9.10 COMPRESSED AIR SYSTEM

9.10.1 DESIGN BASIS

The Compressed Air System consists of the instrument air and plant air subsystems. The instrument air subsystem is designed to provide a reliable supply of dry and oil-free air for the pneumatic instruments and controls and pneumatically operated containment isolation valves. The plant air subsystem is designed to meet necessary service air requirements for plant maintenance and operation. The designs of each subsystem are based on an estimated instrument air requirement of 260 scfm and an estimated plant air requirement of 600 scfm. The instrument air subsystem compressor is sized for 450 scfm.

9.10.2 SYSTEM DESCRIPTION

The Compressed Air System is shown schematically on Figures 9-23 (Unit 1) and 9-28 (Unit 2). The Plant Water and Air Service System is shown in Figure 9-29.

The system incorporates two full-capacity, non-lubricated compressors for instrument air, each having a separate inlet filter aftercooler and moisture separator. The instrument air compressors then discharge to a single header which is connected to two air receivers. Both air receivers discharge to a compressed air outlet header which supplies instrument air to the air dryers and filter assembly. The compressed air header then divides into branch lines supplying the pretreatment and tank storage area, the Intake Structure, the service building, the water treatment area, the Turbine Building, the containment structure, and the Auxiliary Building.

An emergency back-up tie from the plant air header has been provided to automatically supply air to the instrument air system if the pressure to the instrument filter and dryer assembly falls below a preset value. Local controls are provided to prevent plant air use when this occurs. For the transition from normal to emergency service, air storage tanks provide an approximate 20-minute supply (Table 9-21).

Particle size, dew point, and oil hydrocarbons are controlled for instrument air supply in accordance with Instrument Society of America standards. Additionally, the Calvert Cliffs approach to controlling air quality was submitted to the NRC in response to Generic Letter 88-14.

One full-capacity plant air compressor with an inlet filter, and integral air coolers and moisture separators, discharges to the plant air receiver. The receiver outlet header is connected to the prefilter assembly, which is followed by an outlet header branching into two separate air headers, one to the instrument air dryers and filter assembly, and the other to the plant air pretreatment and storage tank area, the Intake Structure, the service building, the water treatment area, the Turbine Building, the Containment Structure, and the Auxiliary Building. A system cross-tie between Unit 1 and Unit 2 has been provided for the plant air headers. Additionally, each plant air system has a permanent connection for the installation of a portable air compressor to allow for maintenance of the compressors or SRW system during Modes 3, 4, 5, 6 and defueled. This connection may also be used in Modes 1 and 2 to provide a contingency backup to an operating plant air compressor should the other installed plant air compressor be unavailable.

9.10.3 SYSTEM COMPONENTS

Ratings and construction of system components are listed in Table 9-21.

9.10.4 SYSTEM OPERATION

A continuous supply of instrument air is provided to hold various pneumatically-operated valve actuators in the positions necessary for operating conditions. Normally, the plant air

compressor and one instrument air compressor will operate and the second instrument air compressor will be on automatic standby.

9.10.5 SYSTEM RELIABILITY

The power supply for the normal compressors is the normal distribution system and can be backed up by the EDG. Additional emergency air compressors, known as the saltwater air compressors (SWACs), provide redundant air supply to most safety-related components when the normal air compressors are lost. The SWACs (Table 9-16B) are seismically qualified, air-cooled, and oil-free. The instrument air portion of the compressed air system is primarily used for valve actuation and is not used in any reactor indication, control, or protective circuitry. These valve actuators are designed to fail in the safe position after loss of the instrument air supply. The design of the system and installed equipment redundancy ensure that total loss of instrument air supply is highly improbable. Concurrently, attention has been given to ensure that valve failures from loss of instrument air supply are consistent with the capability to maintain the plant in a safe condition and mitigate the consequences of any simultaneous incident or accident.

9.10.6 TESTS AND INSPECTIONS

Each component is inspected and cleaned prior to installation into the system. Instruments were calibrated during testing and automatic controls were tested for actuation at the proper setpoints. Alarm functions were checked for operability and limits during plant operational testing. The systems were operated and tested initially with regard to flow paths, flow capacity, and mechanical operability.

TABLE 9-21

COMPRESSED AIR SYSTEM COMPONENT DESCRIPTION

A. INSTRUMENT AIR SYSTEM

Air Compressor	
Type	Vertical, non-lubricated reciprocating, two state Y-angle type
Quantity	2 (per unit)
Design capacity (scfm)	470 (each)
Discharge pressure (psig)	100
Motor	100 hp, 3 phase, 60 Hz, 460 Volt
Code	ASME Section VIII, NEMA
Intake Filter – Silencer	
Type	dry
Quantity	2 per Unit
Base size	8"
Aftercooler and Moisture Separator	
Type	Shell and tube
Quantity	2 (1 per compressor)
Code	TEMA Class C, ASME Section VIII
Air Receiver	
Type	Vertical
Quantity	2 (1 per compressor)
Design pressure (psig)	115
Actual volume (ft^3)	96
Code	ASME Section VIII
Prefilters	
Type	Cartridge
Quantity	2 per Unit
Capacity (scfm)	720
Filtration	99% removal of all liquids, oil, and water droplets
Air Dryer	
Type	Heatless
Desiccant	Activated alumina absorbent
Quantity	2 per unit
Capacity (scfm)	475 (Nos. 12 and 22), 700 (Nos. 11 and 21)
Outlet moisture content with saturated air inlet	-40°F dew point at 100 psig
Afterfilters	
Type	Cartridge
Quantity	2 per Unit
Capacity (scfm)	600
Filtration	100% removal of all particulates over 0.9 microns

TABLE 9-21

COMPRESSED AIR SYSTEM COMPONENT DESCRIPTION

Piping and Valves	
Valves	150 psi ANSI for 2-1/2" and larger, 600 psi ANSI for 2" and smaller
Piping	Seamless ASTM A106, Grade B (2-1/2" through 24")
Code	ANSI B31.1 (ANSI B31.7 - penetration piping)
B. PLANT AIR SYSTEM	
Air Compressor	
Type	Centrifugal, two stage, with integral air coolers and moisture separators
Quantity	One per Unit
Design capacity (scfm)	600
Discharge pressure (psig)	100
Motor	200 hp, 3 phase, 60 Hz, 460 Volt
Code	NEMA
Intake Filter Silencer	
Type	Dry
Quantity	One per Unit
Air Receiver	
Type	Vertical
Quantity	1
Design pressure (psig)	115
Actual volume (ft^3)	96
Code	ASME Section VIII
Prefilter	
Type	Cartridge
Quantity	2 per Unit
Capacity (scfm)	720
Filtration	99% removal of all liquids, oil, and water droplets
Piping and Valving	
Valves	150 psi ANSI for 2-1/2" and larger, 600 psi ANSI for 2" and smaller
Piping	Seamless ASTM A106, Grade B (2-1/2" through 24")
Code	ANSI B31.1 (ANSI B31.7 - penetration piping)
C. INSTRUMENT BACKUP AIR SYSTEM	
Storage Tank	
Type	Vertical
Quantity	4
Capacity	300 ft^3
Design pressure (psig)	225
Code	ASME Section VIII
Air Amplifier	
Ratio	2:1