

**Comanche Peak Nuclear Power Plant, Units 3 & 4**  
**COL Application**  
**Part 2, FSAR**

CHAPTER 10  
STEAM AND POWER CONVERSION SYSTEM

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ACRONYMS AND ABBREVIATIONS

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ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BD	blowdown
CCW	component cooling water
COL	Combined License
CPNPP	Comanche Peak Nuclear Power Plant
CTW	cooling tower
CWS	circulating water system
DCD	Design Control Document
FAC	flow accelerated corrosion
LWMS	liquid waste management system
MSR	maximum steaming rate
NDE	nondestructive examination
QA	quality assurance
SG	steam generator
SGBDS	steam generator blowdown system
T/B	turbine building
TCEQ	Texas Commission on Environmental Quality
TCS	turbine component cooling water system
T/G	Turbine Generator
TPDES	Texas Pollutant Discharge Elimination System
WWS	waste water system

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**10.0 STEAM AND POWER CONVERSION SYSTEM**

**10.1 SUMMARY DESCRIPTION**

This section of the referenced Design Control Document (DCD) is incorporated by reference with no departures and/or supplements.

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**10.2 TURBINE-GENERATOR (T/G)**

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

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**10.2.3.5 Inservice Inspection**

---

STD COL 10.2(1) Replace the last paragraph of **DCD Subsection 10.2.3.5** with the following.

A turbine maintenance and inspection procedure will be established prior to fuel load.

---

**10.2.5 Combined License Information**

Replace the content of **DCD Subsection 10.2.5** with the following.

STD COL 10.2(1) ***COL 10.2(1) Inservice Inspection***

*This Combined License (COL) item is addressed in **Subsection 10.2.3.5**.*

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**10.3        MAIN STEAM SUPPLY SYSTEM**

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

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**10.3.2.4.3        Water (Steam) Hammer Prevention**

---

STD COL 10.3(3) Replace the 6th sentence of first paragraph in **DCD Subsection 10.3.2.4.3** with the following.

The operating and maintenance procedures regarding water hammer are included in system operating procedures in Subsection 13.5.2.1. A milestone schedule for implementation of the procedures is also included in Subsection 13.5.2.1.

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**10.3.6.3        Flow-Accelerated Corrosion (FAC)**

---

STD COL 10.3(1) Replace the last paragraph in **DCD Subsection 10.3.6.3** with the following.

**10.3.6.3.1        Flow-Accelerated Corrosion (FAC) Monitoring Program**

Erosion-corrosion in piping systems is a flow-induced material degradation process. It can affect metallic materials whose corrosion resistance is based on the formation of oxide (protective) surface film. Wear-off destruction of the oxide film by turbulent flow water or steam causes corrosion of the unprotected metal.

The FAC monitoring program analyzes, inspects, monitors, and trends FAC degradation of carbon steel piping and piping components in high-energy systems that carry water or wet steam and are susceptible to erosion-corrosion damage. In addition, the FAC monitoring program addresses the concerns of Generic Letter 89-08 and consistent with the guidelines of NSAC-202L-R2. The FAC monitoring program will be established prior to fuel load.

The thrust of the FAC monitoring program is to:

- Conduct appropriate analysis and perform preservice inspection.
- Determine the extent of pipe wall thinning, if any, and repair/replace components as necessary.



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- Perform follow-up inspections to confirm or quantify pipe wall thinning and take long-term corrective actions (such as adjust water chemistry, operating parameters or others).

**10.3.6.3.1.1 Analysis**

An industry-sponsored program is used to predict the wear rate for piping and components in high-energy carbon steel piping systems which are susceptible to FAC. Each susceptible component is tracked in a database and is inspected in the order of susceptibility. For each piping component, the analytical method predicts the FAC wear rate, trends the estimated inspection interval, repairs, and/or replacement. Carbon steel piping American Society of Mechanical Engineers (ASME) III and B31.1 and pipe components that are used in single-phase and two-phase high-energy flow systems are the most susceptible to FAC damage and receive the most critical analysis.

**10.3.6.3.1.2 Inspections**

Inspections that involve wall thickness measurements are used to identify wall thickness margins for thinning and to evaluate the FAC trending data, and provide the refinement of the predictions. Components are inspected for wear using ultrasonic examination method with grid location, radiographic examination method, or visual observation. Preservice wall thickness measurement or baseline data are collected prior to individual system turnover to operation. The first inspection after preservice inspection is used as a baseline trend for future inspections. Each subsequent inspection determines the FAC wear rate for the piping and piping components and the need for inspection frequency adjustment for those components.

**10.3.6.3.1.3 Training**

The FAC monitoring program is administered by trained and experienced personnel. Task-specific training is provided for plant personnel that implement the monitoring program. The specific nondestructive examination (NDE) is carried out by qualified personnel. Inspection data are analyzed by engineers and/or other experienced personnel to determine the overall effect on the piping and piping components.

**10.3.6.3.1.4 Procedures**

**a. Specific Plant Procedure**

The FAC monitoring program is governed by a procedure. This procedure contains the following elements:

- Requirement to monitor and control FAC

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- Identification of the tasks to be performed (including implementing procedures) and associated responsibilities
- Identification of a managerial position that has overall responsibility for the FAC monitoring program at each plant
- Communication requirements between the manager and other departments that have responsibility for performing support tasks
- Quality assurance (QA) requirements
- Identification of long-term goals and strategies for reducing high FAC wear rates
- A method for evaluating plant performance against long-term goals

**b. Implementing Procedures**

The FAC implementing procedures provide guidelines for controlling the major tasks. The plant procedures for major tasks are as follows:

- Identifying susceptible systems, including piping and pipe components
- Performing FAC analysis
- Performing preservice inspections to verify wall thickness margin for thinning
- Selecting and scheduling components for initial inspection
- Performing inspections after plant operation cycles
- Evaluating degraded and/or thinning components
- Repairing, replacing and/or remodeling components, when necessary
- Selecting and scheduling locations for the next inspections
- Collection and storage of inspections records
- Expanding the inspection locations as necessary

**10.3.6.3.1.5 Industry Experience**

Industry experience provides valuable supplement to the plant analysis and management program. The FAC monitoring program is updated from time to time to include industry experience by identifying susceptible components or piping features.

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**10.3.6.3.1.6 Long-Term Strategy**

The long-term strategy is to improve the inspection program and to reduce susceptibility of piping components to FAC. An effective long-term monitoring program description is included in the CPNPP Units 3 and 4 FAC Monitoring Program.

**10.3.6.3.1.7 Plant Chemistry**

The responsibility for system chemistry is under the purview of the plant chemistry section. The plant chemistry section specifies chemical addition in accordance with plant procedures.

**10.3.7 Combined License Information**

Replace the content of the **DCD Subsection 10.3.7** with the following.

STD COL 10.3(1) **10.3(1)** *FAC monitoring program*  
*This COL item is addressed in Subsection 10.3.6.3*

**10.3(2)** *Deleted from the DCD.*

STD COL 10.3(3) **10.3(3)** *Operating and maintenance procedures for water (steam) hammer prevention*

*This COL item is addressed in Subsection 10.3.2.4.3.*

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**10.4 OTHER FEATURES OF STEAM AND POWER CONVERSION SYSTEM**

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

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**10.4.5.2.1 General Description**

---

CP COL 10.4(1) Replace the fourth sentence of first paragraph in **DCD Subsection 10.4.5.2.1** with the following.

The site-specific circulating water system (CWS) makeup water and blowdown (BD) system is based on the following;

- Makeup water is provided from Lake Granbury through an intake structure and pipelines.
- An installed spare makeup water pump in the intake structure is common to both units.
- CWS blowdown is by gravity drain to Lake Granbury.

Figure 10.4.5-1R and Figure 10.4.5-201 provide the CWS and makeup water and BD Piping and Instrumentation Diagrams. The CWS and cooling tower (CTW) design and selection are subject to environmental conditions as indicated in Table 10.4.5-1R.

---

CP COL 10.4(1) Replace the sixth paragraph in **DCD Subsection 10.4.5.2.1** with the following.

The CWS of each unit is composed of eight, 12.5 percent capacity circulating water pumps, two CTWs, two CTW basins, and two BD line jockey pumps. There are five makeup water pumps located in the intake structure on Lake Granbury. Two pumps serve each unit and one pump is available as a common spare for either unit. A makeup jockey pump is common to both units.

---

CP COL 10.4(1) Replace the first sentence of the last paragraph in **DCD Subsection 10.4.5.2.1** with the following.

Makeup water is provided from Lake Granbury by makeup water pumps to the CTW basins to compensate for the CTW evaporation, drift, and blowdown. A makeup water jockey pump maintains the pressure in the makeup water line header when the makeup water pumps are shut down.

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CP COL 10.4(1) Add the following new paragraph after the end of **DCD Subsection 10.4.5.2.1**.

The CWS also supplies makeup water to the ultimate heat sink system for makeup evaporation and drift loss during normal operation, and to miscellaneous plant users, such as the raw water storage tank of the water treatment system.

A water stream is removed from each CTW basin during plant operation by the BD system to maintain and control water quality in the CTW basins. The BD system utilizes the static head difference that is available between the low water level at the CTW basin and high water level at Lake Granbury. BD priming pumps located at the CTW basins fill the BD lines prior to start of BD operation.

**10.4.5.2.2      Component Description**

---

CP COL 10.4(1) Replace the fifth bullet in **DCD Subsection 10.4.5.2.2** with the following.

- CTW makeup water pumps
  - Makeup water jockey pump
  - BD line priming pumps
  - BD diffusers
  - Piping and valves
  - Makeup water intake structure
  - Makeup water intake structure screens
  - Air compressor/receiver for backwash screens
- 

**10.4.5.2.2.4      Cooling Tower Makeup Water Pumps**

---

CP COL 10.4(1) Replace the first paragraph in **DCD Subsection 10.4.5.2.2.4** with the following.

There are a total of five makeup water pumps installed in the Lake Granbury makeup water intake structure. For each plant unit, the makeup water is provided by two (2) 50 percent capacity vertical, wet-pit pumps. Two pumps serve each of Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4, and one pump is available as a common spare for both units by valve arrangement. The makeup

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water pumps are driven by electric motors. A reliable backup electric power source is provided for makeup water pumps.

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**10.4.5.2.2.5 Blowdown Pumps**

CP COL 10.4(1) Replace the content of **DCD Subsection 10.4.5.2.2.5** with the following.

BD pumps are not installed, since the BD is achieved by gravity drain flow from the CTW basins to Lake Granbury.

**10.4.5.2.2.6 Piping and Valves**

---

CP COL 10.4(1) Replace the third sentence of the second paragraph in **DCD Subsection 10.4.5.2.2.6** with the following.

A control valve is provided at each CTW basin discharge line. This valve is used to adjust the flow rate for the BD system. In addition, an isolation valve is provided upstream of the diffuser on each BD line.

A motor operated valve for regulation of makeup to CTW and a manual isolation valve for maintenance are provided at each makeup water pump discharge line.

Air piping and valves are run from the air compressor receiver tank to each intake screens for air bursting to clean the screen.

---

**10.4.5.2.2.8 Chemical Injection**

---

CP COL 10.4(1) Replace the sixth sentence of the first paragraph in **DCD Subsection 10.4.5.2.2.8** with the following.

Chemical injection is also provided for in the makeup water and blowdown systems and ultimate heat sink basin.

---

CP COL 10.4(1) Add the following new subsections after **DCD Subsection 10.4.5.2.2.8**.

**10.4.5.2.2.9 Makeup Water Jockey Pump**

The common makeup water jockey pump maintains the makeup water lines pressurized when the makeup water pumps are shut down. The jockey pump can be aligned to out-of-service makeup water piping of either or both units. The jockey pump is normally not operating. It operates only to maintain the pressure in the makeup water lines within preset range, to facilitate makeup pump restart. The

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jockey pump can also be powered from the reliable backup power source.

**10.4.5.2.2.10 Cooling Tower Blowdown Line Priming Pumps**

Two BD line-priming pumps are provided per unit. The priming pumps are vertical, wet pit pumps driven by electric motors. One priming pump is located in each CTW basin.

**10.4.5.2.2.11 Blowdown Diffusers**

The BD diffuser is installed at the discharge of the BD line downstream of the BD control valve. The BD discharge is achieved through a series of axial nozzles installed along the length of the diffuser pipe.

Based on the anticipated Texas Commission on Environmental Quality (TCEQ)/ Texas Pollutant Discharge Elimination System (TPDES) waste water discharge limits for total dissolved solids and constituents, it is expected that a portion of the BD from the CPNPP Units 3 and 4 cooling towers will require periodic treatment (based on variable makeup water quality). This treatment is expected to utilize conventional pre-filtration, reverse osmosis technology and evaporation ponds to handle the waste stream. Treatment will be established to comply with permitted TCEQ/TPDES requirements, as required, and on a frequency dictated by conservatively postulated environmental conditions (i.e. makeup water quality).

The permeate will be returned to Lake Granbury through blending with the untreated portion of the BD stream to meet required TCEQ/TPDES waste water discharge limits. The waste concentrates will be managed through the use of a conventional, sectionalized, lined, forced evaporation pond and mechanical removal of the solids left behind by evaporation. The solids will be removed to a conventional solids landfill.

The evaporation pond design and solids disposal methodology will meet all Texas Administrative Code requirements as set forth by the TCEQ.

**10.4.5.2.2.12 Makeup Water Intake Structure**

The CPNPP Units 3 and 4 intake structure is located on Lake Granbury and is designed to meet the requirements of the Clean Water Act, Section 316(b). The makeup water inlets are located at a depth that provides both navigational clearance and sufficient hydraulic submergence to prevent makeup water pump cavitation. The submerged intakes are fitted with fine-mesh passive screens that eliminate the need for traveling screens and/or fish return systems in the pump house and exclude fish and other aquatic life from impingement and direct entrainment through the pumps.

There are four screens that are mounted on a bulkhead wall at the lake face of the intake structure. The flow from the screen passes through steel pipe, through the bulkhead wall, and then passes into the intake structure. Five makeup water pumps are located inside the intake structure for pump suction.

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The surface area of the screens is sized to provide a flow of 0.5 fps or lower through the screen slots, which also serves to minimize the potential for entrainment and to eliminate the potential for impingement of aquatic organisms per the 316(b) regulatory guidelines.

**10.4.5.2.2.13 Makeup Water Intake Structure Screens**

The makeup water intake structure screens are passive screens with adequate surface area to provide a velocity of 0.5 fps through the screen slots with consideration of partially clogged surface area.

The screens are cleaned by means of air blasts with the air being supplied by an air compressor and air receiver tank located in the intake structure. Cleaning is done periodically with a differential pressure monitoring system installed to measure the head loss across each screen and initiate cleaning of any screen that shows an unusual head loss across it due to clogging.

**10.4.5.2.2.14 Air Compressor/Receiver for Backwashing Screens**

Compressed air is used to air blast the screens to clean off accumulated debris on the outside surface. An air compressor and air receiver is used for this purpose.

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**10.4.5.3.2 Normal Operation**

Add the following new paragraph after the third paragraph in **DCD Subsection 10.4.5.3.2**.

The CTW basins have level transmitters/controllers which send a signal to the pump controller for starting and stopping the makeup water pumps, based on low and normal water level in the CTW basins.

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**10.4.5.6 Instrumentation Applications**

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CP COL 10.4(1) Replace the ninth paragraph in **DCD Subsection 10.4.5.6** with the following.

Level instrumentation in the CTW basin activates makeup water flow from Lake Granbury by transmitting level signals to the makeup water pumps. The CTW basin makeup water valves are aligned from the main control room.

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**10.4.7.7 Water Hammer Prevention**

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STD COL 10.4(6) Replace the first sentence of 6th paragraph in **DCD Subsection 10.4.7.7** with the following.

The operating and maintenance procedures regarding water hammer are included in system operating procedures in Subsection 13.5.2.1. A milestone schedule for implementation of the procedures is also included in Subsection 13.5.2.1.

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**10.4.8.1.2 Non-safety Power Generation Design Bases**

CP COL 10.4(2) Add the following text before the first paragraph in **DCD Subsection 10.4.8.1.2**.

Throughout this subsection 10.4.8, "waste water system (WWS)" described in **DCD 10.4.8** is replaced with "existing waste water management Pond C".

---

CP COL 10.4(2) Add the following text after the last bullet in **DCD Subsection 10.4.8.1.2**.

- Discharge secondary side water (after cooling) to existing waste water management Pond C or LWMS during plant start up and abnormal chemistry conditions.
  - Monitor the concentration of radioactive material in the cooled blowdown water with startup SG blowdown heat exchanger downstream radiation monitor downstream of startup blowdown heat exchanger.
- 

**10.4.8.2.1 General Description**

CP COL 10.4(2) Replace the first and second paragraph in **DCD Subsection 10.4.8.2.1** with the following.

The steam generator blowdown system (SGBDS) flow diagrams are shown in Figures 10.4.8-1R, 10.4.8-2R, and 10.4.8-201. Classification of equipment and components in the SGBDS is provided in **Subsection 3.2**.

The SGBDS equipment and piping are located in the containment, the reactor building, the auxiliary building, the turbine building(T/B), and outdoors.

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CP COL 10.4(2) Add the following text after the third paragraph in **DCD Subsection 10.4.8.2.1**.

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The SGBDS also includes startup SG blowdown flash tank, startup blowdown heat exchanger, piping, valves and instrumentation used during plant startup and abnormal water chemistry conditions.

---

CP COL 10.4(2) Replace the thirteenth and fourteenth paragraph in **DCD Subsection 10.4.8.2.1** with the following.

During plant startup, the blowdown rate is up to approximately 3 % of maximum steaming rate (MSR) at rated power. The blowdown from each SG flows to the startup SG blowdown flash tank. The blowdown lines from SGs A and B and the blowdown lines from SGs C and D are joined together before flowing to the startup SG blowdown flash tank.

The blowdown water from each SG is depressurized by a throttle valve located downstream of the isolation valves located in the startup blowdown line. The throttle valves can be manually adjusted to control the blowdown rate.

The depressurized blowdown water flows to the startup SG blowdown flash tank, where water and flashing vapor are separated. The vapor is diverted to the condenser and the water flows to the startup SG blowdown heat exchanger for cooling. The CWS cools blowdown water in this heat exchanger before discharging to the existing waste water management Pond C. Pond C has  $6.7 \times 10^6$  gal storage capacity. A radiation monitor located downstream of the startup SG blowdown heat exchanger measures radioactive level in the blowdown water. When an abnormally high radiation level is detected, the blowdown lines are isolated and the blowdown water included in the SGBDS is transferred to waste holdup tank in the LWMS. The location and other technical details of the monitor will be developed during the detail design phase.

With abnormal water chemistry, the flow of blowdown rate up to approximately 3 % of MSR at rated power is directed to the existing waste water management pond C via the startup SG blowdown flash tank for processing. In this mode, flashed vapor from the startup SG blowdown flash tank flows to the deaerator.

During normal operation, blowdown rate is approximately 0.5 to 1 % of MSR at rated power. At the 1% of MSR at rated power blowdown rate, both cooling trains are used.

---

CP COL 10.4(2) Add the following text after last bullet of the seventeenth paragraph in **DCD Subsection 10.4.8.2.1**.

- High radiation signal from startup SG blowdown water radiation monitor
- High water level in the startup SG blowdown flash tank
- High pressure in the startup SG blowdown flash tank

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**10.4.8.2.2.4      Steam Generator Drain**

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CP COL 10.4(5) Replace the first paragraph in **DCD Subsections 10.4.8.2.2.4** with the following.

Pressurized nitrogen is used to send secondary side water in the steam generators under pressure to the existing waste water management Pond C or the condenser. An approximate 20 psig pressure is maintained. This pressure facilitates draining steam generators without using a pump. If the SG drain temperature exceeds the operating temperature limit of the existing waste water management Pond C prior to discharging to this Pond C, the SG drain is cooled in the Startup SG blowdown Heat Exchanger.

---

**10.4.8.2.3      Component Description**

CP COL 10.4(2) Replace the first sentence of first paragraph in **DCD Subsections 10.4.8.2.3** with the following.

Component design parameters are provided in Table 10.4.8-1R.

---

CP COL 10.4(2) Add the following text after the last paragraph in **DCD Subsection 10.4.8.2.3**.

**(9)Startup SG blowdown flash tank**

The startup SG blowdown flash tank is located outdoors. During plant startup operation and abnormal secondary water chemistry conditions, up to 3 % MSR at rated power conditions, blowdown fluid is separated into flashing vapor and saturated liquid in this tank by lowering the pressure and temperature in the tank.

**(10)Startup SG blowdown heat exchanger**

The startup SG blowdown heat exchanger is located outdoors. One 100 % capacity heat exchanger for the SG blowdown water flow rate and temperature conditions at 3% of MSR at rated power is provided. The SG blowdown water from the startup SG blowdown flash tank or SG drain is cooled in this heat exchanger by the CWS not to exceed permissible temperature of waste water management Pond C.

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**10.4.8.5 Instrumentation Applications**

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CP COL 10.4(2) Add the following after the last paragraph in **DCD Subsection 10.4.8.5**.

High pressure and high water level in the startup SG blowdown flash tank closes the upstream flow control valve.

The startup SG blowdown heat exchanger downstream radiation monitor, located in the piping downstream of the startup SG blowdown heat exchanger, detects the presence of radioactivity in the SGBDS. Upon detection of the significant levels of radioactivity, the blowdown water is diverted to the LWMS.

A high radiation signal of the startup SG blowdown heat exchanger downstream radiation monitor closes the SGBDS isolation valves.

---

**10.4.9.2.2 System Operation**

---

STD COL 10.4(6) Replace the first sentence of last paragraph in **DCD Subsection 10.4.9.2.2** with the following.

The operating and maintenance procedures regarding water hammer are included in system operating procedures in Subsection 13.5.2.1. A milestone schedule for implementation of the procedures is also included in Subsection 13.5.2.1.

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**10.4.12 Combined License Information**

Replace the content of the **DCD Subsection 10.4.12** with the following.

CP COL 10.4(1) **10.4(1) Circulated Water System**

*This COL item is addressed in Subsection 10.4.5, **Table 10.4.5-1R**, **Figure 10.4.5-1R** and **Figure 10.4.5-201**.*

CP COL 10.4(2) **10.4(2) Steam Generator Blowdown System**

*This COL item is addressed in Subsection 10.4.8.1, 10.4.8.2, 10.4.8.5, **Table 10.4.8-1R**, **Figure 10.4.8-1R**, **Figure 10.4.8-2R** and **Figure 10.4.8-201**.*

**10.4(3) Deleted from the DCD.**

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**10.4(4)** *Deleted from the DCD.*

CP COL 10.4(5) **10.4(5)** *System design for Steam Generator Drain*

*This COL item is addressed in Subsection 10.4.8.2.2.4.*

STD COL 10.4(6) **10.4(6)** *Operating and maintenance procedures for water hammer prevention*

*This COL item is addressed in Subsection 10.4.7.7 and 10.4.9.2.2.*

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**Table 10.4.5-1R (Sheet 1 of 3)**

**Design Parameters for Major Components of Circulating  
Water System**

	Ambient design temperature	-	
	Design wet bulb temperature, (°F) (5% Exceedance)	76 (78 including 2 °F recirculation)	
	Circulating water pumps	-	
CP COL 10.4(1)	Number of pumps (per unit)	8	
	Flowrate (gpm)	164,715	
	Mechanical draft cooling towers	-	
CP COL 10.4(1)	Number of towers (per unit)	2	
	Number of cells in each cooling tower	30	
	Design inlet temperature (°F)	103.7	
	Design outlet temperature (°F)	88.5	
	Design temperature rise (°F)	15.2	
	CTW design approach temperature (°F)	10.5	
	Design flowrate (gpm)	1,290,720 plus 27,000 (for Non essential service water)	

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**Table 10.4.5-1R (Sheet 2 of 3)**  
**Design Parameters for Major Components of Circulating Water System**

	Cooling tower makeup water pumps	
CP COL 10.4(1)	Number of pumps  (two pumps serve each units and one pump is common spare for both units)	5
CP COL 10.4(1)	Flowrate (gpm)	16,350
CP COL 10.4(1)	Makeup water jockey pump	
CP COL 10.4(1)	Number of pumps (common use to both units)	1
CP COL 10.4(1)	Flowrate (gpm)	50
	Blowdown pumps	
CP COL 10.4(1)	Number of pumps	N.A. (NOTE)
CP COL 10.4(1)	Flowrate (gpm)	N.A. (NOTE)
CP COL 10.4(1)	Blowdown line priming pumps	
CP COL 10.4(1)	Number of pumps (per unit)	2
CP COL 10.4(1)	Flowrate (gpm)	250

CP COL 10.4(1) NOTE: BD pumps are not installed since BD is achieved by gravity drain.

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**Table 10.4.5-1R (Sheet 3 of 3)**  
**Design Parameters for Major Components of Circulating Water**  
**System**

Piping and components design data	
Design pressure/temperature, (psig/°F)	85/110
Material for intake and discharge tunnel	Pre-stressed reinforced concrete with appropriate lining, if required by the CWS water chemistry.
Material for CWS above ground piping	ASTM A106, Grade B carbon steel piping with lining
Type of CWS major valves	Motor-operated butterfly valves. AWWA C504



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**Table 10.4.8-1R (sheet 1 of 3)**

**Steam Generator Blowdown System Major Component Design Parameters**

**SG blowdown flash tank**

Type	Vertical cylindrical
Number of tanks	1
Capacity (ft <sup>3</sup> )	300
Design flow rate (lb/hr)	202,000 (1% of MSR at rated power)
Design pressure (psig)	300
Design temperature (°F)	410
Materials of construction	Stainless steel

**SG blowdown regenerative heat exchangers (per heat exchanger)**

Type	Shell and tube	
Number of exchangers	2	
Design heat duty (Btu/hr)	17.6x10 <sup>6</sup>	
Operating conditions	Tube side	Shell side
Fluid	SG blowdown	Condensate
	water	
Operating temperature - In (°F)	375	129
- Out (°F)	158	365
Design flow rate (lb/hr)	79.4x10 <sup>3</sup>	73.5x10 <sup>3</sup>
Design pressure (psig)	300	560
Design temperature (°F)	410	410
Materials of construction	Stainless steel	Carbon steel

**SG blowdown non-regenerative coolers (per cooler)**

Type	Shell and Tube	
Number of coolers	2	
Design heat duty (Btu/hr)	3.57x10 <sup>6</sup>	
Operating conditions	Tube side	Shell side
Fluid	SG blowdown	TCS
	Water	
Operating temperature - In (°F)	158	100
- Out (°F)	113	109
Design flow rate (lb/hr)	79.4x10 <sup>3</sup>	397x10 <sup>3</sup>
Design pressure (psig)	300	200
Design temperature (°F)	200	200
Materials of construction	Stainless steel	Carbon steel

**SG blowdown demineralizers**

Number of demineralizers	4 (two cation bed and two mixed bed)
Resin amount (ft <sup>3</sup> )	230
Design flow rate (gpm)	320
Design pressure (psig)	300
Design temperature (°F)	200
Materials of construction	Stainless steel

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**Table 10.4.8-1R (sheet 2 of 3)**

**Steam Generator Blowdown System Major Component Design  
Parameters**

**SG blowdown sample coolers**

Type	Double tube	
Number of coolers	4	
Design heat duty (Btu/hr)	209x10 <sup>3</sup>	
Operating conditions	Tube side	Shell side
Fluid	SG blowdown water	CCW
Operating temperature		
- In (°F)	557	100
- Out (°F)	113	128
Design flow rate (lb/hr)	440	7,500
Design pressure (psig)	1185	200
Design temperature (°F)	568	200
Materials of construction	Stainless steel	Carbon steel

**SG blowdown demineralizers inlet filters**

Type	Vertical cylindrical, cartridge
Number of filters	2
Operating flow rate (gpm)	320
Operating temperature (°F)	113
Design pressure (psig)	300
Design temperature (°F)	200
0.8 micron particles retention (%)	98
Material of construction Filter	Polypropylene
Body	Stainless steel

**SG blowdown isolation valves**

Number of valves	8
Type	Air-operated globe
Nominal valve size (inch)	4
Design pressure (psig)	1,185
Design temperature (°F)	568
Material of construction	Stainless steel
Body	
Construction Code	ASME Section III, Class 2
First valve	
	Seismic category I
Second valve	ASME Section III, Class 3
	Seismic category I

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**Table 10.4.8-1R (sheet 3 of 3)**

**Steam Generator Blowdown System Major Component Design Parameters**

**SG blowdown sample line  
containment isolation valves**

Number of valves	4
Type	Air-operated globe
Nominal valve size (inch)	3/4
Design pressure (psig)	1,185
Design temperature (°F)	568
Material of construction	
Body	Stainless steel
Construction Code	ASME Section III, Class 2 Seismic category I

CP COL 10.4(2)

**Startup SG blowdown flash tank**

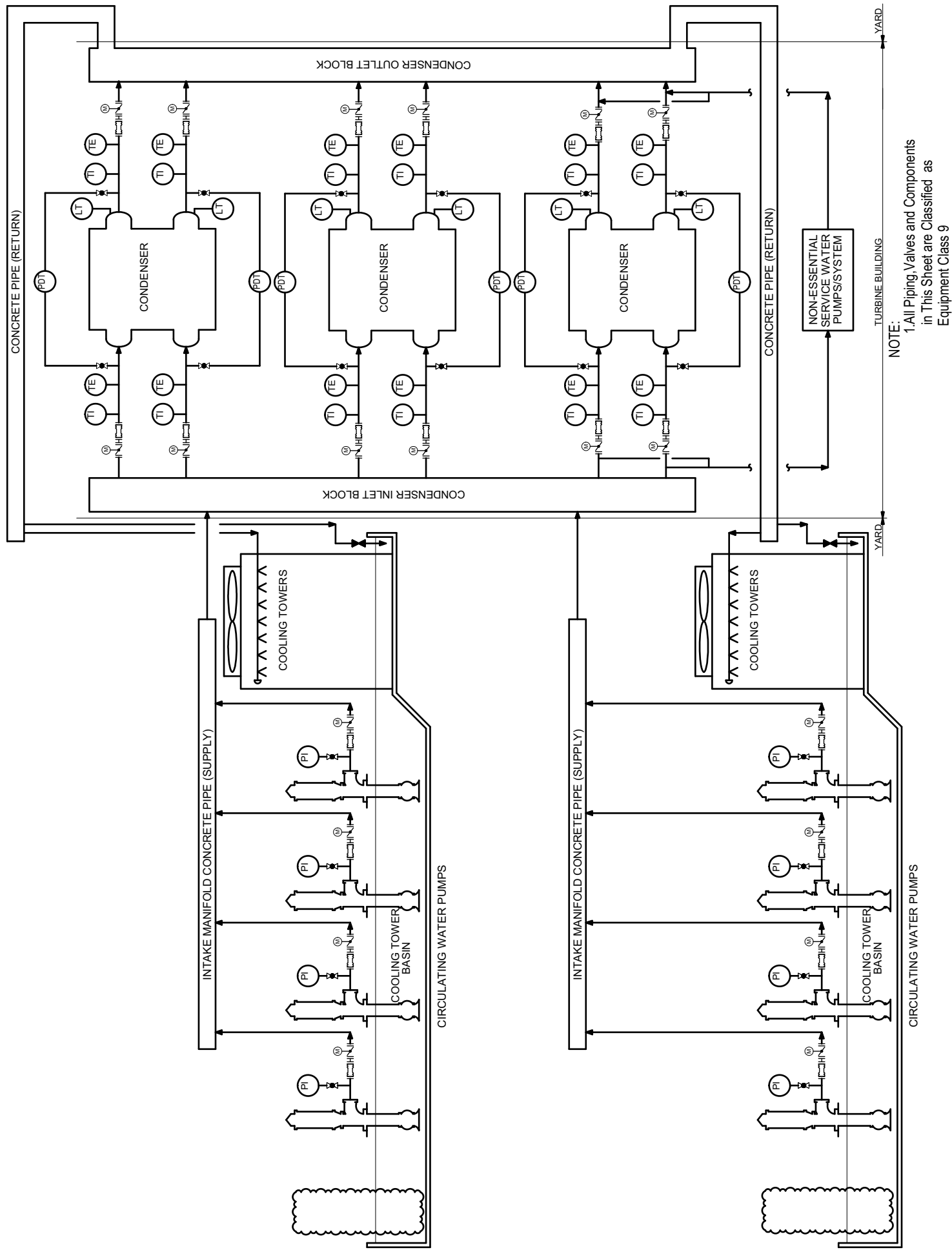
Type	Vertical cylindrical
Number of tanks	1
Capacity (ft <sup>3</sup> )	1100
Design flow rate (lb/hr)	606,000 (3% of MSR at rated power )
Design pressure (psig)	200
Design temperature (°F)	410
Materials of construction	Stainless steel

CP COL 10.4(2)

**Startup SG blowdown heat exchanger**

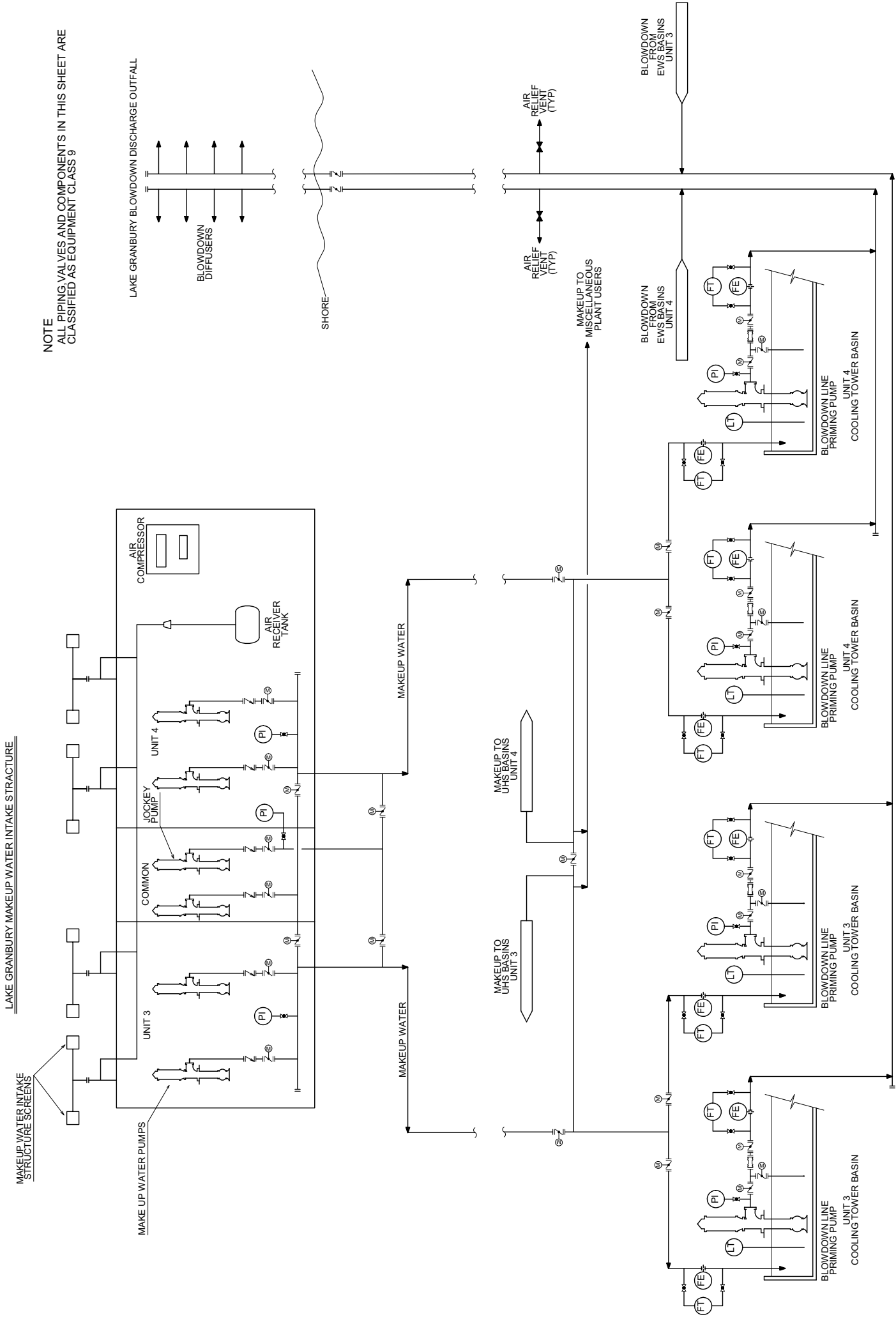
Type	Shell and tube	
Number of exchangers	1	
<u>Startup condition</u>	<u>Tube side</u>	<u>Shell side</u>
Design heat duty (Btu/hr)	71.9x10 <sup>6</sup>	
Fluid	SG blowdown water	Circulating water
Operating temperature - In (°F)	307	89
- Out (°F)	140	170
Design flow rate (lb/hr)	431x10 <sup>3</sup>	888x10 <sup>3</sup>
<u>Abnormal water chemistry conditions</u>	<u>Tube side</u>	<u>Shell side</u>
Design heat duty (Btu/hr)	112x10 <sup>6</sup>	
Fluid	SG blowdown water	Circulating water
Operating temperature - In (°F)	378	89
- Out (°F)	140	150
Design flow rate (lb/hr)	471x10 <sup>3</sup>	184x10 <sup>4</sup>
Design pressure (psig)	200	150
Design temperature (°F)	410	200
Materials of construction	Stainless steel	Carbon steel

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**Figure 10.4.5-1R Circulating Water System Piping and Instrumentation Diagram**

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CP COL 10.4(1)

Figure 10.4.5-201 Circulating Water System Piping and Instrumentation Diagram (Site-specific portion)

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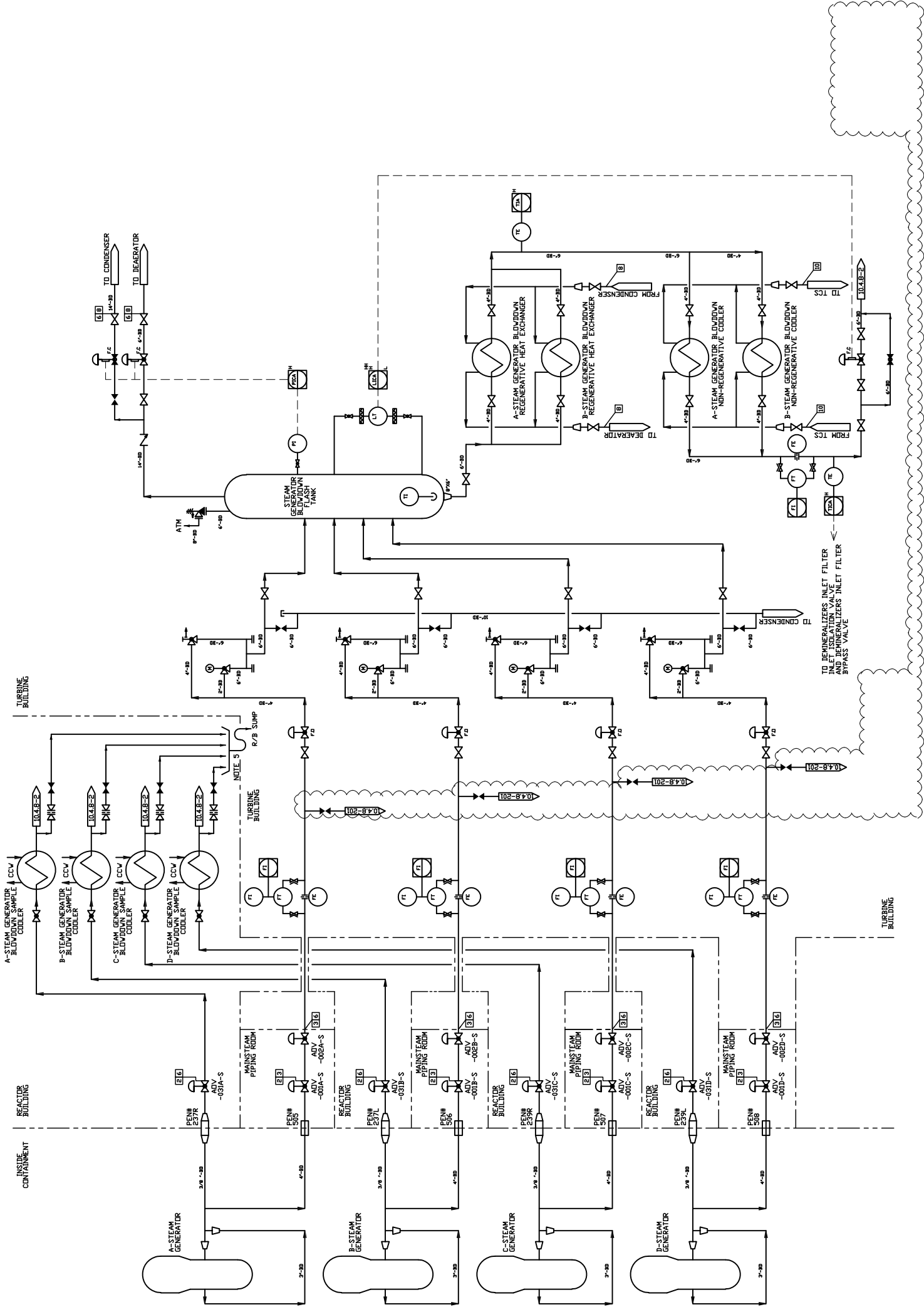
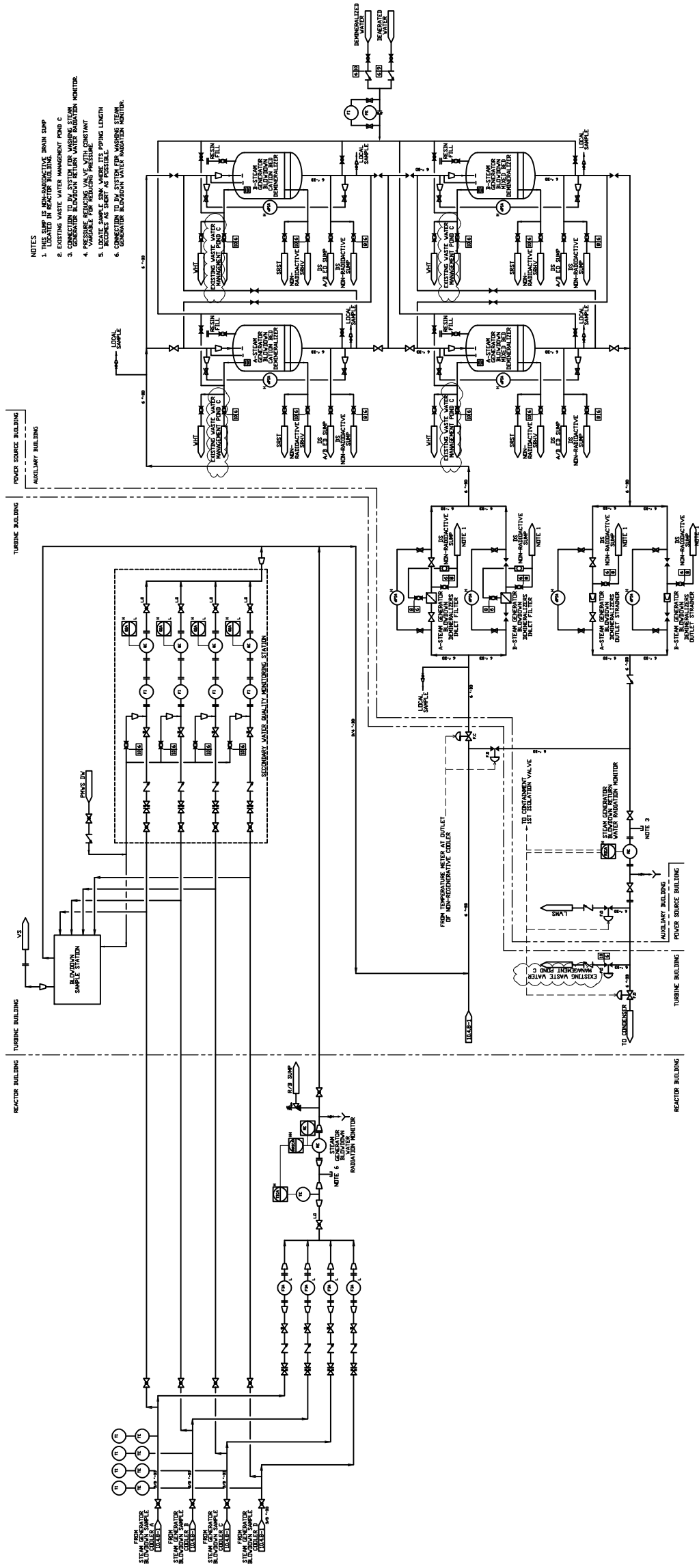


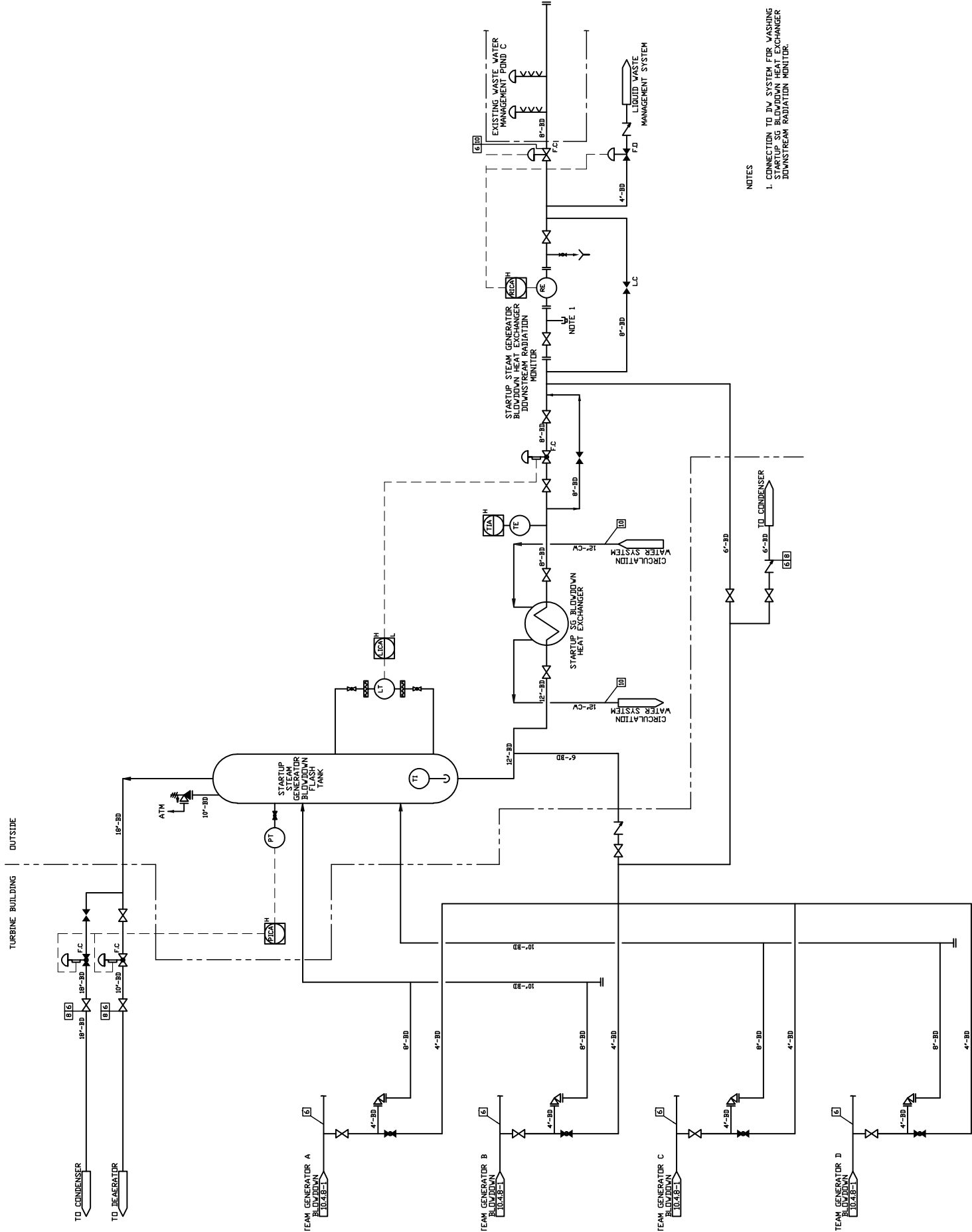
Figure 10.4.8-1R Steam Generator Blowdown System Piping and Instrumentation Diagram (Sheet 1 of 2)

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**Figure 10.4.8-2R Steam Generator Blowdown System Piping and Instrumentation Diagram (Sheet 2 of 2)**

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CP COL 10.4(2)

Figure 10.4.8-201 Steam Generator Blowdown System Piping and Instrumentation Diagram (Site-specific portion)