally open during reactor operation or reactor shutdown and fails closed on loss of instrument air. | | | | | |
| Auxiliary Building Addition Fuel Handling Area Ventilation System | | | | | |
| PO-8001 | Fresh Air Supply | Open | Open | Close on Trip of Fan V-69 | Close |
| PO-8013A | Fuel Handling Add Exhaust | Open | Open | Close on Trip of Fan V-70A | Close |
| PO-8013B | Fuel Handling Add Exhaust | Open | Open | Close on Trip of Fan V-70B | Close |
| Penetration and Fan Rooms Heating and Ventilation System | | | | | |
| PO-8035 | Outside Air Supply | Open | Open | Close (RIA-5710) | Close |
| PO-8036 | Exhaust | Open | Open | Close (RIA-5710) | Close |

## VENTILATION DAMPERS: FUNCTIONS AND POSITIONS FOR VARIOUS MODES OF PLANT OPERATION

| Damper | Description | Normal Position | Shutdown Position | Position After Auto Actuation | Position After Loss of Air |
|---|---|---|---|---|---|
| Containment | | | | | |
| CV-1813 | Air Space Purge Supply | Close | Open | Close on CHP or CHR | Close |
| CV-1814 | Air Space Purge Supply | Close | Open | Close on CHP or CHR | Close |
| CV-1806 | Cont Purge Exhaust | Close | Open | Close on CHP or CHR | Close |
| CV-1805 | Cont Purge Exhaust | Close | Open | Close on CHP or CHR | Close |
| CV-1808 | Cont Purge Exhaust | Close | Open | Close on CHP or CHR | Close |
| CV-1807 | Cont Purge Exhaust | Close | Open | Close on CHP or CHR | Close |

## SAMPLING STATIONS

NSSS Sampling Station

Containment Hydrogen Monitoring System

Turbine Analyzer Panel

Radwaste Sampling Station

Waste Gas Sample Panel

Radwaste Addition Sampling System

## SAMPLE POINT SUMMARY

1. NSSS Sample Station

| | |
|---|---|
| Pressurizer Vapor Phase | Grab Sample, Bomb |
| Pressurizer Liquid Phase | Grab Sample, Bomb |
| Primary Coolant Hot Leg | Grab Sample, Bomb |
| Quench Tank Liquid Phase | Grab Sample, Bomb |
| Quench Tank Vapor Phase | Grab Sample, Bomb |
| Purification Ion Exchange Inlet | Grab Sample |
| Purification Filters Outlet | Grab Sample |
| LPSI Pumps Discharge | Grab Sample |
| Purification Ion Exchange Outlet | Grab Sample |
| SI Drain Tank | Grab Sample |
| Containment Spray Pumps Discharge | Grab Sample |
| SIRW Tank Recirculation | Grab Sample |
| HPSI Pumps Discharge | Grab Sample |

2. Radwaste Sampling Station

| | |
|---|---|
| Primary System Drain Tank Recirc | Grab Sample |
| Equipment Drain Tank Recirc | Grab Sample |
| Vacuum Degasifier Pump Discharge | Grab Sample |
| Receiver Tank Pumps Discharge | Grab Sample |
| Receiver Tank Circ Pumps Discharge | Grab Sample |
| Radwaste Demin Tanks Outlet (3) | Grab Sample |
| Treated Waste Mon Tanks Recirc (2) | Grab Sample |
| Controlled Chem Lab Drain Tank | Grab Sample |
| Filtered Waste Monitor Tank Recirc | Grab Sample |
| Dirty Waste Drain Tank Recirc | Grab Sample |
| Component Cooling Pumps Discharge | Grab Sample |

3. Turbine Analyzer Panel

| | |
|---|---|
| Steam Generator Blowdown (2) | Grab Sample, Conductivity, pH, Sodium, Hydrazine |
| Feedwater Heater Train (2) | Grab Sample, Conductivity, pH, Oxygen, Sodium, Hydrazine |
| Condensate Pumps Discharge (2) | Grab Sample, Conductivity, pH, Oxygen, Sodium, Hydrazine |
| Heater Drains Discharge (2) | Grab Sample, pH |
| Primary Storage Tank | Grab Sample, Conductivity, pH, Sodium |
| Condensate Pump P-11 Discharge | Grab Sample, Conductivity, pH, Sodium |
| Blowdown Demineralizer (3) | Grab Sample |

## SAMPLE POINT SUMMARY

4. Waste Gas Sample Panel

| | |
|---|---|
| Volume Control Tank | Bomb |
| Waste Gas Surge Tank | Bomb |
| Waste Gas Decay Tanks (6) | Bomb |
| Spurt Resin Storage Tank | Bomb |

5. Radwaste Addition Sampling System

| | |
|---|---|
| Radwaste Polishing Demineralizer Discharge | Grab Sample, Conductivity |
| Clean Waste Transfer Pump Discharge | Grab Sample |
| Clean Waste Distillate Pump Discharge | Grab Sample |
| Misc Waste Distillate Pumps Discharge (2) | Grab Sample |
| Misc Waste Demineralizer Tank Discharge (2) | Grab Sample, Conductivity (1) |
| Misc Waste Transfer Pumps Discharge (2) | Grab Sample |
| Misc Waste Filter Inlet | Grab Sample |
| Misc Waste Filter Discharge (2) | Grab Sample |
| Primary System Makeup Water Pump Discharge | Grab Sample |
| Utility Water Transfer Pump Discharge | Grab Sample |
| Spurt Resin Storage Tank Gas | Bomb |
| Waste Gas Decay Tanks (3) | Bomb |
| Radwaste Evaporator Distillate (2) | Grab Sample |

6. Containment Hydrogen Monitor

| | |
|---|---|
| Containment Atmosphere (2) | % Hydrogen |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

1.1 General

| | |
|---|---|
| Normal Letdown Flow | 40 gpm |
| Normal Purification Flow Rate | 40 gpm |
| Normal Charging Flow | 44 gpm |
| Primary Coolant Pump Controlled Bleedoff (4 Pumps) | 4 gpm |
| Normal Letdown Temperature at Loop | 547.8°F |
| Normal Charging Temperature at Loop | 425°F |
| Ion Exchanger Operating Temperature | 120°F |

1.2 Regenerative Heat Exchanger - E-56

| | |
|---|---|
| Quantity | 1 |
| Type | Shell and Tube, Vertical |
| Normal Heat Transfer | $6.6 \times 10^6$ Btu/h |
| Code | ASME B&PV Code, Section III, Class C, 1965 |
| Shell Side (Charging) | |
| Fluid | Primary Coolant, 1 Wt % Boric Acid, Nominal; 15,000 ppm Boric Acid, Maximum (Design) |
| Design Pressure | 2,735 psig |
| Design Temperature | 650°F |
| Material | Stainless Steel |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

Tube Side (Letdown)

| | |
|---|---|
| Fluid | Primary Coolant, 1 Wt % Boric Acid, Nominal; 15,000 ppm Boric Acid, Maximum (Design) |
| Design Pressure | 2,485 psig |
| Design Temperature | 650°F |
| Material | Stainless Steel |

Operating Parameters - Regenerative Heat Exchanger

| | Normal | Maximum Unbalanced Charging With Heat Transfer | Maximum Purification | Maximum Unbalanced Letdown |
|---|---|---|---|---|
| Tube Side (Letdown) | | | | |
| Flow - gpm | 40 | 40 | 120 | 120 |
| Inlet Temp - °F | 547.8 | 547.8 | 547.8 | 547.8 |
| Outlet Temp - °F | 251 | 160 | 319 | 449 |
| Shell Side (Charging) | | | | |
| Flow - gpm | 43 | 133 | 123 | 33 |
| Inlet Temp - °F | 120 | 120 | 120 | 120 |
| Outlet Temp - °F | 416 | 246 | 367 | 523 |
| Heat Transfer - Btu/h | $6.3 \times 10^6$ | $7.9 \times 10^6$ | $14.9 \times 10^6$ | $6.9 \times 10^6$ |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

1.3 Letdown Orifice - RO-2003, RO-2004 and RO-2005

| | |
|---|---|
| Quantity | 3 |
| Capacity (Each) | 40 gpm |
| Design Pressure | 2,485 psia |
| Design Temperature | 650°F |
| Normal Temperature of Fluid | 250°F |
| Maximum Temperature of Fluid | 450°F |
| Normal Downstream Pressure | 470 psia |
| Normal Upstream Pressure | 1,970 psia |
| Material | Stainless Steel |
| Fluid | Primary Coolant, 1 Wt % Boric Acid, Nominal; 15,000 ppm Boric Acid, Maximum (Design) |

1.4 Letdown Heat Exchanger - E-58

| | |
|---|---|
| Quantity | 1 |
| Type | Shell and Tube, Horizontal |
| Design Heat Transfer | $19.1 \times 10^6$ Btu/h |
| Code | ASME B&PV Code, Section III, Class C |
| Tube Side (Letdown) | |
| Fluid | Primary Coolant, 1 Wt % Boric Acid, Nominal; 15,000 ppm Boric Acid, Maximum (Design) |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

| | |
|---|---|
| Design Pressure | 650 psig |
| Design Temperature | 550°F |
| Material | Stainless Steel |
| Shell Side (Cooling Water) | |
| Fluid | Component Cooling Water |
| Design Pressure | 150 psig |
| Design Temperature | 250°F |
| Material | Carbon Steel |

Operating Parameters - Letdown Heat Exchanger

| | Normal | Maximum Unbalanced Charging With Letdown | Maximum Purification | Maximum Unbalanced Letdown |
|---|---|---|---|---|
| Tube Side (Letdown) | | | | |
| Flow - gpm | 40 | 40 | 120 | 120 |
| Inlet Temp - °F | 251 | 160 | 319 | 449 |
| Outlet Temp - °F | 120 | 120 | 120 | 139 |
| Heat Transfer - Btu/h | $2.6 \times 10^6$ | $1.1 \times 10^6$ | $11.9 \times 10^6$ | $19.1 \times 10^6$ |
| Shell Sides (Cooling Water) | | | | |
| Flow - gpm | 66 - 111 | 23 - 40 | 500 - 1,000 | 591 - 960 |
| Inlet Temp - °F | 65 - 90 | 65 - 90 | 65 - 90 | 65 - 90 |
| Outlet Temp - °F | 144-137 | 133-130 | 113 - 114 | 130-130 |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

1.5 Process Radiation Monitor - Element RE-0202

| | |
|---|---|
| Quantity | 1 |
| Design Pressure | 200 psig |
| Design Temperature | 250°F |
| Normal Operating Pressure | 20 psig |
| Normal Operating Temperature | 120°F |
| Normal Flow Rate | 0.5 gpm |
| Code | ASA B31.1 |

1.6 Ion Exchangers - T-51A, T-51B and T-52

| | |
|---|---|
| Quantity | 3 |
| Type | Flushable |
| Design Pressure | 200 psig |
| Design Temperature | 250°F |
| Normal Operating Pressure | 20 psig |
| Normal Operating Temperature | 120°F |
| Resin Volume | 32 $ft^3$ |
| Normal Flow Rate | 40 gpm |
| Maximum Flow Rate | 120 gpm |
| Decontamination Factor, Minimum | 10 |
| Retention Screen | 80 US Mesh |
| Code for Vessel | ASME B&PV Code, Section III, Class C |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

| | |
|---|---|
| Material | Stainless Steel |
| Fluid | 1 Wt % Boric Acid, Nominal; 15,000 ppm Boric Acid, Maximum (Design) |

1.7 Purification Filters - F-54A and F-54B

| | |
|---|---|
| Quantity | 2 |
| Type of Elements | Synthetic Fiber |
| Retention | 0.05 to 6.0 Micron Absolute; 1.0 Micron Nominal (or finer) |
| Design Pressure | 200 psig |
| Design Temperature | 250°F |
| Design Flow | 120 gpm |
| Normal Flow | 40 gpm |
| Maximum Flow | 160 gpm |
| Code for Vessel | ASME B&PV Code, Section III, Class C, 1965 |
| Material | Stainless Steel |
| Fluid | 1 Wt % Boric Acid, Nominal; 15,000 ppm Boric Acid, Maximum (Design) |

1.8 Volume Control Tank - T-54

| | |
|---|---|
| Quantity | 1 |
| Type | Vertical, Cylindrical |
| Design Pressure, Internal | 75 psig |
| Design Pressure, External | 15 psig |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

| | | |
|---|---|---|
| | Design Temperature | 250°F |
| | Internal Volume, Minimum | 4,170 gal |
| | Operating Pressure Range | 0 to 75 psig |
| | Normal Operating Pressure | 10 psig |
| | Normal Operating Temperature | 120°F |
| | Normal Spray Flow | 40 gpm |
| | Blanket Gas | Hydrogen or Nitrogen |
| | Code | ASME B&PV Code, Section III, Class C, 1965 |
| | Fluid | 1 Wt % Boric Acid, Nominal; 15,000 ppm Boric Acid, Maximum (Design) |
| | Material | Stainless Steel |
| 1.9 | Spray Nozzle (Volume Control Tank) | |
| | Quantity | 1 |
| | Type | Medium Angle, Full Cone |
| | Design Pressure | 200 psig |
| | Design Temperature | 250°F |
| | Normal Spray Flow | 40 gpm |
| | Maximum Spray Flow | 120 gpm |
| | Fluid | 1 Wt % Boric Acid, Nominal; 15,000 ppm Boric Acid, Maximum (Design) |
| | Material | Stainless Steel |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

1.10 Variable Speed Charging Pump - P-55A

| | |
|---|---|
| Quantity | 1 |
| Type | Positive Displacement |
| Design Pressure | 2,735 psig |
| Design Temperature | 250°F |
| Flow Rate Range | 33 to 53 gpm |
| Normal Flow Rate | 44 gpm |
| Normal Discharge Pressure | 2,200 psig |
| Normal Temperature of Pumped Fluid | 120°F |
| Maximum Discharge Pressure (Short Term) | 2,900 psig |
| NPSH Required | 7.65 ft (Ref. 25) |
| NPSH Available (Normal Suction From VCT) | 30.39 ft (Ref. 25) |
| Maximum Pressure Pump Starts Against | 2,485 psig |
| Driver Rating | 100 hp |
| Type Variable Capacity Device | Fluid Drive |
| Fluid Drive and Pump Cooling Water Requirements | 22 gpm, 15°F Rise |
| Materials in Contact With Pumped Fluid | Stainless Steel or Equivalent Corrosion Resistance |
| Fluid | 1 Wt % Boric Acid, Nominal; 12 Wt% Boric Acid, Maximum (Design) |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

1.11 Constant Speed Charging Pumps - P-55B and P-55C

| | |
|---|---|
| Quantity | 2 |
| Type | Positive Displacement |
| Design Pressure | 2,735 psig |
| Design Temperature | 250°F |
| Flow Rate | 40 gpm |
| Normal Discharge Pressure | 2,200 psig |
| Normal Temperature of Pumped Fluid | 120°F |
| Maximum Discharge Pressure (Short Term) | 3,010 psig |
| NPSH Required | 7.41 ft (Ref. 25) |
| NPSH Available P-55B/C (Normal Suction From VCT) | 28.22/28.18 ft (Ref. 25) |
| Maximum Pressure Pump Starts Against | 2,500psig |
| Driver Rating | 75 hp |
| Pump Cooling Water Requirements | 5 gpm, 15°F Rise |
| Materials in Contact With Pumped Fluid | Stainless Steel or Equivalent Corrosion Resistance |
| Fluid | 1 Wt % Boric Acid, Nominal; 12 Wt % Boric Acid, Maximum (Design) |

1.12 Boric Acid Batching Tank - T-77

| | |
|---|---|
| Quantity | 1 |
| Internal Volume | 580 gal |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

| | | |
|---|---|---|
| | Useful Volume | 457.4 gal |
| | Design Pressure | Atmospheric |
| | Design Temperature | 200°F |
| | Normal Operating Temperature | 150°F |
| | Type Heater | Electric Immersion |
| | Heater Capacity | 31.5 kw Minimum |
| | Code | ASME B&PV Code, Section VIII |
| | Fluid | 6-1/4 Wt % Boric Acid, Normal; 12 Wt % Boric Acid, Maximum (Design) |
| | Material | Stainless Steel |
| 1.13 | Boric Acid Strainer - F-10 (YS-0224) | |
| | Quantity | 1 |
| | Type | Basket |
| | Design Pressure | 125 psig |
| | Design Temperature | 250°F |
| | Screen Size | 100 x 100 US Mesh |
| | Design Flow | 50 gpm |
| | Material | Stainless Steel |
| | Fluid | 6-1/4 Wt % Boric Acid, Normal; 12 Wt % Boric Acid, Maximum (Design) |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

1.14 Concentrated Boric Acid Storage Tanks - T-53A and T-53B

| | |
|---|---|
| Quantity | 2 |
| Internal Volume | 6,550 gal |
| Design Pressure | Atmospheric |
| Design Temperature | 200°F |
| Normal Operating Temperature | 140°F to 170°F |
| Type Heater | Electrical, Dry Well Installation |
| Heater Capacity | Two Independent 4 kW Banks per Tank |
| Fluid | 6-1/4 Wt % Boric Acid, Normal; 12 Wt % Boric Acid, Maximum (Design) |
| Material | Stainless Steel |
| Code | ASME B&PV Code, Section III, Class C, 1965 |

1.15 Boric Acid Pumps - P-56A and P-56B

| | |
|---|---|
| Quantity | 2 |
| Type | Centrifugal |
| Design Pressure | 150 psig |
| Design Temperature | 250°F |
| Design Head | 225 ft |
| Design Flow | 143 gpm |
| Minimum Flow | 10 gpm |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

| | |
|---|---|
| Normal Operating Temperature | 160°F |
| NPSH Required | 7.50 ft (Ref. 25) |
| NPSH Available P-56A/B | 25.06/25.23 (Ref. 25) |
| Horsepower | 30 |
| Fluid | 6-1/4 Wt % Boric Acid, Normal; 12 Wt % Boric Acid, Maximum (Design) |
| Material in Contact With Liquid | Stainless Steel |

1.16 Boric Acid Filter - F-9

| | |
|---|---|
| Quantity | 1 |
| Type Elements | Synthetic Fiber |
| Retention of 5 Micron Particles | 98% |
| Design Pressure | 150 psig |
| Design Temperature | 250°F |
| Design Flow | 140 gpm |
| Material | Stainless Steel |
| Liquid | 6-1/4 Wt % Boric Acid, Normal; 12 Wt % Boric Acid, Maximum (Design) |
| Code | ASME B&PV Code, Section III, Class C, 1965 |

1.17 Chemical Addition Tank - T-56

| | |
|---|---|
| Quantity | 1 |
| Capacity | 10.5 gal |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

| | |
|---|---|
| Design Pressure | Atmospheric |
| Design Temperature | 200°F |
| Normal Operating Temperature | Ambient |
| Material | Stainless Steel |
| Fluid | Hydrazine ($N_2H_4$), LiOH, KOH, $NH_4OH$ |
| Code | ASME B&PV Code, Section VIII |

1.18 Chemical Addition Strainer - F-58

| | |
|---|---|
| Quantity | 1 |
| Type | Basket |
| Design Pressure | 100 psig |
| Design Temperature | 250°F |
| Screen Size | 60 US Mesh |
| Design Flow | 30 gph |
| Material | Stainless Steel |
| Fluid | Hydrazine ($N_2H_4$), LiOH, KOH, $NH_4OH$ |

1.19 Metering Pump - P-57

| | |
|---|---|
| Quantity | 1 |
| Type | Air Operated Double Diaphragm |
| Design Pressure | 120 psig |
| Design Temperature | 190°F |
| Design Flow Rate | 0 to 35 gpm |

## CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

| | |
|---|---|
| Design Air Consumption | 0 to 50 scfm |
| Normal Fluid Temperature | 75°F |
| Material | Stainless Steel |
| Fluid | Hydrazine ($N_2H_4$), LiOH, KOH, $NH_4OH$ |

## FUEL HANDLING DATA

| | |
|---|---|
| 1. New Fuel Storage Rack | |
| Core Storage Capacity | 1/6 |
| Equivalent Fuel Assemblies | 36 |
| Center-to-Center Spacing of Assemblies | 11 in |
| 2. Spent Fuel Storage Pool | |
| Core Storage Capacity | 4.3 |
| Equivalent Fuel Assemblies | 892 |
| Number of Space Accommodations for Spent Fuel Shipping Casks | 1 |
| Center-to-Center Spacing of Assemblies | |
| Region 1 | 10-1/4 in |
| Region 2 | 9.17 in |
| Maximum $k_{eff}$ With Unborated Water | Less Than 1.0 |
| 3. Miscellaneous Details | |
| Wall Thickness for Spent Fuel Storage Pool | 4 ft to 6-1/2 ft |
| Weight of Fuel Assembly | 1,500 lb |
| Capacity of Refueling Water Storage Tank | 285,000 gal |
| Quantity of Water Required for Refueling | 250,000 gal |

## FUEL BUILDING CRANE

| | |
|---|---|
| Main Hoist | 3 ft/min at Full Load (3 Steps), 25 hp at 900 r/min |
| Main Hoist Brake Capacity | 179 ft-lb |
| Auxiliary Hoist | 25 ft/min at Full Load (Stepless), 25 hp at 900 r/min |
| Trolley | 25 ft/min at Full Load (3 Steps), 3 hp at 1,800 r/min * |
| Bridge | 25 ft/min at Full Load (3 Steps), 5 hp at 1,800 r/min * |
| Service Class | Class A, Electric Overhead Crane Institute Specification 70 |
| Lift Main Hoist | 54 ft 0 in |
| Lift Auxiliary Hoist | 108 ft 5 in |
| Span | 44 ft 10 in Center-to-Center Rails |
| Bridge Travel | Approximately 100 ft |
| Lifting Tackle | Main Hoist - Rope 16 Parts 1¾-Inch SS, Drum 52½-Inch Pitch Diameter, Sheaves 28-Inch Pitch Diameter |
| | Auxiliary Hoist - Rope 4 Parts ¾-Inch SS, Drum 15-Inch Pitch Diameter, Sheaves 13-Inch Pitch Diameter |
| Girders | Welded Box Section |
| Runway Rail | 100 lbs ASCE |
| Trolley Rail | 175 lbs USS |
| Bridge Drive | Direct Drive Arrangement With Oiltight Center Gear Case |
| Trolley Drive | Direct Drive Arrangement With Oiltight Center Gear Case |

* Single failure proof mode of operation only

## FUEL BUILDING CRANE

| | |
|---|---|
| Capacity in Net Tons | Bridge 110 Tons, Main Hoist 110 Tons, Auxiliary Hoist 15 Tons |
| Wheels | Bridge Has Eight 21-Inch Steel Hardened Treads |
| | Trolley Has Four 21-Inch Diameter Steel Hardened Treads |
| Bridge End Assembly | Rotating Axle |
| Bumpers | Rubber |
| Bearings | Antifriction Throughout |
| Gearing | Helical Gearing Heat-Treated Steel Throughout Except Trolley Traverse. All Gearing in Oiltight Casing |

POWER BLOCK STRUCTURE

| Building | Fire Area | Description |
|---|---|---|
| Auxiliary | 1 | Control Room Complex |
| Auxiliary | 2 | Cable Spreading Room |
| Auxiliary | 3 | 1D Switchgear Room & North Cableway |
| Auxiliary | 4 | 1C Switchgear Room |
| Auxiliary | 5 | 1-1 Diesel Generator Room |
| Auxiliary | 6 | 1-2 Diesel Generator Room |
| Auxiliary | 7 | Diesel Generator 1-1 Fuel Oil Day Tank |
| Auxiliary | 9 | Diesel Generator 1-2 Fuel Oil Day Tank |
| Auxiliary | 10 | East Engineered Safeguards Room |
| Auxiliary | 11 | Battery Room #2 |
| Auxiliary | 12 | Battery Room #1 |
| Auxiliary | 13 | Auxiliary Building - Miscellaneous |
| Auxiliary | 15 | Engineered Safeguards Panel Room & Stairway |
| Auxiliary | 16 | Component Cooling Pump Room |
| Auxiliary | 17 | Refueling & Spent Fuel Pool Room |
| Auxiliary | 18 | Demineralizer Rooms |
| Auxiliary | 19 | Track Alley |
| Auxiliary | 21 | Electrical Equipment Room |
| Auxiliary | 27 | Radwaste Addition - VRS |
| Auxiliary | 28 | West Engineered Safeguards Room |
| Auxiliary | 29 | Center Mechanical Equipment Room |
| Auxiliary | 30 | East Mechanical Equipment Room |
| Auxiliary | 31 | West Mechanical Equipment Room |
| Auxiliary | 32 | SIRW Tank & CCW Roof Area |
| Auxiliary | 33 | Technical Support Center |
| Auxiliary | 34 | Man Hole #1 |
| Auxiliary | 35 | Man Hole #2 |
| Auxiliary | 36 | Man Hole #3 |
| Auxiliary | 26 | Southwest Cable Penetration Room |
| Reactor | 14 | Reactor Containment Building |
| Turbine | 9 | Intake Structure |
| Turbine | 22 | Turbine Lube Oil Room |
| Turbine | 23 | Turbine Building |
| Turbine | 24 | Auxiliary Feedwater Pump Room |
| Turbine | 25 | Heating Boiler Rooms |
| Turbine | 56 | Diesel Fire Pump Fuel Oil Day Tank Room |
| Feedwater Purity | 39 | Feedwater Purity Building |
| Yard | 41 | Outside Area within Protected Area & Transformer Area |
| Switchyard | 40 | Switchyard |
| Enclosure | 59 | Diesel - Driven AFW Pump P-8D Enclosure |