9.4 AIR CONDITIONING, HEATING, COOLING AND VENTILATION SYSTEMS

9.4.1 CONTROL ROOM AIR CONDITIONING SYSTEM

The control room envelope at elevation +46 ft- MSL in the Reactor Auxiliary Building will be referred to as the "control room" and will include the following:

a) main control room (includes supervisor office),

b) computer room,

c) toilet areas,

d) kitchenette and kitchen,

e) computer room supplemental air conditioning equipment room,

f) conference room (Technical Support Center) and vault,

g) storage area and emergency storage area,

h) locker rooms,

i) emergency living quarters (Technical Support Center),

j) control room heating, ventilating and air conditioning equipment room,

k) corridors,

1) Technical Support Center (NRC Office), and

m) QSPDS Room.

9.4.1.1 Design Bases

The Control Room Air Conditioning System is designed to:

→(DRN 04-977, R14)

a) limit control room doses due to airborne activity to within General Design Criterion 19 (Appendix A of 10CFR50) and 10CFR50.67 limits,

←(DRN 04-977, R14)

b) maintain the ambient temperature required for personnel comfort during normal plant operating conditions, as shown in Table 9.4-1,

c) permit personnel occupancy and proper functioning of instrumentation and controls during all normal and design basis accident conditions assuming a single active failure coincident with a loss of offsite power,

d) withstand a safe shutdown earthquake without loss of function,

e) permit personnel occupancy in the control room during a toxic chemical accident, and

f) provide accessibility for adjustments and periodic inspections and testing of the system components to assure continuous functional reliability.

The safety class and seismic classifications of the Control Room Air Conditioning System components are given in Table 3.2-1. Protection against the dynamic effects associated with postulated pipe rupture is discussed in Section 3.6. Environmental design criteria and qualification of components are discussed in Section 3.11. Control room habitability following a design basis accident is discussed in Section 6.4.

9.4.1.2 <u>System Description</u>

The Control Room Air Conditioning System air flow diagram is shown on Figure 9.4-1. The principal system component design date are listed in Table 9.4-2.

9.4.1.2.1 Normal Operation

→(DRN 06-843, R15)

During normal operation, outside air (2200 cfm) enters an air intake louver located at elevation 62 ft. -1 in. MSL at the northeast corner of the Reactor Auxiliary Building. Two safety-related 100 percent capacity air handling units (AH-12) are provided. One unit operates on a continuous basis and maintains the open position of the outside air intake butterfly valves (3HV-B169A and 3HV-B170B) and dampers D-39 and D-40, while the second unit is on standby. The second unit will be automatically started by Class 1E instrumentation should the first one fail.

←(DRN 06-843, R15)

Each air handling unit includes a medium efficiency filter, chilled water cooling coil, electric heating coil and centrifugal fan. Each cooling coil is served by the Essential Services Chilled Water System described in Subsection 9.2.9. A Class 1E temperature sensing element in the air handling unit's discharge duct modulates the motor operated chilled water control valve to maintain a fixed air discharge temperature. A Class 1E low-limit thermocouple provides freeze protection by sensing the temperature across the upstream face of the chilled water cooling coil. It will fully close the outside air intake damper to set the Control Room Air Conditioning System on a 100 percent recirculation mode when the air temperature is at or below its setpoint. When the air temperature entering the coil is at or below its low-low setpoint, the unit fan is stopped and the standby unit started.

Zone reheat coils are provided in various branches of the duct distribution system. These reheat coils are non-safety, seismic Category I and function only during normal operation. Room thermostats control operation of these electric heating coils to maintain desired room temperatures. These coils will not operate unless air flow is established through the coils.

Air (2000 cfm) is exhausted to the atmosphere from the control room through the toilet exhaust fans (E-34) and a conference room and kitchen exhaust fan (E-42). Starting the toilet exhaust fan (E-34) manually from the control room will open the discharge butterfly valves (3HV-B177A and 3HV-B178B) and close bypass dampers D-18 after which the fan will start. Starting the conference room and kitchen exhaust fan (E-42) manually from the control room will open the discharge butterfly valves (3HV-B177A and 3HV-B172B) and close bypass dampers D-19 after which the fan will start.

Local coolers remove heat generated in the control room HVAC equipment room. These safety-related coolers (AH-26) are redundant and each consists of a centrifugal fan, chilled water cooling coil and throw-away filters.

9.4.1.2.2 Smoke Purge Operation

In the event of a fire in the computer room underfloor, the supply and return dampers D-62 and D-63 in the ducts serving the computer room are closed to prevent the spread of fire to other spaces in the control room. Smoke will be exhausted from the raised floor plenum by fan E-42, acting as a purge unit, after damper D-64 is opened and dampers D-43, D-44 and
D-67 are closed.

The main control room can be purged of smoke or fumes by fan E-42 after damper D-43 is opened and dampers D-44, D-64 and D-67 are closed. Additional purging can be accomplished by fan E-34 by closing dampers D-46 and D-68 and opening damper D-45.

9.4.1.2.3 Emergency Operation

See Subsection 6.4.3.3 for a description of the emergency operation of the system.

9.4.1.3 <u>Safety Evaluation</u>

The Control Room Air Conditioning System is completely isolated from the Reactor Auxiliary Building Ventilation System described in Subsection 9.4.3, physically as well as functionally. The control room emergency filtration units are an engineered safety feature described in detail as part of the fission product removal system in Subsection 6.5.1.

In the event of a fire within an area of the control room, means are provided to purge the smoke. A description of the fire detection and protection available to the control room is given in Subsection 9.5.1.

→(DRN 06-898, R15)
In the event of smoke detection at the normal outside air intake the following arrangement maintains the habitability of the main control room and meets the intent of isolating it from the same conditions:
←(DRN 06-898, R15)

→(DRN 06-843, R15)
There is one normal outside air intake (louver) for the control room. It is located at elevation 62 feet 1 inch MSL at the northeast corner of the Reactor Auxiliary Building. This is in a position located high above an open area and there is no direct fire exposure to it. During the normal mode of operation, only 2200 cfm of outside air is drawn into the main control room HVAC system to mix with approximately 37,000 cfm of return air. If outside air becomes laden with smoke from an outside or a remote source, it would be diluted by the large volume of return air prior to entry into the control room. This small amount of smoke in the mixture would be readily discernible by personnel in the continually manned control room. They would also be alerted by an alarm from the main control room area
←(DRN 06-843, R15)

detectors. This mixture would be tolerable and not adversely affect the operation of the main control room. In the unlikely event that the mixture does become untenable, or if it is the intent of the control room operator to mitigate the situation, he can investigate the conditions and determine the necessity to manually stop the smoke entry by closing the isolation valves on the normal outside air intake. This can be done from the control room by manually simulating the alarm for the toxic chemical conditions.

The Control Room Air Conditioning System is protected from externally generated missiles by virtue of its location inside the Reactor Auxiliary Building. The outside air intakes are all located in HVAC shafts within the Reactor Auxiliary building. The louvers at the top of the shafts are all missile protected. Where required, fan casings are designed to contain internally generated missiles, such as a loose fan wheel blade being propelled by centrifugal force, in order to prevent one safety train from damaging the other.

Adequate drainage in the HVAC equipment room is provided to prevent the possibility of flooding should a chilled water pipe rupture.

9.4.1.4 Inspection and Testing Requirements

All fans of the Control Room Air Conditioning System are tested in accordance with standards of the Air Moving and Conditioning Association. Each component is inspected prior to installation.

Each system component is operated and tested initially with regard to flow paths, flow capacity and mechanical operability. Ductwork is tested for leakage during installation.

A system air balance test and adjustment to design conditions is conducted in the course of the plant preoperational test program. Instruments are calibrated during testing. Automatic controls are tested for actuation at the proper set points. Alarm functions are checked for operability during preoperational testing.

Components are accessible for periodic inspection. The emergency filtration units are inspected and tested in accordance with procedures described in Subsection 6.5.1.4.

9.4.2 FUEL HANDLING BUILDING VENTILATION SYSTEM

9.4.2.1 Design Basis

The Fuel Handling Building Ventilation System is designed to:

→(DRN 02-1753, R12-A)

a) provide a suitable environment for personnel, equipment and controls in the Fuel Handling Building (refer to Table 9.4-1).

←(DRN 02-1753, R12-A)

b) direct airflow from areas of low potential airborne contamination to areas of progressively higher potential airborne contamination,

→(DRN 02-1753, R12-A)

c) Deleted

←(DRN 02-1753, R12-A)

d) withstand a safe shutdown earthquake without loss of function by that portion of the Fuel Handling Building Ventilation System required to mitigate the consequences of a fuel handling accident, and

e) provide accessibility for adjustments and periodic inspections and testing of the system components to assure continuous functional reliability.

→(DRN 02-1753, R12-A)

Protection of the Fuel Handling Building Ventilation System from wind and tornadoes is discussed in Section 3.3. Flood design is discussed in Section 3.4. Missile protection is discussed in Section 3.5. Protection against dynamic effects associated with postulated pipe rupture is discussed in Section 3.6. Environmental design criteria and qualification of components are discussed in Section 3.11.

←(DRN 02-1753, R12-A)

→(DRN 02-1753, R12-A)

←(DRN 02-1753, R12-A)

9.4.2.2 System Description

The Fuel Handling Building Ventilation System flow diagram is shown on Figure 9.4-2. The principal system component design data are presented in Table 9.4-4.

9.4.2.2.1 Normal Operation

During normal operation, air is distributed throughout the Fuel Handling Building by non-safety air handling unit AH-14 and exhausted from the building by the non-safety normal exhaust fans E-20.

The control room operator will start air handling unit AH-14, and then start one of the two redundant 100 percent capacity exhaust fans E-20. The exhaust fans are interlocked with the air handling unit, so that they cannot function unless the air handling unit is operating. Gravity damper GD-22 prevents air recirculation through the respective non-operating fan.

Air handling unit AH-14 includes a bank of medium efficiency filters, electric heating coil (EHC-41) and centrifugal fan. The electric heating coil will not operate unless airflow is established in the discharge duct of the air handling unit. A low limit freeze protection thermocouple, located downstream of the electric heating coil, will stop the air handling unit fan when the air temperature falls below its setpoint. The output of the electric heating coil will be controlled by means of controls sensing temperature downstream of the supply fan.

The ductwork is designed to assure that airflow is directed from areas of low potential radioactivity to areas of progressively higher potential radioactivity.

9.4.2.2.2 Emergency Operation

→(DRN 00-691, R11-A; 02-1753, R12-A)

The fuel handling building ventilation system is not required to mitigate the consequences of a fuel handling accident. However, the system is maintained to function as described in Section 9.4.2.1, Design Basis.

←(DRN 02-1753, R12-A)

Upon the occurrence of a fuel handling accident, Class 1E radiation monitors, described in Subsection 12.3.4, will produce a fuel handling accident signal. In order to isolate the envelope of the Fuel Handling Building, where such an accident can take place, safety-related isolation dampers, D-37 and D-38 are provided. The accident signal will stop air handling unit AH-14, stop normal exhaust fans E-20, close isolation dampers D-37 and D-38, and start the safety-related emergency filtration exhaust units. Additionally, it will allow the safety-related emergency H&V room exhaust fan E-21 to start and the corresponding air intake Louver LD-40 to open subject-to space temperature as measured by the space temperature elements.. The accident signal will also position dampers D-27, D-28(A), D-28(B), D-31, D-35(A), D-35(B), D-36(A) and D-36(B) to their fail positions. Louver-dampers LD-40 are interlocked with respective H&V room exhaust fans E-21. Two permissives, namely the fuel handling accident signal and the room temperature, are provided for these fans.

←(DRN 00-691, R11-A)

The safety-related emergency filtration exhaust units E-35 are redundant, and each is sized at 100 percent exhaust air capacity. Each unit includes an electric heating coil, a bank of medium efficiency filters, a bank of HEPA prefilters, a charcoal adsorber, a bank of HEPA after-filters, and a centrifugal exhaust fan. Both exhaust fans will start, and their associated intake dampers D-29 will open upon receipt of the fuel handling accident signal. The electric heating coil is provided to assure that the air entering the adsorber has a relative humidity not exceeding 70 percent in order to assure maximum adsorption efficiency of the charcoal. When the emergency filtration units are started, their respective makeup air dampers D-72 operate in response to differential pressure controls, whose function is to maintain the spent fuel handling area at a negative pressure relative to the outdoors.

Upon completion of the above sequence of events, the control room operator has the option to manually stop one of the two operating emergency filtration units, causing its intake damper to close and its electric heating coil to be de-energized.

The control room operator then has the option of manually restarting the Fuel Handling Building normal ventilation system, the air handling unit AH-14 and the exhaust fan E-20, to cool, ventilate, and if necessary, maintain a positive pressure in the uncontaminated areas with respect to the contaminated areas of the Fuel Handling Building. If the operator chooses this option, a bypass damper D-36 automatically re-routes 15000 cfm from AH-14 which normally is intended for the potentially contaminated areas. Safety-related area radiation monitors are provided to alarm the operator of high radiation in any safety-related area of the Fuel Handling Building.

A low-flow air bleed bypass is provided across the two emergency filtration units E-35, connecting the two units at the suction side of their respective exhaust fans. This will assure uninterrupted flow of cooling air through the adsorber of the standby filtration unit.

The control room operator is provided with the following safety-related alarms for the Fuel Handling Building Ventilation System:

a) differential pressure (high and low) across each emergency filtration unit,

b) temperature difference (low) across electric heating coil,

c) high H&V room temperature, and

d) low Fuel Handling Building to ambient differential pressure.

The following safety-related indication is provided in the main control room:

a) status of emergency H&V room exhaust fans,

b) position of emergency filtration exhaust units inlet dampers D-29,

c) status of emergency filtration exhaust unit fans E-35,

d) position of isolation dampers D-37 and D-38, and

e) differential pressure across emergency filtration units.

f) position of dampers D-35 and D-36

9.4.2.3 Safety Evaluation

The portion of the Fuel Handling Building Ventilation System that is normally in operation meets the requirements of the Uniform Building Code and is on the manual load block of the diesel generators. The post-accident air cleaning portion of the Fuel Handling Building Ventilation System is designed to Safety Class 3 and seismic Category I requirements. All isolation dampers and exhaust air ductwork transporting contaminated air subsequent to an accident is designed and supported to satisfy seismic Category I requirements.

→(DRN 02-1753, R12-A)

The emergency filtration exhaust units maintain a negative pressure in the contaminated envelope of the Fuel Handling Building. The normal ventilation system, if operating, will maintain a positive pressure in uncontaminated areas to ensure air transfer only to the potentially contaminated areas. This has an effect of inducing leakage into the contaminated area and prohibiting any outleakage of air. The exhaust air is drawn through the filtration units before it is released to the outside environment.

←(DRN 02-1753, R12-A)

All safety related components of the Fuel Handling Building Ventilation System are designed to satisfy the single failure criterion. Redundant trains are powered from separate safety buses A and B so that in the event of a single active failure in one train, the other safety bus provides power to its associated train which operates and provides the safety function. A failure modes and effects analysis is provided in Table 9.4-5.

In the event of a failure of the electric heating coil in one emergency filter train, the affected filter train will be automatically shutdown. The redundant filter train will continue to operate. The automatic stoppage of the affected filter train prevents de-adsorption from the charcoal filter caused by excessive entering air humidity.

The analysis of a fuel handling accident is discussed in Chapter 15.

9.4.2.4 Inspection and Testing Requirements

→(DRN 02-1753, R12-A)

Each component is inspected prior to installation. Components are accessible for periodic inspection during normal plant operation. A system air balance test and adjustment to design conditions is conducted in the course of the plant preoperational test program. Instruments are calibrated during testing. Automatic controls are tested for actuation at the proper set points and alarm functions are checked for operability and limits during preoperational testing.

←(DRN 02-1753, R12-A)

9.4.3 REACTOR AUXILIARY BUILDING VENTILATION SYSTEM

9.4.3.1 Reactor Auxiliary Building (RAB) Normal Ventilation System

9.4.3.1.1 Design Bases

The RAB Normal Ventilation System is designed to meet the following requirements:

a) maintain a suitable operating environment for all equipment and personnel during normal operation (refer to Table 9.4-1),

b) maintain air flow from areas of low potential radioactivity to areas of progressively higher potential radioactivity,

c) limit concentrations of airborne radioactivity by circulating sufficient volumes of purging air,

d) minimize airborne fission product releases from the building exhaust during normal operation,

e) monitor ventilation system discharge to detect and prevent excessive release of airborne radioactivity,

→(DRN 00-691, R11-A)

f) provide means for filtering containment purge air,

g) permit periodic inspection and testing of system components, and

←(DRN 00-691, R11-A)

h) automatic shutdown upon a toxic chemical event.

The RAB Normal Ventilation System is not required to operate following a design basis accident and therefore is not designed to safety or seismic requirements.

9.4.3.1.2 System Description

→(DRN 02-220, R11-A)

The RAB Normal Ventilation System air flow diagram is shown in Figure 9.4-3 (for Figure 9.4-3, Sheet 5, refer to Drawing G853, Sheet 19) and principal component data are presented in Table 9.4-6. The ventilation supply system includes an outside air louver, medium efficiency bag type filter, electric heating coil, two 100 percent capacity centrifugal fans (S-6), gravity discharge dampers and chilled water cooling coil located in the common discharge duct of fans S-6. Supply air is discharged through a sheet metal duct distribution system throughout the Reactor Auxiliary Building. The flow of air throughout the building is from areas of low potential radioactivity to areas of progressively higher potential radioactivity.

←(DRN 02-220, R11-A)

→(DRN 02-220)
←(DRN 02-220)

Air is exhausted from the Reactor Auxiliary Building spaces through a ventilation exhaust system. The ventilation exhaust system includes a medium efficiency prefilter, HEPA filter, charcoal adsorber, fan inlet vane dampers, two 100 percent capacity centrifugal fans (E-22) and discharge dampers to prevent air recirculation through the standby fan. The ventilation exhaust system discharges to the plant stack. The exhaust fan inlet vane dampers automatically adjust air flow from the minimum flow rate during the Reactor Auxiliary Building "ventilation only" mode to the maximum flow rate for the Reactor Auxiliary Building ventilation and the Reactor Building "purge combined" mode. The maximum flow occurs only during containment purge (refer to Subsection 9.4.5 for a detailed description of containment purge exhaust system).

Air flow monitors in the discharge duct of exhaust fans maintain the design air flow rate through the nonsafety related filtration unit. Low air flow and failure of the supply fan are alarmed in the main control room. The operating supply fan is automatically stopped if the exhaust fan fails, but the operating exhaust fan continues to operate if the supply fan fails. Individual filter pressure drops are alarmed in the main control room through the plant monitoring computer.

The chemical monitors, as described in Subsection 6.4.4.2, are interlocked with the Normal RAB ventilation (E22) exhaust fans, to shut down the RAB Normal Ventilation System upon this type of event. The trip logic is a 1 out of 2 scheme, which allows either monitor to trip the operating fan. This interlock automatically trips the operating (E22) exhaust fan. When the exhaust fan is tripped, the supply air (S6) fan trips, and the intake/exhaust dampers close. The Operator has the option of re-starting the fans, after a trip, using the “over-ride” feature of the circuit design. If the Operator selects this “over-ride” feature, with the trip present, this condition will be alarmed in the Control Room to the Operator.

Regulatory Guide 1.140 was not a design criterion for Waterford 3. Table 9.4-21 is a comparison of the Waterford 3 Normal Ventilation Exhaust System Air Filtration and Adsorption Unit with regulatory positions of Regulatory Guide 1.140 (March 1978).

The criteria established for the changeout of prefilters, HEPA filters and charcoal in the charcoal adsorber section of the RAB Normal Ventilation Exhaust System air cleaning unit is based on "Normal Operation" of the plant. It is described individually for each filter bank and the charcoal adsorber as follows:

a) Prefilters

Prefilter initial pressure drop (clean) is 0.65 inches W.G. or less. The prefilters will be changed before the pressure drop reaches 2.0 inches W.G.

b) HEPA Filters

HEPA filter initial pressure drop (clean) will be 1.0 inches W.G. The HEPA filters will be changed before the pressure drop reaches 4.0 inches W.G. The system will be retested for leak integrity when new HEPA filters are installed or the old filters are disturbed.

c) Charcoal Adsorber

→(DRN 00-691)

The changeout of activated carbon in the adsorber will be determined from periodic laboratory testing of samples which are removed from a test canister located on the air cleaning unit. This test canister is one of a set of six standard test canisters.

←(DRN 00-691)

At prescribed intervals, a test canister will be removed and placed in a polyethylene bag in the same orientation as it was on the High Efficiency Charcoal Adsorber (HECA). A blank will be installed in its place.

Carbon adsorber differential pressure should remain constant over cell life at approximately 1.8 inches W.G. Replace carbon depending on results of checking test canisters.

The system will be retested for leak integrity when new carbon is installed.

9.4.3.1.3 Safety Evaluation

The RAB Normal Ventilation System is not safety related and consequently is not designed to seismic Category I requirements since its operation is not required to mitigate the consequences of an accident or to shutdown the reactor and maintain it in a safe shutdown condition. A failure of any component of the RAB Normal Ventilation System following a design basis accident will not have any adverse effect on safety related components or systems.

Subsequent to a design basis accident, the safety injection actuation signal will shutdown the RAB Normal Ventilation System supply and exhaust fan, isolate the normal ventilation paths to the controlled areas (eg, shutdown heat exchangers or safeguard pump rooms), and activate the safety related Controlled Ventilation Area System which will operate to exhaust air from these areas (refer to Subsection 6.5.1).

→(DRN 02-1623, R12-B)
Rupture in the chilled water piping will not cause any jet impingement or flooding of other pieces of equipment since the lines have low stress levels, which are below the criteria for postulated moderate energy cracks.
←(DRN 02-1623, R12-B)

Fire detection and protection for the charcoal adsorbers is discussed in Subsection 9.5.1.

Duct penetrations to equipment cells are carefully designed for radiation shine geometry to prevent impingement of direct radiation on personnel.

Radiation monitors are provided in the RAB Normal Ventilation System to monitor airborne radioactivity contamination in the general areas of the RAB. Subsection 12.3.4 provides a discussion of the radiation monitoring provided.

9.4.3.1.4 Inspection and Testing Requirements

Each component is inspected prior to installation. Components are accessible for periodic inspection. A system air balance test and adjustment to design conditions is conducted in the course of the plant preoperational test program. Instruments are calibrated, automatic controls are tested for actuation at the proper setpoints, and alarm functions are checked for operability and limits during preoperational testing.

Each system is operated and tested initially with regard to flow paths, flow capacity, and mechanical operability. Ductwork is tested for leakage during installation.

The ventilation exhaust unit is tested in place for casing leaks, air-aerosol mixing uniformity for HEPA filter, leakage of HEPA filter banks, and a performance leakage test of the charcoal adsorber. Periodic testing for filters and adsorber will be performed after initial operation.

9.4.3.2 Personnel and Decontamination Areas Ventilation System

9.4.3.2.1 Design Bases

The Personnel and Decontamination Areas Ventilation System is designed to meet the following requirements:

a) maintain a suitable operating environment to assure comfort of personnel as well as provide a suitable environment for equipment and controls (refer to Table 9.4-1), and

b) permit accessibility for adjustments, tests and inspections to assure continued functional reliability.

The Personnel and Decontamination Areas Ventilation System is not required to operate following a design basis accident and therefore is not designed to safety or seismic requirements.

9.4.3.2.2 System Description

→
The Personnel and Decontamination Areas Ventilation System air flow diagram is shown in Figure 9.4-3 (for Figure 9.4-3, Sheet 5, refer to Drawing G853, Sheet 19) and principal system component design data are given in Table 9.4-7.
←

The supply air system consists of two air handling units, AH-6 and AH-8, both handling 100 percent outside air. Each unit includes an inlet pneumatic damper, medium efficiency filter, electric heating coil, chilled water cooling coil and centrifugal fan. Air handler AH-6 supplies air to the health physics work area, instrument repair shop, counting room, office, sample laboratory, and radio-chemistry laboratory. Air handler AH-8 supplies air to the men's locker room, general storage area, health physics room, corridor and foyer, decontamination and control access area, women's restroom, first aid room and laundry room. All these areas are on elevation -4 ft. MSL. Air is exhausted through the RAB Normal Ventilation System, described in Subsection 9.4.3.1.

Electric reheat coils, controlled by room thermostats, are located in the supply branches for final control of space temperatures.

9.4.3.2.3 Safety Evaluation

The Personnel and Decontamination Areas Ventilation System is not safety related and is not designed to seismic Category I requirements since it's operation is not required to mitigate the consequences of an accident or shutdown the reactor and maintain it in a safe shutdown condition. A failure of any component of the Personnel and Decontamination Areas Ventilation System following s design basis accident will not have any effect on safety related components or systems.

9.4.3.2.4 Inspection and Testing Requirements

Each component is inspected prior to installation. Components are accessible for periodic inspection.

Air system air balance test and adjustment to design conditions are conducted in the course of the plant preoperational test programs. Instruments are calibrated, automatic controls are tested for actuation at the proper setpoints, and alarm functions are checked for operability and limits during preoperational testing.

Each system is operated and tested initially with regard to flow paths, flow capacity, and mechanical operability. Ductwork is tested for leakage during installation.

9.4.3.3 Emergency Diesel Generator Ventilation System

9.4.3.3.1 Design Basis

The Emergency Diesel Generator Ventilation System is designed to meet the following requirements:

a) maintain the temperature in the diesel generator rooms at a maximum of 120° F whenever the diesel generators are in operation,

b) provide redundant trains A and B powered by separate safety buses such that failure of a single active component cannot result in a complete loss of any engineered safety feature system function,

c) remain functional during and after a safe shutdown earthquake, and

d) permit periodic testing and inspection of principal components.

The Emergency Diesel Generator Ventilation System is designed to safety class 3 and seismic Category I requirements.

9.4.3.3.2 System Description

→

The Emergency Diesel Generator Ventilation System is shown in Figure 9.4-3 (for Figure 9.4-3, Sheet 5, refer to Drawing G853, Sheet 19). Principal component design data are presented in Table 9.4-8. Each diesel generator room is provided with an axial flow exhaust fan E-28 (3A-SA) and E-28 (3B-SB) serving Generator Room A and B respectively. Each fan flow is controlled by automatically adjusting the fan blade pitch in response to its respective room temperature sensor. Each fan is provided with a start-auto-stop switch. With the switch in the automatic position, start-up of the diesel generator automatically initiates start-up of the respective fan and opens its respective outside air intake dampers, LD-2(SA) and D-7(SB).

←

During normal operation, when the diesel generators are not operating, the diesel generator rooms are maintained within the environmental conditions stated in Table 9.4-1 by ventilation supplied from the RAB Normal Ventilation System (refer to Subsection 9.4.3.1).

The control room operator is provided with safety related indication on the operation of each exhaust fan as well as a safety related indicator for diesel generator room temperature with a high-low safety alarm.

→(LBDCR 14-011, R308)

There is also non-safety related indication in the control room of each exhaust fan's operation that is provided on the Plant Monitoring Computer (PMC). The PMC provides the status of each exhaust fan's flow against a low differential pressure setpoint that can be used to assist in evaluating fan operation. There is also a differential pressure indicator that can be read locally.

←(LBDCR 14-011, R308)

9.4.3.3.3 Safety Evaluation

The Emergency Diesel Generator Ventilation System is designed to safety class 3 and seismic Category I requirements. In the event of loss of offsite power, each system is powered from its respective emergency diesel generator.

A single active failure in the ventilation system can affect only one of the two diesel generators. Therefore one diesel generator is available to mitigate the consequences of a design basis accident and to provide safe plant shutdown.

The use of storm type louvers limits entry of rain to the building. Missile barriers are provided at all outdoor air intakes and exhausts to absorb the possible impact of missiles generated by tornados. The damper linkages and operators are located inside the Reactor Auxiliary Building.

9.4.3.3.4 Inspection and Testing Requirements

Each component is inspected prior to installation. Components are accessible for periodic inspection.

A system air balance test and adjustment to design conditions are conducted in the course of the plant preoperational test program. Automatic controls are tested for actuation at proper set points. Alarm functions are checked for operability and limits during preoperational testing.

Each train is operated and tested initially with regard to flow paths, flow capacity and mechanical operability. During installation, ductwork is tested for leakage.

9.4.3.4 RAB H & V Equipment Room Ventilation System

9.4.3.4.1 Design Basis

The RAB H & V Equipment Room Ventilation System is designed to satisfy the following requirements:

a) maintain suitable temperatures for all equipment in the RAB H & V equipment room at elevation +46 ft. MSL during normal (refer to Table 9.4-1) or accident conditions,

b) remain functional during and after a safe shutdown earthquake,

c) provide redundant trains A and B, powered by separate safety buses, such that a single active component failure cannot result in a complete loss of any engineered safety feature system function, and

d) permit periodic testing and inspection of principal components.

The RAB H & V Equipment Room Ventilation System is designed to safety class 3 and seismic Category I requirements.

→(EC-17580, R306)

The security equipment air conditioning and hydrogen detection systems are classified as non-safety-related and do not perform any safety-related functions.

←(EC-17580, R306)

9.4.3.4.2 System Description

The RAB H & V Equipment Room Ventilation System air flow diagram is shown in Figure 9.4-3 (for Figure 9.4-3, Sheet 5, refer to Drawing G853, Sheet 19) and principal component design data represented in Table 9.4-9. The system is located on elevation +46 ft. MSL.

The supply system consists of two 100 percent capacity air handling units, AH-13. Each unit includes a throw away filter, electric heating coil and centrifugal fan. The supply air is discharged through a sheet metal duct distribution system.

Air is exhausted directly from the RAB H & V Equipment Room by two 100 percent capacity exhaust fans E-41. Each fan discharge duct contains a gravity damper to prevent air recirculation through the standby fan.

→(EC-17580, R306)

A dedicated split air conditioning system is provided for Security Uninterruptible Power Station, distribution equipment, and batteries to maintain the battery room ambient temperature within a specified operating range. A hydrogen detection system will alarm when the accumulation of hydrogen reaches 2% room volume during battery charging operation. The system is located in the H&V Fan Room on elevation +21 ft.

←(EC-17580, R306)

9.4.3.4.2.1 Normal Operation

A three-position (run-auto-stop) control switch for each supply fan, AH-13, is provided in the main control room. The operator will select which supply fan will be the lead unit and which is to be the lag unit (lead unit control switch in "run" position, lag unit control switch in "automatic" position). The lag supply fan will automatically start, in response to room temperature conditions. If the lead selection is not determined using the control switches, both supply fans will act as lag fans and start when the room air temperature reaches 100°F.

Two position automatic control of dampers is used to maintain room temperature. When the room air temperature rises to 90°F, the outside air intake dampers (LD-1) and (D-2) for both air handling units are fully open and the return dampers (D-1) are fully closed. When the temperature reaches 80°F, the return dampers (D-1) are fully open and the outside intake dampers (LD-1) and (D-2) are fully closed.

The room temperature is measured at eight locations, four each for train A and B, and the average is used to control- the RAB H & V Equipment Room Ventilation System. This instrumentation is designed to Class 1E requirements.

When the room air temperature rises to 90° F, the dampers are positioned as described above and the lead exhaust fan E-41 starts. When the room temperature reaches 100°F, the lag supply and exhaust fans are started. With both trains are running and the room air temperature drops to 90°F, the lag supply and exhaust fans are deenergized. As the room air temperature continues to drop to 80°F, the lead exhaust air fan is deenergized. At 80°F, the outside air intake dampers for both units are fully closed and the recirculation air dampers are fully opened. As the temperature drops to 50°F, the first stage of the electric heating coil is energized. If the temperature continues to fall to 45°F the second stage of the electric heating coil is energized. Both stages of the electric heating coils remain energized until the room air temperature reaches 55°F.

→(EC-17580, R306)
The security equipment air conditioning system operates to maintain a design temperature of 77 F. The hydrogen detection system alarms when the hydrogen concentration reaches 2% of the room volume.
←(EC-17580, R306)

9.4.3.4.2.2 Emergency Operation

During a design basis accident, a safety injection actuation signal will start both supply air fans. The control room operator can place one supply fan on standby by stopping one fan.

The exhaust air fans will start in the same manner as described in Subsection 9.4.3.4.2.1.

The electric heating coils are not powered from the emergency diesel generators. if offsite power is available, the control system will activate the electric heating coil if the room temperature indicates the need for heating.

The control room operator is provided with safety related high-low average room temperature alarms. Safety related status indication is provided for each supply and exhaust fan. Damper position indication is available to the control room operator via computer.

9.4.3.4.3 Safety Evaluation

The RAB H & V Equipment Room Ventilation System is designed to safety class 3 and seismic Category I requirements. A single active failure will not prevent the system from ventilating the H & V equipment room. Each redundant air handling unit and exhaust fan is powered from separate safety power sources.

The outside air intake louvers and the exhaust louvers are designed to prevent rain from entering and are protected to withstand the effects of tornado generated missiles. The fan casings are of sufficient thickness to provide protection from internally generated missiles penetrating the casing.

9.4.3.4.4 Inspection and Testing Requirements

Each component is inspected prior to installation. Components are accessible for periodic inspection.

A system air balance test and adjustment to design conditions are conducted in the course of the plant preoperational test program. Automatic controls are tested for actuation at proper set points, and annunciation functions are checked for operability and limits during preoperational testing.

Each train is operated and tested initially with regard to flow rates, flow capacity and mechanical operability. Ductwork is tested for leakage during installation.

9.4.3.5 RAB Cable Vault and Switchgear Areas Ventilation System

9.4.3.5.1 Design Basis

The RAB Cable Vault and Switchgear Areas Ventilation System is designed to satisfy the following requirements:

a) maintain suitable operating environment for all electrical equipment during normal (refer to Table 9.4-1) and accident conditions,

b) prevent the accumulation of a combustible concentration of hydrogen in the battery rooms during normal and accident conditions,

c) remain functional during and after a safe shutdown earthquake,

d) provide redundant trains A and B powered by separate safety buses such that a failure of a single active component cannot result in a complete loss of any engineered safety feature system functions,

e) provide smoke purge in the electrical areas, and

f) permit periodic testing and inspection of principal components.

Those components of the RAB Cable Vault and Switchgear Areas Ventilation System that are needed to mitigate the consequences of a design basis accident or to bring the plant to a safe shutdown condition are designed to safety class 3 and seismic Category I requirements. These components are listed in Table 3.2-1.

9.4.3.5.2 System Description

The RAB Cable Vault and Switchgear Areas Ventilation System air flow diagram is shown on Figure 9.4-4 and design data for principal components are shown in Table 9.4-10. The cooling part of the RAB Cable Vault and Switchgear Areas Ventilation System is made up of two separate air handling subsystems, one comprised of two 100 percent capacity air handling units AH-25 located in an H&V room on elevation +46 ft. MSL and the other comprised of two 100 percent capacity air handling units AH-30 located in the H&V room on elevation +7 ft. MSL. The remainder of the RAB Cable Vault and Switchgear Areas Ventilation System consists of two 100 percent capacity safety-related battery room exhaust fans E-29, E-30, E-31 and E-46 for each battery room, two non-safety-related exhaust fans for smoke purging, E-48 and E-50, one exhaust fan E-49 used during normal operation and smoke purging and two 100 percent capacity safety-related H&V room (elevation +69 ft. MSL) ventilation fans E-52.

Each air handling unit AH-25 and AH-30 consists of a medium efficiency filter. chilled water cooling coil and centrifugal fan. Additionally, the AH-25 units each have an electric heating coil.

9.4.3.5.2.1 Normal Operation

During normal operation, the control room operator sets the mode selection switch to its normal mode position which positions the dampers and starts one supply unit AH-25. The associated recirculation dampers D-48 and D-49 are fully open the outside air intake dampers D-65 are positioned partially open admitting outside air and the inlet damper D-8 is fully open. The control room operator then starts exhaust fan E-49. The operator will start one recirculation air handling unit AH-30. Electric heating coils will not operate unless air flow is established in the discharge duct of the supply unit AH-25.

To eliminate the possibility of hydrogen accumulation, one battery room exhaust fan will be manually started for each battery room.

For each AH-25 unit, two safety-related thermocouples are provided in the switchgear area and one safety-related thermocouple is provided in each of Relay Rooms 'A' and 'B'. The highest temperature of the four thermocouples will position the electric motor operated chilled water control valve at the cooling coil. The lowest temperature of the four thermocouples will control the operation of the electric heating coil. Four safety-related thermocouples are provided in the switchgear area for each AH-30 unit. The highest temperature will position the electric motor operated chilled water control valve for the cooling coil.
→
A thermostat, sensing the lowest temperature across the upstream face of the AH-25 cooling coil will trip the unit fan to prevent the coil from freezing.
←
The exhaust fans (E-52) are automatically controlled by the temperature in the H&V room at elevation +69 ft. MSL. Fan E-52 (train A) will start automatically if the room temperature is at or above 90° F and one of the train A battery room exhaust fans is running, and will stop when the temperature falls to 70° F. Fan E-52 (train B) will operate similarly if one of the train B battery room exhaust fans is running.

Starting exhaust fan E-49 will automatically position dampers D-60 and D-61B to exhaust air from the electrical penetration area and relay room provided that local panel damper switches are in their "auto" position. Non-safety electric reheat coils provided in various locations are controlled from individual room thermostats.

9.4.3.5.2.2 Smoke Exhaust Operation

In order to purge smoke from any of these electrical areas, the outside air intake dampers D-65 will be opened fully and recirculation dampers D-48 and D-49 will be closed fully. Air handling unit AH-25 will draw 100 percent outside air and discharge it into each area. E-48 will be started to remove smoke from switchgear AB area (elevation +21 ft. MSL). Smoke will be purged by E-49 from either the electrical penetration area, the cable vault or the relay room by opening dampers D-60, D-61A or D-61B, respectively.

Smoke will be purged by E-50 from the penetration area by opening dampers D-58 and D-59. The Smoke Purge Operation overrides the normal freeze protection by opening the outside air intake dampers D-65 and chilled water temperature control valve 3AC-TM 188A or 3AC-TM 189B irrespective of the outside air temperature.

9.4.3.5.2.3 Emergency Operation

After a design basis accident, a safety injection actuation signal will position the outside air intake dampers D-65 to their normal partially opened position, if not already in that position. This will admit outside air to the air handling units AH-25. The signal will start both air handling units AH-25, which will open both dampers D-8. If one air handling unit AH-25 is placed on standby, it will start automatically in response to switchgear area high temperature. A controller, sensing highest room temperature, will position the motor operated chilled water control valve.

A safety injection actuation signal will start both AH-30 units. The operator can place one on standby which will be automatically started in response to switchgear area high temperature. A controller, sensing highest room temperature, will position the motor operated chilled water control valve.

A safety injection actuation signal starts all battery room exhaust fans. The control room operator can place one fan for each room on standby. If the battery room exhaust fans are operating and the H&V room temperature is 90 F or higher, the exhaust fans E-52 will start.

Exhaust fan E-49 is not required post-accident. An SIAS will trip the fan E-49 and the dampers D-60 and D-61B will close provided that their respective damper control switches are in the "auto" position. Damper D-61A has manual controls only.

The control room operator is provided with the following safety-related alarms:

a) high switchgear area temperature, and

→(DRN 03-1988, R15)

b) high-low battery fan room temperature.

←(DRN 03-1988, R15)

The following safety related indication is provided in the main control room:

a) position of outside air intake damper D-65

b) status of battery room exhaust fans (E-29, E-30, E-31, E-46),

c) status of air handling units AH-30,

d) status of air handling units AH-25, and

e) status of exhaust fan E-52.

9.4-3-5.3 Safety Evaluation

The RAB Cable Vault and Switchgear Areas Ventilation System is required to operate during normal, smoke and accident conditions. The components of the RAB Cable Vault and Switchgear Areas Ventilation System that are required during and following an accident condition are designed to safety class 3 and seismic Category I requirement. Each safety related redundant train is powered from separate safety power sources. Therefore a single active failure will not prevent this system from mitigating the consequences of a design basis accident or prevent the plant from safely shutting down. A failure mode and effects analysis is provided in Table 9.4-11.

Following a design basis accident, the air handling units are on a recirculation mode. Dampers D-58, D-59, D-60 and D-61B are all designed to close and exhaust fans E-48, E-49, and E-50 are not required to operate post accident. The electric reheat coils are not required during or after an accident and are not safety related but are seismically qualified.

Battery room ventilation is required during normal and accident conditions to avoid the buildup of hydrogen. Each battery room is provided with redundant safety related exhaust fans.

All intake and exhaust louvers are designed to prevent rain from entering and are protected to withstand the effects of tornado generated missiles. The fan casings are of sufficient thickness to prevent internally generated missiles from penetrating the casing.

9.4.3.5.4 Inspection and Testing Requirements

Each component is inspected prior to installation. Components of each system are accessible for periodic inspection.

A system air balance test and adjustment to design conditions are conducted in the course of the plant preoperational test program. Instruments are calibrated, automatic controls are tested for actuation at the proper set points and alarms functions are checked for operability and limits during preoperational testing.

Each system is operated and tested initially with regard to flow paths, flow capacity, and mechanical operability. Ductwork is tested for leakage during installation.

9.4.3.6 <u>RAB Hot Machine Shop and Decontamination Area Ventilation System</u>

9.4.3.6.1 Design Bases

The RAB Hot Machine Shop and Decontamination Area Ventilation System is designed to:

a) maintain a suitable operating environment for personnel in the hot machine shop and decontamination area (refer to Table 9.4-1),

b) maintain airflow from areas of low potential radioactivity to areas of progressively higher potential radioactivity, where applicable,

c) limit concentrations of airborne radioactivity by exhausting the decontamination room over the ultrasonic cleaning tanks (to capture rising vapor and droplets which could carry radioactive particulates) and by exchanging the hot machine shop through hoods located at the point of machine tool operation (to capture dust, generated by the machining processes, which could carry or be radioactively contaminated),

d) minimize normal airborne fission product releases by high efficiency particulate filtration of area exhausts, and

e) permit periodic inspection and testing of system components.

The RAB Hot Machine Shop and Decontamination Area Ventilation System is not required to mitigate the consequences of a design basis accident or provide safe shutdown for the reactor. Therefore the system is nonsafety and nonseismic.

9.4.3.6.2 System Description

The RAB Hot Machine Shop and Decontamination Area Ventilation System airflow diagram is shown in Figure 9.4-5 and principal component design data are presented in Table 9.4-12. The system is a single pass type and consists of a ventilation supply system and a filtered exhaust system. The ventilation supply system includes two supply air handling units, one supplying the hot machine shop (AH-33) and the other the decontamination room (AH-32).

The hot machine shop air handling unit, AH-33, has a medium efficiency filter, electric heating coil, chilled water cooling coil and centrifugal fan. The air handling unit supplying the decontamination room, AH-32, has a medium efficiency filter, electric heating coil, chilled water cooling coil and centrifugal fan. Pneumatic operated dampers D-52 and D-53 at the intake of the air handling units isolate the units during filter replacement.

The exhaust air handling units AH-34 and AH-35 exhaust air from the decontamination room and hot machine shop, respectively. Each contains a medium efficiency filter, HEPA filter and centrifugal fan which discharges through a pneumatically operated damper and louver. Bird screens are provided on all louvers. Exhaust from the spray wash booth in the decontamination room passes through a demister before entering the exhaust system ductwork.

9.4.3.6.3 Safety Evaluation

The RAB Hot Machine Shop and Decontamination Area Ventilation System is not safety-related and is not designed to seismic Category I requirements since its operation is not required to prevent or mitigate the consequences of a design basis accident or provide the capability to shutdown the reactor.

All intake and discharge louvers are designed to prevent rain from entering the room and are missile protected.

9.4.3.6.4 Inspection and Testing Requirements

Preoperational tests are performed on the system to ensure that it is capable of meeting its performance and design basis requirements. All automatic and manual sequences are tested to ensure proper operation. Components are accessible for periodic inspection.

9.4.3.7 RAB Air Conditioning System

9.4.3.7.1 Design Bases

The RAB Air Conditioning System is designed to:

→ (DRN 99-2476)

a) maintain a suitable operating environment for all equipment and personnel in the electrical area, Administrative Area and I&C room on elevation +7 ft. MSL during normal operation (refer to Table 9.4-1), and

← (DRN 99-2476)

b) permit periodic inspection and testing of system components.

The RAB Air Conditioning System is not required to prevent or mitigate the consequences of a design basis accident or to provide a safe shutdown of the reactor. Therefore, the system is non-safety and nonseismic.

9.4.3.7.2 System Description

The RAB Air Conditioning System airflow diagram is shown on Figure 9.4-3 (for Figure 9.4-3, Sheet 5, refer to Drawing G853, Sheet 19) and principal component design data are given in Table 9.4-13.

Air handling unit AH-5 provides a supply of air to the electrical area and I&C room on elevation +7 ft. MSL in the Reactor Auxiliary Building. The air handling unit includes a medium efficiency filter, electric heating coil, chilled water cooling coil and centrifugal fan. The temperature inside the I&C room is maintained by a thermostat which controls electric reheat coil EHC-62.

When the air handling unit AH-5 is inoperable, the operator will start the non-safety local fan cooler AH-36 which will maintain space temperature inside the security room of the I&C area. The local fan cooler AH-36 can be connected to the diesel generators in the event of a loss of offsite power which causes AH-5 to be inoperable.

An exhaust fan E-47 exhausts excess air from the same spaces fed by AH-5.

9.4.3.7.3 Safety Evaluation

The RAB Air Conditioning System is not safety related since it is not required to prevent or mitigate the consequences of a design basis accident or to provide a safe shutdown of the reactor.

The outside air intake and exhaust louvers are designed to prevent rain from entering and are protected to withstand the effects of tornado generated missiles. The fan casings are of sufficient thickness to prevent internally generated missiles from penetrating the casing.

9.4.3.7.4 Inspection and Testing Requirements

Preoperational tests are performed on the system to ensure that it is capable of meeting its performance and design basis requirements. Automatic and manual sequences are tested to ensure proper operation. Components are accessible for periodic inspection.

9.4.3.8 Fan Coolers

9.4.3.8.1 Design Bases

Individual fan coolers are located in various rooms of the Reactor Auxiliary Building. Table 9.2-16 specifies the location for safety and non-safety-related fan coolers. The safety-related fan coolers are designed to:

a) maintain a suitable operating environment for equipment during accident conditions (refer to Table 9.4-1),

b) remain functional during and after a safe shutdown earthquake,

c) provide redundant trains A and B powered by separate safety buses such that a single active component failure cannot result in a complete loss of any engineered safety feature system function, and

d) permit periodic testing and inspection of principal components.

The non-safety fan coolers are designed to:

a) maintain a suitable operating environment during normal operation (refer to Table 9.4-1), and

b) permit periodic testing and inspection of principal components.

Table 3.2-1 specifies the safety class and seismic Category of the fan coolers. Protection against the effects of missiles and pipe rupture is discussed in Sections 3.5 and 3.6, respectively. Environmental design criteria and qualification of components are discussed in Section 3.11.

9.4.3.8.2 System Description

→
The fan cooler locations are shown on Figures 9.4-1, 3 and 5 (for Figure 9.4-3, Sheet 5, refer to Drawing G853, Sheet 19). Component design data is presented in Table 9.4-14.
←

The fan coolers are air handling units, each unit consisting of a fan section, cooling coil and filter. The safety-related cooling coils are supplied with water from the Essential Services Chilled Water System (refer to Subsection 9.2.9). The safety-related fan coolers circulate room air across the cooling coil and discharge the cooled air directly to the space being served. The safety-related fan coolers serving pump rooms are automatically started when the pumps start.

Each A/B pump room contains two 100 percent capacity fan coolers. If the A/B pump is energized from safety bus A, the A fan cooler will operate or if the A/B pump is energized from safety bus B, the B fan cooler will operate, except for the high pressure safety injection pump A/B. In this case, the high pressure safety injection pump A/B is interlocked with fan coolers AH-2 (3A-SA) and AH-2 (3C-SA) when energized from the safety A bus and AH-21 (3-SB) when energized from safety B bus. The fan coolers in the heat exchanger rooms are started by room temperature. High room temperature is annunciated (Class 1E) in the main control room.

➔
The non-safety fan coolers provide cooling during normal operation only. Chilled water is supplied by the supplemental chilled water system.
🡐

9.4.3.8.3 Safety Evaluation

The safety-related fan coolers are required to operate during an accident condition in order to maintain an acceptable operating environment for the engineered safety features equipment located in each area. These fan coolers are designed to seismic Category I requirements.

Where equipment on one safety channel occupies a single room, the fan cooler serving that room is powered from the safety bus with the same designation Rooms containing equipment on both safety channels are served by fan coolers on the A safety bus and other fan coolers on the B safety bus. In both cases, where pumps are involved, the fan cooler is interlocked to start and run when the pump starts and runs. Thus, the loss of a fan cooler or coolers, on one safety channel, will only affect other safety-related equipment on the same channel.

➔
Fan coolers serving non-safety equipment are not required to mitigate the consequences of an accident or to provide safe shutdown to the reactor. Therefore, these fan coolers are not safety-related or seismically qualified.
🡐

9.4.3.8.4 Inspection and Testing Requirements

Each fan cooler is tested and inspected prior to installation. Components of each fan cooler are accessible for periodic inspection.

Preoperational tests are performed on the fan cooler to ensure they are capable of meeting their performance and design basis requirements. Automatic and manual sequences are tested to ensure proper operation.

9.4.3.9 <u>Controlled Ventilation Area System</u>

The Controlled Ventilation Area System is described in Subsection 6.5.1.

9.4.4 TURBINE BUILDING VENTILATION SYSTEM

9.4.4.1 Design Bases

The Turbine Building Ventilation System is designed to:

a) provide a suitable operating environment for all equipment and personnel during normal operation (refer to Table 9.4-1), and

b) permit periodic inspection and testing of system components.

The Turbine Building Ventilation System is not required to operate following a design basis accident and therefore is not designed to safety or seismic requirements.

9.4.4.2 System Description

→
The Turbine Building Ventilation System air flow diagram is shown on Drawing G853, Sheet 14. The principal component design data are presented in Table 9.4-15.
←

The ventilation system, except for the switchgear room described below, is a single pass type and consists of ventilation air intake louvers and dampers, supply fans, exhaust fans, and exhaust louvers and dampers distributed about the periphery of the building on both the ground floor and the mezzanine floor.

The Turbine Building switchgear room is separately ventilated by two 50 percent capacity air handling units, AH-15 and AH-29 which cool the space with outside air. Each air handling unit contains a medium efficiency filter and centrifugal fan. Outside air intake for the switchgear area is automatically varied from zero air flow to the maximum system air flow by temperature control of system dampers. As the outside air intake is increased, the return air is decreased proportionately. All filters are provided with local indication of pressure drop.

Electric unit heaters are provided on the ground floor and the mezzanine floor, distributed to cover all areas, so that a minimum temperature of 50°F can be maintained.

Fans are manually controlled by local switches mounted on a central HVAC control panel in the Turbine Building.

9.4.4.3 Safety Evaluation

The Turbine Building Ventilation System is not required to mitigate the consequences of a design basis accident or to provide a safe shutdown of the reactor. Therefore it is not designed to safety or seismic requirements. The failure of any system component will not affect any safety related system, structure or component.

9.4.4.4 Testing and Inspection Requirements

Each component is inspected prior to installation. Components are accessible for periodic inspection. A system air balance test and adjustment to design conditions are conducted in the course of the plant preoperational test program. Instruments are calibrated and automatic controls are tested for actuation during the preoperational program.

9.4.5 REACTOR BUILDING VENTILATION SYSTEM

The following systems provide ventilation for, and control the atmosphere inside, the containment:

a) Containment Cooling System,

b) Airborne Radioactivity Removal System,

c) Containment Atmosphere Purge System,

d) Containment Atmosphere Release System,

e) Containment Vacuum Relief System,

f) Reactor Cavity Cooling System, and

g) Control Element Drive Mechanism Cooling System.

The following systems are associated with maintaining design conditions within the annulus of the Shield Building:

a) Annulus Negative Pressure System, and

b) Shield Building Ventilation System.

The Reactor Building ventilation systems air flow diagram is shown on Figure 9.4-7.

9.4.5.1 Containment Cooling System

The Containment Cooling System is described in detail in Subsection 6.2.2.

9.4.5.2 Airborne Radioactivity Removal System

9.4.5.2.1 Design Bases

The Airborne Radioactivity Removal System is designed to satisfy the following:

a) limit the buildup of airborne radioactivity leaking from the Reactor Coolant System during normal operation, and

b) reduce airborne radioactivity of containment atmosphere below limits of 10CFR20 to permit access for operation, maintenance, inspection and testing inside containment during normal operation, shutdown or refueling.

The system is used for radioactivity removal during normal operation only and serves no function for post-accident dose reduction. The system is not designed to safety or seismic requirements.

9.4.5.2.2 System Description

The system consists of two airborne radioactivity removal units, each consisting of a medium efficiency filter, HEPA prefilter, charcoal adsorber and centrifugal fan (E-13). Component design data are given in Table 9.4.16.

→(DRN 06-898, R15)

The airborne radioactivity removal units are operated when required to limit the buildup of airborne radioactivity leaking from the Reactor Coolant System during normal operation. The frequency of operation will depend on the concentration of particulate and gaseous activities present in the closed containment atmosphere as measured by radiation monitors (refer to Subsection 12.3.4). Airborne radioactivity removal units are manually started and stopped from the main control room.

←(DRN 06-898, R15)

The Airborne Radioactivity Removal System is shut down automatically when the reactor coolant pump deluge system is actuated.

Filter differential pressure and charcoal adsorber temperature are monitored.

9.4.5.2.3 Safety Evaluation

→(EC-5000082470, R301)

The Airborne Radioactivity Removal System is not safety related and is not designed to seismic Category I requirements since its operation is not required to mitigate the consequences of a design basis accident or to provide safe shutdown for the reactor. A failure of this system will have no effect on any safety related system, component or structure.

←(EC-5000082470, R301)

9.4.5.2.4 Testing and Inspection Requirements

The airborne radioactivity removal units are factory tested to demonstrate compliance with specification requirement.

The airborne radioactivity removal units are accessible during plant shutdown for periodic inspection and testing. Preoperational tests are performed to verify performance and check that the system operates as designed.

9.4.5.3 <u>Containment Atmosphere Purge System</u>

9.4.5.3.1 Design Bases

The Containment Atmosphere Purge System is designed to reduce the level of radioactive contamination in the containment atmosphere below the limits of 10CFR20 so as to permit personnel access to the containment.

The Containment Atmosphere Purge System is nonsafety and nonseismic, except for the containment penetrations and isolation valves (safety class 2, seismic Category I).

9.4.5.3.2 System Description

The Containment Atmosphere Purge System consists of a containment purge air makeup unit and a containment purge exhaust which is connected to the exhaust portion of the RAB Normal Ventilation System (refer to Subsection 9.4.3.1). Component design date are given in Table 9.4-17.

Makeup air enters through a louvered damper LD-39 and passes through a medium efficiency filter and an electric heating coil, EHC-50, all located in a casing installed at elevation +46 ft. MSL of the Reactor Auxiliary Building. The makeup air flows in series through pneumatic operator actuated butterfly valves 2HV-B15OB, 2HV-B151A and 2HV-B152A to enter the containment.

There are two modes of operation, the "Purge" mode and the "Refueling Ventilation" mode. The control switch is located in the main control room. Actuation of either mode positions valves and dampers.

For both modes of operation the air is filtered for removal of any radioactive particulates and radioiodines before being exhausted by RAB Normal Ventilation System exhaust fans E-22 to the stack.

Area radiation monitors and airborne radiation monitors (as discussed in Subsection 11.5 and 12.3.4) located inside the containment and at the plant stack will generate a Containment Purge Isolation Signal (CPIS) upon detection of radioactivity above their setpoint. The setpoint for area radiation monitors and airborne radiation monitors inside containment, varies with background radiation levels. The plant stack ODCM determines the monitor setpoint. The CPIS closes the containment purge isolation valves regardless of plant operating mode. Note, in Technical Specification Mode 5, only the plant stack monitor generates a CPIS preventing out-of-limits releases. This action will prevent release of containment air which contains an unacceptable level of radioactivity. The purge isolation valves are permitted to open when the radioactivity being monitored falls to an acceptable level. This acceptable level is achieved by manually starting the Airborne Radioactivity Removal System to provide air cleaning for reduction of airborne radioactivity. The isolation valves will also close upon receipt of a Containment Isolation Actuation Signal (CIAS). Discussions of the CIAS and CPIS are provided in Subsections 7.3.1.1.4 and 7.6.1.5, respectively.

The containment purge isolation valves are butterfly valves which are leaktight at maximum containment internal design pressure. This permits the space between the isolation valves to be pressurized to ascertain continued leaktightness. The shaft seals for all purge isolation valves consist of a double seal with a leak test space between the seals which can be pressurized for testing shaft seal leakage. To provide operability assurance the valve’s most highly stressed component, i.e. shaft, was analyzed considering concurrent DBA and SSE loads. Also considered in the analysis was the containment pressure vs. valve position relationship throughout the closing mode. The resulting stresses in the shaft permit a maximum valve open position of 52 degrees. The maximum valve open position therefore, is limited to 52 degrees by mechanical stops.

The exhaust portion of the RAB Normal Ventilation System operates in the refueling ventilation mode during refueling operations to ventilate the refueling pool inside the containment and simultaneously provide some purging of the containment atmosphere.

Figure 6.2-39 shows the ductwork arrangement for the refueling pool sweep system inside containment. Pool sweep supply air flows from containment purge makeup duct at centerline Elevation + 52.5 ft. MSL and then sweeps over the pool surface before entering the exhaust inlet ducts.

Each mode of operation is discussed separately as follows:

Purge Mode

When the control switch is in the "purge" position, damper D-22 remains in the fully opened position. The purge isolation exhaust butterfly valves 2HV-B153B, 2HV-B154B and 2HV-B155A will go to their open positions. With the exhaust isolation valves and damper D-22 in the open position, their individual limit switches permit damper controls of the exhaust portion of the RAB Normal Ventilation System to be energized.

Inlet dampers D-32, D-33, D-34 actuate to partially closed positions and the discharge damper D-5 remains in a full open position. The inlet vane damper D-4 of the operating exhaust fan E-22 modulates open to obtain full capacity purge flow. When a containment vacuum is reached and the control switch is in the "purge" mode, pressure differential transmitters will cause the purge makeup isolate butterfly valves 2HV-B150B, 2HV-B151A and 2HV-B152A and louver damper LD-39 to go to their open positions. The purging of the containment continues with damper D-23, on the exhaust branch duct from the refueling pool, fully closed.

"Refueling Ventilation" Mode

When the selector control switch is placed in its "Refueling Ventilation" position, dampers D-22 and D-23 are repositioned and all other components, valves and dampers act in the same function as that required in the "purge" mode. The damper D-22 actuates to a partially closed-position and damper D-23 actuates to a fully open position. Approximately 10,000 cfm will be exhausted from the refueling pool area inside the containment, and the balance of the airflow through damper D-22 is used to purge the containment.

The interface between refueling airflow and containment purge air flow occurs inside the containment in seismic Category I ductwork after the air streams pass through dampers D-22 and D-23 to the isolation butterfly valve ZHV-B153B.

The Containment Atmosphere Purge System is not operated following an accident.

Sheet metal air ducts are constructed of galvanized steel. Ducts embedded in concrete are either galvanized steel or stainless steel.

9.4.5.3.3 Safety Evaluation

The Containment Atmosphere Purge System is not a safety related system and will not be required to operate following a design basis accident. However, it is required for purging the containment to allow required access time for plant personnel during inspection, refueling and maintenance operations.

Isolation valves and containment penetrations are designed to safety class 2 and seismic Category I requirements. The isolated valves are designed to fail closed upon loss of instrument air.

9.4.5.3.4 Testing and Inspection Requirements

Each component of the Containment Atmosphere Purge System is inspected prior to installation. Components are accessible for periodic inspection during plant shutdown. Preoperational tests are performed on the system to ensure meeting performance and design basis requirements. Automatic and manual sequences are tested to ensure proper operation.

9.4.5.4 Containment Atmosphere Release System

For a detailed discussion of the Containment Atmosphere Release System, see Subsection 6.2.5.

9.4.5.5 Containment Vacuum Relief System

The Containment Vacuum Relief System is described as part of the containment functional design in Subsection 3.8.2.3.

9.4.5.6 Reactor Cavity Cooling System

9.4.5.6.1 Design Bases

→(DRN 05-1480, R14-A)

The Reactor Cavity Cooling System is designed to ventilate the annular space between the reactor vessel and the concrete primary shield wall to maintain the ambient steady state air temperature from exceeding the maximum design basis air temperature of the reactor cavity during normal operations. The system is not safety related, but the fans and portions of the ductwork are designed to seismic Category I requirements.

←(DRN 05-1480, R14-A)

9.4.5.6.2 System Description

The Reactor Cavity Cooling System consists of two 100 percent capacity axial supply fans (S-2) arranged in parallel and connected to a common supply duct. Fan design data are provided in Table 9.4.18. Each fan is provided with a supply discharge gravity damper to prevent recirculation through the standby fan. Each axial supply fan draws cooled air from the Containment Cooling System ring header. The fans supply air to ventilate the annular space between the reactor vessel and primary shield wall. The cooling provided by the Reactor Cavity Cooling System minimizes the possibility of concrete dehydration and subsequent faulting. The system limits thermal growth of the reactor vessel supporting steelwork.

System redundancy is provided to assure continuity and reliability of operation. Each fan is powered from separate safety buses. If there is a loss of offsite power, the fans are tripped and can be loaded manually onto the safety buses.

The control room operator selects the operation of either fan. If air flow is not maintained after a time delay the other fan will automatically start. The reactor cavity temperature is recorded on CP-18, the HVAC control panel located in the main control room, and a high cavity temperature is anunciated.

9,4.5.6.3 Safety Evaluation

The Reactor Cavity Cooling System is not a safety-related system. However, the fans and portions of the ductwork are designed and installed to satisfy seismic Category I requirements. Where the collapse of ductwork can cause damage of safety-related equipment located close to the duct, that portion of the ductwork is seismically qualified to remain intact in the event of a safe shutdown earthquake.

9.4.5.6.4 Inspection and Testing Requirements

Each component of the Reactor Cavity Cooling System is inspected prior to installation. The components are accessible for periodic inspection during plant shutdown.

All instrumentation and controls are tested and calibrated, fans are statically and dynamically balanced, ductwork is leak tested, and the system is balanced, adjusted, and tested for performance during preoperational testing.

9.4.5.7 <u>Control Element Drive Mechanism Cooling System</u>

9.4.5.7.1 Design Bases

The Control Element Drive Mechanism (CEDM) Cooling System is designed to:

a) cool the magnetic jack coils and thereby maintain them at a temperature below 350°F, and

b) provide accessibility for adjustments and regularly scheduled tests to assure continued functional reliability.

→(EC-33471, R307)

The system is not safety-related but is designed to seismic Category I requirements to protect neighboring safety-related equipment.

←(EC-33471, R307)

9.4.5.7.2 System Description

The CEDM Cooling System consists of four 50 percent capacity exhaust fans (E-16) and cooling coils. Components design data are given in Table 9.4-19.

Two of the four fans operate to maintain a negative pressure inside the CEDM cooling shroud. The other two fans are standby units. Isolation dampers are provided to prevent flow through the standby fans. Containment air is drawn through the cooling shroud for the magnetic jack coil elements to the CEDM cooling system. The heated air is cooled by water cooling coils, supplied from the Component Cooling Water System, and is discharged back to the containment through the system fans, thereby rejecting the CEDM generated heat to a sink outside the containment.

Each fan is started manually from a control switch in the main control room. Indicating lights in the main control room indicate operating status. Control room indication exists for air temperature entering the cooling coil and high exit temperature is annunciated. The shroud temperature and the temperature of component cooling water leaving the cooling coil are indicated in the main control room. A low temperature lockout, sensing containment temperature, prevents fans from starting.

9.4.5.7.3 Safety Evaluation.

The CEDM Cooling System is not a safety-related system. Although failures of this system can produce no consequences that would require a safety classification, it has been designed with the necessary features to assure continuity and reliability of operation. Two fans are powered from safety bus A and two fans are powered from safety bus B. If there is a loss of offsite power or a SIAS, the fans will be automatically tripped and can be loaded manually onto the safety buses.

9.4.5.7.4 Inspection and Testing Requirements

Each component of the CEDM Cooling System is inspected prior to installation. The components are accessible for periodic inspection during plant shutdown.

All instrumentation and controls are tested and calibrated, fans are statically and dynamically balanced, ductwork is leak tested, and the system is balanced, adjusted, and tested for performance during preoperational testing.

9.4.5.8 Annulus Negative Pressure System

9.4.5.8.1 Design Bases

→(DRN 05-787, R14)

The Annulus Negative Pressure System is provided to maintain the Shield Building annulus at a negative pressure during normal operation to support the value assumed in radiological analyses. This minimizes the leakage of unfiltered air to the outside atmosphere. The system is non-safety and nonseismic.

←(DRN 05-787, R14)

9.4.5.8.2 System Description

The system consists of two 100 percent capacity exhaust fans (E-19), arranged in parallel, connected to a single duct system which penetrates the Shield Building and discharges into the stack. Component design data are given in Table 9.4-20.

The operator selects the operating fan and the standby fan by means of switches in the main control room. The controls are arranged so that neither fan can start until both Shield Building isolation valves (3HV-B175 and 3HV-B176) and inlet dampers D-24 are open. Initiation of the fan starting sequence first opens these valves and dampers. The standby fan is automatically started upon loss of air flow from the operating fan after a time delay. An alarm is provided in the main control room when the negative pressure drops to 6 inches water gage.

A negative pressure of 8 in. WG is maintained in the annulus by damper D-25 through differential pressure control.

Automatic fan inlet dampers and fan gravity discharge dampers permit fan isolation for maintenance purposes and prevent air recirculation through the standby fan.

The system operates continuously during normal operation until a SIAS closes the isolation valves causing shutdown of the system fans though the respective valve limit switches.

9.4.5.8.3 Safety Evaluation

The two isolation valves and interconnected piping penetrating the Shield Building are designed to safety class 3 and seismic Category I requirements. Operation of the remaining portion of the Annulus Negative Pressure System serves no safety function and consequently is not designed to safety or seismic requirements. The system is isolated by a CIAS or SIAS and serves no function thereafter.

System redundancy is provided for the fans which have motors powered from separate safety buses, trains A and B. If there is a loss of offsite power to either bus, the fan is automatically tripped. During normal shutdown coincident with a loss of offsite power, the control room operator can manually restart the fans (refer to Table 8.3-1).

When one system fan is shut down due to power failure and the power has been restored to the division bus, the operator must manually restore power to the non-safety portion of the motor control center before the fan is restarted.

9.4.5.8.4 Inspection and Testing Requirements

Each component of the Annulus Negative Pressure System is inspected prior to installation. The components are accessible for periodic inspection,

All instrumentation and controls are tested and calibrated, fans are statically and dynamically balanced, ductwork is leak tested, and the system is balanced, adjusted, and tested for performance during preoperational testing.

9.4.5.9 Shield Building Ventilation System

The Shield Building Ventilation System is an engineered safety feature filter system described as part of the fission product. removal systems in Subsection 6.5.1. The design bases, design description, operation and reliability of the Shield Building Ventilation System is discussed in Subsection 6.2.3.

TABLE 9.4-1 (Sheet 1 of 2) Revision 306 (05/12)

DESIGN SPACE TEMPERATURES AND HUMIDITIES FOR NORMAL PLANT OPERATION (1)

Location	Summer Temp (F) (Dry Bulb)	Summer Relative Humidity (%) or Temp (Wet Bulb)	Winter Temp (F) (Dry Bulb)
Outdoor	93	81	32
Control Room Envelope			
Main Control Room	75	50%	70
Computer Room	75	50%	70
HVAC Equipment Room	104	--	50
Reactor Auxiliary Bldg (RAB)			
Radwaste Area			
a) Holdup Tank Rooms	120	--	50
b) Unrestricted Areas	104	--	50
Personnel Decontamination Area	75	50%	70
CVAS Area	104	--	50
CCW Area	104	--	50
Emergency Diesel Generator Area	120	--	50
Cable Vault & Switchgear Area	104	--	50
Battery Rooms	77	--	77
Communication Room	77	--	77
CEDMCS Cabinets Area (RAB Switchgear B Area)	85	60% (Max)(2)	50
Hot Machine Shop	75	--	70
Decontamination Area	75	--	70
RAB H & V Room	104	--	50
→(EC-17580, R306)			
RAB H & V Room EL. +21	77	--	77
←(EC-17580, R306)			

TABLE 9.4-1 (Sheet 2 of 2) Revision 14-A (03/06)

Location	Summer Temp (F) (Dry Bulb)	Summer Relative Humidity (%) or Temp (Wet Bulb)	Winter Temp (F) (Dry Bulb)
RAB Air Conditioning System			
I & C Area	75	50%	70
Mechanical Equip Rm	104	--	50
Fuel Handling Bldg	104	--	50
Turbine Bldg			
Accessible Area	104	--	50
Switchgear Room Area	104	--	50
Reactor Bldg			
Containment	120	--	50
Reactor Cavity	120	--	50
Shield Bldg	120	--	50

(1) Based on ASHRAE (1972): Climatic conditions 99 percent of winter hours and one percent of summer hours.

(2) Space relative humidity is not controlled. However, it is not expected to exceed the listed limit as is coincident with space design cooling load.

→(DRN 05-1480, R14-A)

(3) Upper Reactor Cavity 145°F
Lower Reactor Cavity 145°F

←(DRN 05-1480, R14-A)

TABLE 9.4-2 (Sheet 1 of 5) Revision 302 (12/08)

DESIGN DATA FOR CONTROL ROOM AIR CONDITIONING SYSTEM COMPONENTS

A. Air Handling Unit Identification AH-12 (3A-SA) and AH-12 (3B-SB)

1) Fans

Quantity per Unit	1
Type	Centrifugal, belt driven
Air flow, per fan, acfm	38,200
Static pressure, in. WG	5.33
Code	Air Moving and Conditioning Association (AMCA), Anti-Friction Bearing Manufacturers Association (AFBMA)

2) Motors

Quantity per Unit	1
Size	75 hp
Type	Horizontal induction
Electrical Characteristics	460 volt, 60 Hz, 3 phase
Insulation	Type H
Enclosure	TEFC
Code	IEEE 323-1974 IEEE 344-1975 NEMA MG-1

3) Cooling Coils

Quantity per Unit	1 bank
Type	chilled water, finned tube
Capacity, each bank,	
→(EC-2188, R302) Btu/hr	1,401,000 ←(EC-2188, R302)
Material	Copper fin on copper tube
Code	ARI Standard 410 ASME Section III Class 3

4) Heating Coils EHC-34 (3A-SA) and EHC-34 (3B-SB)

Quantity per Unit	1
Type	electric
Capacity, each Coil kW	30
Electrical Characteristics	480 volt, 60 Hz, 3 phase
Code	IEEE 323-1971 IEEE 344-1975

5) Medium Efficiency Filters

Quantity per Unit	1 bank
No. of cells, size, in.	24 cells (24 x 24 x 12)
Type	Disposable cellular
Material	Glass fiber

TABLE 9.4-2 (Sheet 2 of 5)

B.	Toilet Exhaust System Identification	E-34 (3A-SA) and E-34 (3B-SB)
	1) Fans	
	Quantity	2
	Type	Centrifugal, direct drive
	Air flow per fan, acfm	1070
	Static pressure, in. WG	1.85
	Code	AMCA and AFBMA
	2) Motors	
	Quantity per Unit	1
	Size	3/4 hp
	Type	Horizontal induction
	Electrical Characteristics	460 volt, 60 Hz, 3 phase
	Insulation	Type F
	Enclosure	TEFC
	Code	IEEE 323-1974 IEEE 344-1975 NEMA MG-1
C.	Conference Room & Kitchen Exhaust System Identification	E-42 (3)
	1) Fan	
	Quantity	1
	Type	Centrifugal, direct drive
	Air flow per fan, acfm	985
	Static pressure, in. WG	1.85
	Code	AMCA and AFBMA
	2) Motors	
	Quantity	1
	Size	3/4 hp
	Type	Horizontal induction
	Electrical Characteristics	460 volt, 60 Hz, 3 phase
	Insulation	Type F
	Enclosure	TEFC
	Code	IEEE 323-1974 IEEE 344-1975 NEMA MG-1

D. Equipment Room Local Coolers

Air Handling Unit Identification AH-26 (3A-SA) and AH-26 (3B-SB)

1) Fans

Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, per fan, acfm	3500
Static pressure, in. WG	.85
Code	AMCA and AFBMA

2) Motors

Quantity, per Unit	1
Size	3 hp
Type	Horizontal induction
Electrical Characteristics	460 volt, 60 Hz, 3 phase
Insulation	Type H
Enclosure	TEFC
Code	IEEE 323-1974 IEEE 344-1975 NEMA MG-1

3) Cooling Coils

Quantity per Unit	1 bank
Type	Chilled water, finned tube
Capacity, Btu/hr. - Coil	86,600
Material	Copper fins on copper tube
Code	ARI Standard 410 ASME Section III Class 3

→(EC-2188, R302)

←(EC-2188, R302)

4) Filters

Quantity, per Unit	1 Bank
No. of cells, size, in.	4-(16 x 25 x 2)
Type	Disposable
Material	Glass fiber

E. Emergency Filtration Units

Unit Identification S-8 (3A-SA) and S-8 (3B-SB)

1) Fans

Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, per fan, acfm	4,225
Static pressure, in. WG	12.84
Code	AMCA, AFBMA

E. Emergency Filtration Units (Cont'd)

2) Motors

Quantity per Unit	1
Size	15 hp
Type	Horizontal induction
Electrical Characteristics	460 volt, 60 Hz, 3 phase
Insulation	Type H
Enclosure	TEFC
Code	IEEE 323-1974 IEEE 344-1975 NEMA MG-1

3) Medium Efficiency Filters

Quantity per Unit	1 bank, 4 cells (24 x 24 x 12)
Type	Cartridge
Material	Glass fiber

4) HEPA Filters (Prefilter and Afterfilter)

Quantity, per Unit	2 banks, 4 cells/bank
Cell size, in.	(24 x 24 x 12)
Max. resistance clean, in. WG	1.0 each section
Max. resistance loaded, in. WG	4.0 each section with 0.3 micron DOP
Material	Glass sheet, separator less type, supported on cadmium plated steel frame
Efficiency	99.97%
Code	MIL-F-51068

5) Charcoal Adsorbers

→(DRN 01-572, R11-A)

Quantity per Unit	1
Type	4 in. deep bed gasketless welded construction
Efficiency	Methyl iodide penetration of less than 0.5% when tests are performed in accordance with ASTM D3803-1989 at 30°C and relative humidity of 70%.

←(DRN 01-572, R11-A)

→(EC-5000082470, R301)

Design Loading	4.19×10^{-3} g
Peak Decay Heat Load,	6.53×10^{-1} BTU/hr

←(EC-5000082470, R301)

→(DRN 01-572, R11-A)

Btu/hr.

Codes ANSI N509-1976 and ASTM D3803-

1989

←(DRN 01-572, R11-A)

TABLE 9.4-2 (Sheet 5 of 5) Revision 9 (12/97)

E. Emergency Filtration Units (Cont'd)

6) Heating Coils EHC-49 (3A-SA) and EHC-49 (3B-SB)

Quantity per Unit	1
Type	Electric
Capacity, kW per Coil	10
Electrical Characteristics	480 volt, 60 Hz, 3 phase
Code	IEEE 323-1971
	IEEE 344-1975
	NEMA, NEC

→

←

→ (DRN 99-1097)

TABLE 9.4-3 (Sheet 1 of 3) Revision 11 (05/01)

← (DRN 99-1097)

CONTROL ROOM AIR CONDITIONING SYSTEM FAILURE MODES & EFFECTS ANALYSIS

Component Identification	Failure Mode	Effect on System	Method of Detection	Monitor	Remarks
→ (DRN 99-1097) Normal Outside air intake valves 3HV-B169A or 3HV-B170B ← (DRN 99-1097)	Valve fails to close on isolation signal	None	Class 1E valve position indicating lights	CRI*	Redundant valve in series will close.
Emergency outside air intake valves 3HV-B196A, 3HV-B198A, 3HV-B197B, 3HV-B199B, 3HV-B201A, 3HV-B203A, 3HV-B200B or 3HV-B202B	Valve fails to a) open or b) close	None	Class 1E valve position indicating lights	CRI	a) Valve on redundant parallel duct will open or b) redundant valve on same duct will close.
→ (DRN 99-1097) Outside air intake damper to Air Handling Unit AH-12 D-40(SA) or D-40(SB) ← (DRN 99-1097)	Damper fails to open	No outside air flow	Damper position indicator	CRI	Control Room operator starts redundant air handling unit
Air Handling Unit AH-12 filters (2)	Filter clogs	Reduction in supply air flow	Class 1E differential pressure alarm across filters	CRI	100 percent capacity redundant air handling unit remains operable
Air Handling Unit AH-12 cooling coil (2)	Fails due to rupture of chilled water piping	Increase in supply air temperature	Class 1E temperature alarm with sensor at fan discharge	CRI	100 percent capacity redundant air handling system remains operable
Air Handling Unit AH-12 Fan (2)	Fails to start	No supply air	Class 1E differential pressure transmitter	CRI	Automatically starts 100 percent capacity redundant unit.
Air Handling Unit AH-12 Electric heating coil EHC-34 (3A-SA) or EHC-34 (3B-SB)	Class 1E primary over-temperature protection thermal cutouts fail to de-energize coil	Increase in supply air temperature	Temperature rises in the main control room	CRI	Class 1E secondary over-temperature protection thermal cutouts are provided to de-energize electric heating coil and coil in redundant system remains operable
Air Handling Unit AH-12 electric heating coil EHC-34(3A-SA) or EHC-34 (3B-SB)	Class 1E primary over-temperature protection thermal cutouts remain in open position or coil fails to operate for other reasons	Decrease in supply air temperature	Temperature falls in main control room	CRI	Coil in redundant system remains operable
Inlet damper to Air Handling Unit AH-12 D-39 (SA), or D-39 (SB)	Fails to open	Fan will not start	Class 1E fan status indicating lights	CRI	100 percent capacity redundant unit will start automatically

→ (DRN 99-1097)

TABLE 9.4-3 (Sheet 2 of 3) Revision 11 (05/01)

← (DRN 99-1097)

CONTROL ROOM AIR CONDITIONING SYSTEM FAILURE MODES & EFFECTS ANALYSIS

→ (DRN 99-1097)

Component Identification	Failure Mode	Effect on System	Method of Detection	Monitor	Remarks
Zone reheat coils EHC-21(3), EHC-23(3), EHC-24(3) and EHC-25(3)	a) Fails to shut off b) Fails to start	a) Increase in supply air temperature b) Decrease in supply air temperature	Temperature rises in the main control room	CRI	a) Manually disconnect power supply at coil terminal box b) N/A
Emergency Filtration Unit Fans S-8 (3A-SA) or S-8 (3B-SB)	Fails to start	No air flow through filter train	Class 1E differential pressure indicating switch across filter train and Class 1E fan status indicating switch	CRI	100 percent capacity redundant unit will automatically start
Inlet damper for Emergency Filtration Unit D-17(SA), D-17(SB), D-41(SA) or D-41(SB)	a) Fails to open b) D-41 (SA/SB) fails to close	a) Fan will not start b) Residual flow	Class 1E status indicating light	CRI	a) 100 percent capacity redundant unit will automatically start b) Residual flow through filter unit
Emergency Filtration Unit Filters: Medium Efficiency Filter, HEPA Prefilter, or HEPA Afterfilter	Filter clogs	Reduced air flow through filter train	Class 1E differential pressure alarm across filter train	CRI	Control Room operator starts redundant filtration unit
← (DRN 99-1097)					
Emergency Filtration Unit Electric Heating Coil EHC-49(3A-SA) or EHC-49 (3B-SB)	Class 1E primary over-temperature protection thermal cutouts remain in open position or coil fails to operate for other reason.	Filter train fan will stop	Class 1E temperature sensors	CRI	100 percent capacity redundant system will automatically start
Emergency Filtration Electric Heating Coil EHC-49(3A-SA) or EHC-49(3B-SB)	Class 1E primary over-temperature protection thermal cutouts fail to de-energize coil	Increase in air temperature	Class 1E temperature sensors	CRI	Class 1E secondary over-temperature protection thermal cutouts are provided to de-energize coil and coil in redundant system remains operable.
Main Control Room H & V Equipment Room Coolers Fans AH-26 (3A-SA), or AH-26 (3B-SB)	Fails to start	Temperature will rise slowly inside equipment room	Class 1E room temperature sensor	CRI	Control Room operator starts redundant AH-12, and interlocked AH-26 automatically starts

→ (DRN 99-1097)

TABLE 9.4-3 (Sheet 3 of 3) Revision 11 (05/01)

← (DRN 99-1097)

CONTROL ROOM AIR CONDITIONING SYSTEM FAILURE MODES & EFFECTS ANALYSIS

Component Identification	Failure Mode	Effect on System	Method of Detection	Monitor	Remarks
Main Control Room H & V Equipment Room coolers filters	Filter clogs	Reduced air flow through cooler will increase room temperature	Class 1E temperature sensor in H & V equipment room	CRI	Control Room operator starts redundant AH-12 and interlocked AH-26 automatically starts
Exhaust System Isolation valves 3HV-B171A, 3HV-B172B, 3HV-B177A or 3HV-B178B	Isolation valve fails to close	None	Class 1E valve position indicating light	CRI	Redundant isolation valve in series will close
→ (DRN 99-1097)					
Emergency Outside air pilot tube flow measuring device in duct (2)	Emergency outside air intake flow measuring system fails	Excessive or insuf-ficient outside air to system	Class 1E flow indicator	CRI	Redundant flow measuring device is operable
Inlet Dampers D-18 (SA&SB) and D-19 (SA&SB) from TSC, kitchen, toilets, locker room, or janitors closet (normally closed, fail open, open for isolation mode)	a) Fails to open b) Fails to close	a) No recirc flow from TSC, kitchen, toilets, locker room, or janitors closet during isolation mode b) Recirc flow from TSC, kitchen, toilets, locker room, or janitors closet during isolation mode	Indicating light	CRI	a) Control Room operator opens the redundant damper. b) Control Room operator closes the redundant damper.

← (DRN 99-1097)

*CRI: main control room indication.

TABLE 9.4-4 (Sheet 1 of 4)

DESIGN DATA FOR FUEL HANDLING BUILDING VENTILATION SYSTEM

A.	Air Handling Unit Identification		AH-14(3)
	1)	Fan	
		Quantity	1
		Type	Centrifugal, direct drive
		Air flow, acfm	29,130
		Static pressure, in. WG	3.22
		Code	AMCA and AFBMA
	2)	Motor	
		Quantity	1
		Size	40 hp
		Type	Horizontal induction
		Electrical Characteristics	460 volt, 60 Hz, 3 phase
		Insulation	Type B
		Enclosure	TEFC
		Code	NEMA MG-1
	3)	Heating Coil	
		Identification	EHC-41 (3)
		Quantity	1
		Type	Electric
		Capacity, kW	200
		Electrical Characteristics	480 volt, 60 Hz, 3 phase IEEE 323-1971 IEEE 344-1975 NEMA, NEC
	4)	Medium Efficiency Filter	
		Quantity	1 bank - 15 cells (24 x 24 x 12)
		Type	Disposable
		Material	Glass fiber
B.	Normal Exhaust Fans Identification E-20(3A), E-20(3B)		
	1)	Fans	
		Quantity	1
		Type	Centrifugal, direct drive
		Air flow, acfm	29,565
		Static pressure, in. WG	4.86
		Code	AMCA and AFBMA

TABLE 9.4-4 (Sheet 2 of 4) Revision 11-A (02/02)

2) Motor

→(DRN 00-691)

Quantity per Unit	1
Size	50 hp
Type	Horizontal induction
Electrical Characteristics	480 volt, 60 Hz, 3 phase
Insulation	Type F
Enclosure	TEFC
Code	NEMA Design B

←(DRN 00-691)

C. Emergency Filtration Units

Fan Identification	E-35 (3A-SA) & E-35 (3B-SB)

1) Fans

Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, acfm	4000
Static pressure, in. WG	10.5
Code	AMCA and AFBMA

2) Motors

Quantity per Unit	1
Size	15 hp
Type	Horizontal induction
Electrical Characteristics	460 volt, 60 Hz, 3 phase
Insulation	Type H
Enclosure	TEFC
Code	IEEE 323-1974 IEEE 344-1975 NEMA MG-1

3) Heating Coils

Identification	EHC-42 (3A-SA), EHC-42 (3B-SB)
Quantity per Unit	1
Type	Electric
Capacity, kW per Coil	25
Electrical Characteristics	480 volt, 60 Hz, 3 phase
Codes	IEEE 323-1971 IEEE 344-1975 NEMA, NEC

4) Medium Efficiency Filters

Quantity per Unit	1 bank - 4 cells (24 x 24 x 24)
Type	Cartridge
Material	Glass Fiber

5) HEPA Filters (Prefilters and Afterfilters)

Quantity	2 banks - 4 filters/bank
Cell size, in.	24 x 24 x 12
Max. Resistance Clean, in. WG	1.0 per bank
Max. Resistance Loaded, in. WG	4.0 per bank
	Glass sheet, separatorless type supported on cadmium plated steel frame
Efficiency	99.97 percent
Code	MIL-F-51068

6) Charcoal Adsorbers

Quantity per Unit	1 bank
Type	4 in. deep bed gasketless welded construction

→(DRN 01-572, R11-A; 02-1753, R12-A)

←(DRN 01-572, R11-A; 02-1753, R12-A)

D. H&V Room, Exhaust Fans Identification E-21 (3A-SA) and E-21 (3B-SB)

1) Fans

Quantity, per Unit	1
Type	Centrifugal, direct drive
Air flow, acfm	3,310
Static pressure, in. WG	0.35
Code	AMCA and AFBMA

2) Motors

→(DRN 00-691, R11-A)

Quantity per fan	1
Size	1.5 hp
Type	Horizontal induction
Electrical Characteristics	480 volt, 60 Hz, 3 phase
Insulation	Type H
Enclosure	TEFC
Codes	IEEE 323-1974 IEEE 344-1975 NEMA MG-1

←(DRN 00-691, R11-A)

TABLE 9.4-4 (Sheet 4 of 4)

E. H&V Room, Electric Convention Heaters EHC-1(3) and EHC-2(3)

Type	Electric resistance, surface-mounted built-in thermostat, automatic-reset over temperature cut-out.
Quantity	2
Heating Capacity, (kW each)	3
Electric Service	480 V/3ph/60 Hz
Codes	UL-listed

TABLE 9.4-5 Revision 11-A (02/02)

F.H.B. VENTILATION SYSTEM FAILURE MDOES & EFFECTS ANALYSIS

Component Identification	Failure Mode	Effect on System	Method of Detection	Monitor	Remarks
Heating & Ventilation Room Exhaust Fans E-21 (3A-SA) or E-21 (3B-SB)	Fan E-21 fails to start	H & V Equipment room temperature rises	Class IE Temperature sensor in H & V Equipment room	CRI*	100 percent capacity redundant exhaust fan remains operable
Outside air intake Louver Dampers LD-40 (SA) or LD-40 (SB)	Damper fails to open	Fan will not start	Class IE fan status indicating light	CRI	100 percent capacity redundant system remains operable
Emergency Filtration Fan E-35 (3A-SA) or E-35 (3B-SB)	Fan fails to start	No air flow through filter train	Class IE differential pressure alarm across filter train	CRI	100 percent capacity redundant system will automatically start
Inlet damper to emergency filter train D-29 (SA) or D-29 (SB)	Fails to open	Fan will not start	Class IE fan status indicating light	CRI	100 percent capacity redundant system will automatically start
Emergency Filtration Unit Filters: Medium Efficiency Filter, HEPA Prefilter, or HEPA Afterfilter	Filter clogs	Reduced airflow through filter train	Class IE differential pressure alarm across filter train	CRI	100 percent capacity redundant filtration unit will automatically start
Electric Heating Coil EHC-42 (3A-SA) or EHC-42 (3B-SB)	Class 1E primary over-temperature protection thermal cutouts remain in open position or coil fails to operate for other reasons	Filter train fan will stop	Class IE temperature sensors	CRI	100 percent capacity redundant system will automatically start
Electric Heating Coil EHC-42 (3A-SA) or EHC-42 (3B-SB)	Class 1E primary over-temperature protection thermal cutouts fail to de-energize coil	Increase in air temperature	Class IE temperature sensors	CRI	Class 1E secondary over-temperature protection thermal cutouts are provided to de-energize coil and coil in redundant system remains operable
→(DRN 01-423) Isolation Dampers (4) D-37A, D-37B, D-38A or D-38B					
Isolation Dampers (2) D-35A and D-35B	Fails to close	None	Class IE status indicating lights	CRI	A single Emergency Filtration Unit (E-35) can maintain the required flow and negative pressure in the FHB Spent Fuel Pool Area with one damper failed open.
Bypass Dampers (2) D-36A or D-36B ←(DRN 01-423)	Fails to open	None	Class IE status indicating lights	CRI	Redundant damper in parallel will open

*CRI = main control room indication

TABLE 9.4-6 (Sheet 1 of 3)

DESIGN DATA FOR REACTOR AUXILIARY BUILDING

NORMAL VENTILATION SYSTEM

A. Supply System

Air Handling Unit Identification:	S-6 (3A) and S-6 (3B)
1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air Flow, per fan, acfm	79,055
Static Pressure, in. WG	9.3
Code	AMCA and AFBMA
2) Motors	
Quantity, per fan	1
Size	200 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Type F
Enclosure	TEFC
Code	NEMA MG-1
3) Cooling Coil	
Quantity	1 Bank
Type	Chilled water, finned tube
Material	Copper tubes and fins
Capacity, Btu/hr	1,680,000
Code	ARI Standard 410
4) Heating Coil	
Identification	EHC-35(3)
Quantity	1
Type	Electric
Capacity, kW	450
Electrical Characteristics	480V, 60Hz, 3 phase
Code	NEMA, NEC
5) Medium Efficiency Filter	1 Bank
Quantity	40
No. of cells, size, in.	(24 x 24 x 12)
Type	Disposable
Material	Glass fiber

TABLE 9.4-6 (Sheet 2 of 3)

B. Exhaust System

Air Handling Unit Identification:	E-22 (3A) and E-22 (3B)
1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, acfm	92,190 Normal Exhaust 151,330 Normal Exhaust and Purge
Static Pressure, in. WG	12.5 Normal Exhaust 16.3 Normal Exhaust and Purge
Code	AMCA and AFBMA
2) Motors	
Quantity per fan	1
Size	700 hp
Type	Horizontal induction
Electrical Characteristics	4000V, 60Hz, 3 phase
Insulation	Class B Powerhouse
Enclosure	Dripproof
Code	NEMA MG-1
3) Air Clean-up Exhaust Filter Identification	E-22
a) Medium Efficiency Filters	
Quantity	1 bank - 90 cells
Cell Size, in.	(24 x 24 x 12)
Material and Type	Glass Fiber (Extended media)
Efficiency	55 percent
Code	UL
b) HEPA Filters	
Quantity	1 bank - 90 cells
Cell size, in.	(24 x 24 x 12)
Max. Resistance Clean, in. WG.	1.0
Max. Resistance Loaded, in. WG.	3.0

TABLE 9.4-6 (Sheet 3 of 3)

B. Exhaust System (Cont'd)

Material	Glass sheet, separatorless type, supported on cadium plated steel frame.
Efficiency	99.97 percent
Code	MIL-F-51068 and MIL-F-51079
c) Charcoal Adsorbers	
Quantity per Unit	1 Bank
Type	4 in. deep bed, Gasketless welded construction
Efficiency	99.9 percent minimum of iodides with 5 percent in the form of methyl iodide, CH_3I, when operating at 70 percent relative humidity and 150°F.
Code	ANSI N 509 - 1976

TABLE 9.4-7 (Sheet 1 of 2)

DESIGN DATA FOR PERSONNEL DECONTAMINATION AREA VENTILATION SYSTEM

A. Supply System

Air Handling Unit Identification	AH-6(3)
1) Fan	
Quantity	1
Type	Centrifugal, direct drive
Air flow, acfm	5240
Static Pressure, in. WG	3.4
Code	AMCA and AFBMA
2) Motor	
Quantity	1
Size	7-1/2 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60Hz, 3 phase
Insulation	Class B
Enclosure	TEFC
Code	NEMA MG-1
3) Cooling Coil	
Quantity	1 Bank
Type	Chilled water, finned tube
Material	Copper Tubes & Fins
Capacity, Btu/hr	526,000
Code	ARI Standard 410
4) Heating Coil	
Identification	EHC-30(3)
Quantity	1
Type	Electric
Capacity, kW	38
Electrical Characteristics	480V, 60Hz, 3 phase
Code	NEMA, NEC
5) Medium Efficiency Filter	
Quantity	1 Bank
No. of cells, size, in.	3-(12 x 24 x 12) & 2-(24 x 24 x 12)
Type	Disposable
Material	Glass Fiber
6) Reheat Coils Identification	EHC-3(3), EHC-4(3), EHC-6(3) and EHC-7(3)
Quantity	4
Type	Electric
Capacity, kW	12, 5, 10, 10
Electrical Characteristics	4870V, 60Hz, 3 phase
Code	NEMA, NEC

TABLE 9.4-7 (Sheet 2 of 2)

DESIGN DATA FOR PERSONNEL DECONTAMINATION AREA VENTILATION SYSTEM

A. Supply System (Cont'd)

Air Handling Unit Identification		AH-8(3)
1)	Fan	
	Quantity	1
	Type	Centrifugal, direct drive
	Air flow, acfm	4,300
	Static Pressure, in. WG.	3.34
	Code	AMCA and AFBMA
2)	Motor	
	Quantity	1
	Size	5 hp
	Type	Horizontal induction
	Electrical Characteristics	460V, 60Hz, 3 phase
	Insulation	Class B
	Enclosure	TEFC
	Code	NEMA MG-1
3)	Cooling Coil	
	Quantity	1 Bank
	Type	Chilled water, finned tube
	Material	Copper Tubes & Fins
	Capacity, Btu/hr	426,000
	Code	ARI Standard 410
4)	Heating Coil	
	Identification	EHC-32(3)
	Quantity	1
	Type	Electric
	Capacity, kW	34
	Electrical Characteristics	480V, 60Hz, 3 phase
	Code	NEMA, NEC
5)	Medium Efficiency Filter	
	Quantity	1 Bank
	No. of Cells, Size, in.	2-(24 x 24 x 12)
	Type	Disposable
	Material	Glass Fiber
6)	Reheat Coils Identification	EHC-8(3), EHC-11(3) and EHC-13(3)
	Quantity per Zone	1
	Type	Electric
	Capacity, kW	8 18, 2
	Electrical Characteristics	480V, 60Hz, 3 phase
	Code	NEMA, NEC

TABLE 9.4-8 (Sheet 1 of 2) Revision 7 (10/94)

DESIGN DATA FOR EMERGENCY DIESEL GENERATOR VENTILATION SYSTEM

A. Diesel Generator Room Ventilation System (Train A)

1. Exhaust System (Train A)

Fan Identification	E-28(3A-SA)
a) Fan	
Quantity	1
Type	Axial Flow
Air Flow, acfm	117,600
Total Pressure, in. WG	1.75
Code	AMCA and AFBMA
b) Motor	
Quantity	1
Size	60 hp
Electrical Characteristics	460V, 60Hz, 3 phase
Insulation	Class RH
Enclosure	TEAO
Codes	NEMA MG-1 IEEE 323-1974 IEEE 344-1975

2. Normal Ventilation System (NNS)
(Served by RAB Normal Ventilation System)

a) Electric Heating Coil	
Identification	EHC-56(3A)
Quantity	1
Type	Electric
Capacity, kW	6
Electrical Characteristics	480V, 60Hz, 3 phase
Code	NEMA, NEC

B. Diesel Generator Room Ventilation System (Train B)

1. Exhaust System (Train B)

Fan Identification	E-28(3B-SB)
a) Fan	
Quantity	1
→ Type	Axial Flow
Air Flow, acfm	128,000
Total Pressure in. WG	2.8
← Code	AMCA and AFBMA

TABLE 9.4-8 (Sheet 2 of 2)

DESIGN DATA FOR EMERGENCY DIESEL GENERATOR VENTILATION SYSTEM

B. Diesel Generator Room Ventilation System (Train B) (Cont'd)

1. Exhaust System (Train B) (Cont'd)

b) Motor

Quantity	1
Size	100 hp
Electrical Characteristics	460V, 60Hz, 3 phase
Insulation	Class RH
Enclosure	TEAO
Codes	NEMA MG-1 IEEE 323-1974 IEEE 344-1975

2. Normal Ventilation System (NNS)
(Served by RAB Normal Ventilation System)

a) Electric Heating Coil

Identification	EHC-56(3B0)
Quantity	1
Type	Electric
Capacity, kW	2
Electrical Characteristics	480V, 60Hz, 3 phase
Codes	NEMA, NEC

DESIGN DATA FOR RAB H&V ROOM VENTILATION SYSTEM

A. Supply System

	Air Handling Units Identification	AH-13(3A-SA) and AH-13(3B-SB)
1)	Fans	
	Quantity per Unit	1
	Type	Centrifugal, direct drive
	Air Flow, acfm	27,400
	Static Pressure, in. WG	3.02
	Code	AMCA and AFBMA
2)	Motors	
	Quantity per Unit	1
	Size	30 hp
	Type	Horizontal induction
	Electrical Characteristics	460V, 60Hz, 3 phase
	Insulation	Class H
	Enclosure	TEFC
	Codes	NEMA MG-1 IEEE 323-1974, IEEE 344-1975
3)	Heating Coils Identification	EHC-55(3A), EHC-55(3B)
	Quantity per Unit	1
	Type	Electric
	Capacity, kW	50
	Electrical Characteristics	480V, 60Hz, 3 phase
	Code	NEMA, NEC
4)	Filters	
	Quantity per Unit	1 Bank
	No. of Cells, Size, in.	24 - (20 x 25 x 2)
	Type	Disposable
	Material	Glass Fiber

B. Exhaust System Identification — E-41(3A-SA) and E-41(3B-SB)

1)	Fans	
	Quantity	2
→(DRN 06-843, R15)		
	Type	Centrifugal, belt drive
←(DRN 06-843, R15)		
	Air Flow, acfm	27,390
	Static Pressure, in. WG	1.23
	Codes	AMCA and AFBMA

TABLE 9.4-9 (Sheet 2 of 2)

DESIGN DATA FOR RAB H&V ROOM VENTILATION SYSTEM

B. Exhaust System (Cont'd)

2) Motors

Quantity per Fan	1
Size	15 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Codes	NEMA MG-1 IEEE 323-1974 IEEE 344-1975

TABLE 9.4-10 (Sheet 1 of 5) Revision 302 (12/08)

DESIGN DATA FOR RAB CABLE VAULT AND SWITCHGEAR AREAS VENTILATION SYSTEM

A. Supply Air - EL + 46 ft MSL

Air Handling Units Identification	AH-25(3A-SA) and AH-25 (3B-SB)

→(DRN 05-365, R14)

1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, acfm	30,300
Static Pressure, in. WG	4.82
Code	AMCA and AFBMA

←(DRN 05-365, R14)

2) Motors	
Quantity per Unit	1
Size	50 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Code	NEMA MG-1 IEEE 323-1974, IEEE 344-1975
3) Cooling Coils	
Quantity per Unit	1 bank
Type	Chilled water, finned tube
Material	Copper

→(EC-2188, R302)

Capacity, Btu/hr/Coil	1,650,500

←(EC-2188, R302)

Code	ARI Standard 410 ASME Section III Class 3
4) Heating Coils	
Identification	EHC-36(3A-SA) and EHC-36(3B-SB)
Quantity per Unit	1
Type	Electric
Capacity	60 kW
Electrical Characteristics	480V, 60Hz, 3 phase NEMA, NEC IEEE 323-1971 IEEE 344-1975
5) Medium Efficiency Filters	
Quantity per Unit	1 bank
No. of Cells, Size, in.	20 - (24 x 24 x 12)
Type	Disposable
Material	Glass Fiber

B. Reheat Coils

Identification	EHC-52(3), * EHC-53(3), EHC-54(3), EHC-57(3)
→(DRN 00-691, R11-A)	
Quantity, total	4
Type	Electric
Capacity each, kW	2 SVS-EEHC-316A-2BL 3 SVS-EEHC-316B-2BR SVS-EEHC-316A-3BL SVS-EEH-316B-2BL
←(DRN 00-691, R11-A)	
Electrical Characteristics	480V, 60Hz, 3 phase
Code	NEMA, NEC

C. Recirculated Supply Air - EL + 7 ft MSL

Air Handling Units Identification	AH-30(3A-SA) and AH-30(3B-SB)
1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, acfm	11,105
Static Pressure, in. WG	3.15
Code	AMCA and AFBMA
2) Motors	
Quantity per Unit	1
Size, hp	15
Type	Horizontal induction
Electrical Characteristics	460V, 60Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Codes	NEMA MG-1 IEEE 323-1974 IEEE 344-1975
3) Cooling Coils	
Quantity	1 bank
Type	Chilled water, finned tube
Material	Copper tubes
→(EC-2188, R302)	
Capacity, Btu/hr/Coil	534,500
←(EC-2188, R302)	
Code	ARI Standard 410 ASME Section III Class 3
4) Medium Efficiency Filters	
Quantity per Unit, Cell	1 bank, 6 cells-(24 x 24 x 12) and
Size, in.	2 cells-(12 x 24 x 12)
Type	Disposable
Material	Glass Fiber

* EHC-58(3) has been abandoned in place.

TABLE 9.4-10 (Sheet 3 of 5) Revision 10 (10/99)

D. Reheat Coil

Identification	EHC-59(3)
Quantity	1
Type	Electric
Capacity, kW	8
Electrical Characteristics	480V, 60Hz, 3 phase
Code	NEMA, NEC

E. Battery Rooms A & B Exhaust Fans

	Battery Room A	Battery Room B
Identification	E-29(3A-SA) E-29(3B-SB)	E-30(3A-SA) E-30(3B-SB)
1) Fans		
Quantity per Room	2	
Type	Centrifugal, direct drive	
Air flow, per fan, acfm	257	283
Static Pressure; in. WG	1.1	1.1
Codes	AMCA and AFBMA	
2) Motors		
Quantity per Fan	1	
Size	3/4 hp	
Type	Horizontal induction	
Electrical Characteristics	460V, 60Hz, 3 phase	
Insulation	Class H	
Enclosure	TEFC	
Codes	NEMA MG-1 IEEE 323-1974 IEEE 344-1975	

F. Battery Room AB and Computer Battery Room

	Battery Room AB	Computer Battery Room
	E-31(3A-SA) E-31(3B-SB)	E-46(3A-SA) E-46(3B-SB)
1) Fans		
Quantity	2	
Type	Centrifugal, direct drive	
Air flow, per fan, acfm	265	580
Static Pressure, in. WG	1.05	1.0
Codes	AMCA and AFBMA	

TABLE 9.4-10 (Sheet 4 of 5)

F. Battery Room AB and Computer Battery Room (Cont'd)

2) Motors

Quantity per Fan	1
Size	3/4 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Codes	NEMA MG-1 IEEE 323-1974 IEEE 344-1975

G. Smoke Purge Exhaust Fans

	Penetration Area	Cable Vault	Switchgear Room
Identification	E-50(3)	E-49(3)	E-48(3)
1) Fans			
Quantity	1	1	1
Type	Centrifugal, direct drive		
Air flow, acfm	3065	3065	49,250
Static Pressure, in. WG	1.5	1.5	2.5
Code	AMCA and AFBMA		
2) Motors			
Quantity	1	1	1
Size	2 hp	2 hp	60 hp
Type	Horizontal induction		
Electrical Characteristics	460V, 60Hz, 3 phase		
Insulation	Class F		
Enclosure	TEFC		
Codes	NEMA MG-1		

H. Equipment Room Exhaust Fans

Identification E-52(3A-SA) and E-52(3B-SB)

1) Fans

Quantity	2
Type	Centrifugal
Airflow, acfm, fan	275
Static Pressure, in. WG	1.0
Code	AMCA and AFBMA

TABLE 9.4-10 (Sheet 5 of 5)

H. Equipment Room Exhaust Fans (Cont'd)

2) Motors

Quantity per fan	1
Size	3/4 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Codes	NEMA MG-1 IEEE 323-1974 IEEE 344-1975

TABLE 9.4-11 (Sheet 1 of 2)

RAB CABLE VAULT AND SWITCHGEAR AREAS VENTILATION SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS

Component Identification	Failure Mode	Effect on System	Method of Detection	Monitor	Remarks
Outside Air Intake Dampers: D-65(SA) or D-65(SB)	Fails to open	Increase or decrease in discharge temperature of AH-25 (depending on outside air temperature)	Class 1E damper position indicating lights	CRI*	Mechanical stops will assume that dampers remain partially open
Air Handling Unit AH-25 Inlet Dampers: D-8(SA) or D-8(SB)	Fails to open	Fan will not start	Class 1E fan status indicating lights	CRI	Redundant air handling unit will automatically start
Air Handling Unit AH-25 Fan (2)	Fails to start	No supply air	Class 1E fan status indicating lights	CRI	Redundant unit will start automatically
Air Handling Unit AH-25 Medium Efficiency Filter (2)	Filter clogs	Reduced supply air flow	Class 1E temperature alarm with sensor in switchgear area	CRI	Redundant air handling unit remains operable
Chilled Water Cooling Coil (2)	Fails due to rupture of chilled water piping	Increase in supply air temperature	Class 1E temperature alarm with sensors in switchgear area	CRI	Redundant air handling unit will start automatically
Recirculation Dampers: D-48(SA), D-48(SB), D-49(SA) or D-49(SB)	Fails to open	No impact	Damper position indication	CRI	Damper in redundant parallel duct will remain open
Recirculation Air Handling Unit AH-30 Fans (2)	Fails to start	No supply air	Class 1E fan status indicating lights	CRI	Redundant air handling unit will automatically start
Medium Efficiency Filters (2)	Filter clogs	Reduced supply air flow	Class 1E temperature alarm with sensor in switchgear area	CRI	Redundant air handling unit will start automatically
Chilled Water Cooling Coils (2)	Fails due to rupture of chilled water piping	Increase in supply air temperature	Class 1E temperature alarm with sensors in switchgear	CRI	Redundant air handling unit will start automatically
Battery Room Exhaust Fans: E-29(3A-SA), E-29(3B-SB), E-30(3A-SA), E-30(3B-SB), E-31(3A-SA), E-31(3B-SB), E-46(3A-SA) or E-46(3B or SB)	Fails to start	Increase in hydrogen concentration	Class 1E fan status indicating lights and alarm	CRI	Redundant exhaust fan remains operable

TABLE 9.4-11 (Sheet 2 of 2)

RAB CABLE VAULT AND SWITCHGEAR AREAS VENTILATION SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS

Component Identification	Failure Mode	Effect on System	Method of Detection	Monitor	Remarks
Recirculation Air Handling Units AH-30 Inlet Dampers: D-50(SA) or D-50(SB)	Fails to open	Fan will not start	Class 1E fan status indicating lights	CRI	Redundant air handling unit will automatically start
H&V Room Exhaust Fans: E-52(3A-SA) or E-52(3B-SB)	Fails to start	Increase in H&V room temperature	Class 1E temperature alarm with sensors in H&V room	CRI	Redundant fan remains operable
H&V Room Outdoor Air Dampers: D-66(SA) or D-66(SB)	Fails to open	Increase in H&V room temperature	Class 1E temperature alarm with sensor in H&V room	CRI	Redundant fan remains operable

* CRI - main control room indication

TABLE 9.4-12 (Sheet 1 of 2)

DESIGN DATA FOR RAB HOT MACHINE SHOP AND DECONTAMINATION AREA VENTILATION SYSTEM

		Decontamination Room	Hot Machine Shop
A.	Supply System		
	Air Handling Units Identification	AH-32(3)	AH-33(3)
1)	Fans		
	Quantity	1	1
	Type	Centrifugal	direct drive
	Air flow, acfm	12, 720	7,160
	Static Pressure, in. WG	3.52	3.63
	Codes	AMCA and AFBMA	
2)	Motors		
	Quantity	1	1
	Size	15 hp	10 hp
	Type	Horizontal induction	
	Electrical Characteristics	460V, 60 Hz, 3 phase	
	Insulation	Class B	
	Enclosure	TEFC	
	Codes	NEMA MG-1	
3)	Cooling Coils		
	Quantity	1 Bank	1 Bank
	Type	Chilled water, finned tube	
	Material	Copper	
	Capacity, Btu/hr.	1,392,000	
	Code	ARI Standard 410	
4)	Heating Coil		
	Identification	EHC-60(3)	EHC-61(3)
	Quantity	1	1
	Type	Electric	
	Capacity, kW	125	100
	Electrical Characteristics	480V, 60 Hz, 3 phase	
	Code	NEMA, NEC	
5)	Medium Efficiency Filters		
	Quantity per Unit	1 Bank	1 Bank
	No. of Cells and Size, in.	6-(24x24x12) 5-(12x24x12)	6-(24x24x12)
	Type	Disposable	
	Material	Glass Fiber	

TABLE 9.4-12 (Sheet 2 of 2)

			Decontamination Room	Hot Machine Shop
B.	Exhaust System			
	Identification		AH-34(3)	AH-35(3)
	1)	Fans		
		Quantity	1	1
		Type	Centrifugal	direct drive
		Air flow, acfm	13,180	7,196
		Static Pressure, in. WG	7.2	6.9
		Codes	AMCA and AFBMA	
	2)	Motors		
		Quantity	1	1
		Size	30 hp	20 hp
		Type	Horizontal induction	
		Electrical Characteristics	460V, 60 Hz, 3 phase	
		Insulation	Class B	
		Enclosure	TEFC	
		Code	NEMA MG-1	
	3)	Medium Efficiency Filters		
		Quantity/Unit	1 Bank - 9 cells	1 Bank - 6 cells
		Cell Size, in.	(24x24x12)	
		Type	Disposable	
		Material	Glass Fiber	
	4)	HEPA Filters		
		Quantity per unit	1 Bank - 9 cells	1 Bank - 6 cells
		Cell Size, in.	(24x24x12)	
		Max. Resistance Clean in. WG	1.0	
		Max. Resistance Loaded, in. WG	3.0	
		Material	Glass sheet, separatorless type, supported on cadmium plated steel frame	
		Efficiency	99.97 percent	
		Code	MIL-F-51068 and MIL-F-51079	
C.	Moisture Separator; Spray Wash Booth Exhaust			
	Quantity		1	
	Air flow, cfm		200	
	Face Velocity, fpm		200	
	Cell Size, in.		12x12	

TABLE 9.4-13 (Sheet 1 of 2)

DESIGN DATA FOR RAB
AIR CONDITIONING SYSTEM

A. Supply System

Air Handling Unit Identification	AH-5(3)
1) Fan	
Quantity	1
Type	Centrifugal
Air flow, acfm	7,100
External Static Pressure, in. WG	3.5
Codes	AMCA and AFBMA
2) Motor	
Quantity	1
Size	15 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class B
Enclosure	TEFC
Code	NEMA MG-1
3) Cooling Coil	
Quantity	1 Bank
Capacity, Btu/hr.	260,700
Type	Chilled Water, finned tube
Material	Copper tubes & fins
Code	ARI Standard 410
4) Heating Coil	
Identification	EHC-1(3)
Quantity	1
Type	Electric
Capacity, KW	30
Electrical Characteristics	480V, 60 Hz, 3 phase
Code	NEMA, NEC
5) Medium Efficiency Filter	
Quantity	1 Bank
No. of Cells & Size, in.	6 - (24x24x12) 2 - (12x24x12)
Type	Disposable
Material	Glass Fiber

TABLE 9.4-13 (Sheet 2 of 2)

B. Exhaust System

Identification		E-47(3)
1)	Fan	
	Quantity	1
	Type	Centrifugal, direct drive
	Air flow, acfm	1205
	Total Static pressure, in. WG	1.25
	Codes	AMCA and AFBMA
2)	Motor	
	Quantity	1
	Size	3/4 hp
	Type	Horizontal induction
	Electrical Characteristics	460 volt, 60 Hz, 3 phase
	Insulation	Class F
	Enclosure	TEFC
	Code	NEMA MG-1

DESIGN DATA FOR CONTROLLED VENTILATION AREA SYSTEMS (CVAS) FAN COOLERS

A. Shutdown Heat Exchanger Areas A and B

Fan Coolers Identification	AH-3(3A-SA) and AH-3(3B-SB)
1) Fan	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, acfm	5810
Static Pressure, in. WG	0.95
Code	AMCA and AFBMA
2) Motors	
Quantity per Unit	1
Size	3 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Code	NEMA MG-1, IEEE 323-1974, IEEE 344-1975
3) Cooling Coils	
Quantity per Unit	1 Bank
Type	Chilled water, finned tube
Material	Copper tubes and fins
→(EC-2188, R302)	
Capacity, Btu/hr. - Coil	150,000
←(EC-2188, R302)	
Code	ARI Standard 410 ASME Section III Class 3
4) Filters	
Quantity	1 Bank
No. of Cells, Size in.	6 cells (20x20x2)
Type	Disposable
Material	Glass Fiber

B. Safeguard Pump A and A/B Area

Fan Coolers Identification	AH-2(3A-SA), AH-2(3C-SA) & AH-21(3B-SAB)		
1) Fans			
Quantity per Unit	1	1	1
Type	Centrifugal, direct drive		
Air flow, acfm	8500	8500	5575
Static Pressure, in. WG	1.12	1.12	1.05
Code	AMCA and AFBMA		

TABLE 9.4-14 (Sheet 2 of 7) Revision 302 (12/08)

B. Safeguard Pump A and A/B Area (Cont'd)

2)	Motors			
	Quantity per Unit	1	1	1
	Size	5 Hp	5 Hp	3Hp
	Type	Horizontal induction		
	Electrical Characteristics	460V, 60 Hz, 3 phase		
	Insulation	Class H		
	Enclosure	TEFC		
	Code	NEMA MG-1, IEEE 323-1974, IEEE 344-1975		
3)	Cooling Coils			
	Quantity per Unit	1 Bank	1 Bank	1 Bank
	Type	Chilled water, finned tubing		
	Material	Copper tubes and fins		
→(EC-2188, R302)				
	Capacity, Btu/hr	406,300	406,300	192,700
←(EC-2188, R302)				
	Code	ARI Standard 410 ASME Section III Class 3		
4)	Filters			
	Quantity per Unit	1 Bank	1 Bank	1 Bank
	Cell per Bank	9	9	6
	Cell Size, in.	(16x25x2)	(16x25x2)	(20x20x2)
	Type	Disposable		
	Material	Glass Fiber		

C. Safeguard Pump B Area

	Fan Coolers Identification	AH-2(3B-SB), AH-2(3D-SB)
1)	Fans	
	Quantity per Unit	1
	Type	Centrifugal, direct drive
	Air flow, acfm	8615
	Static Pressure, in. WG	0.98
	Codes	AMCA and AFBMA
2)	Motors	
	Quantity per Unit	1
	Size	5 hp
	Type	Horizontal induction
	Electrical Characteristics	460V, 60 Hz, 3 phase
	Insulation	Class H
	Enclosures	TEFC
	Codes	NEMA MG-1 IEEE 323-1974, IEEE 344-1975

TABLE 9.4-14 (Sheet 3 of 7) Revision 302 (12/08)

C. Safeguard Pump B Area (Cont'd)

3) Cooling Coils	
Quantity per Unit	1 Bank
Type	Chilled water, finned tubing
Material	Copper tubes and fins
→(EC-2188, R302)	
Capacity, Btu/hr. - Coil	310,600
←(EC-2188, R302)	
Code	ARI Standard 410 ASME Section III Class 3
4) Filters	
Quantity per Unit	1 Bank
No. of Cells, Size, in.	9 cells (16 x 25 x 2)
Type & Size, in.	Disposable
Material	Glass Fiber

DESIGN DATA FOR CHARGING PUMP AREA FAN COOLERS

A. Charging Pump A and B Areas

Fan Coolers Identification	AH-18(3A-SA) and AH-18(3B-SB)
1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow/fan, acfm	3700
Static pressure, in. WG	0.83
Code	AMCA and AFBMA
2) Motors	
Quantity per Unit	1
Size	3 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Codes	NEMA MG-1 IEEE 323-1974, IEEE 344-1975
3) Cooling Coils	
Quantity per Unit	1 Bank
Type	Chilled water, finned tube
Material	Copper tubes and fins
→(EC-2188, R302)	
Capacity, Btu/hr. - Coil	49,800
←(EC-2188, R302)	
Code	ARI Standard 410 ASME Section III Class 3
4) Filters	
Quantity per Unit	1 Bank
No. of Cells, Size, in.	4 cells - (16 x 25 x 2)
Type	Disposable
Material	Glass Fiber

B. Charging Pump AB Area

Fan Coolers Identification	AH-22(3A-SAB) and AH-22(3B-SAB)
1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow/fan, acfm	3700
Static pressure, in. WG	0.8
Code	AMCA and AFBMAS
2) Motors	
Quantity per Unit	1
Size	3 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Codes	NEMA MG-1 IEEE 323-1974, IEEE 344-1975
3) Cooling Coils	
Quantity per Unit	1 Bank
Type	Chilled water, finned tube
Material	Copper tubes and fins
→(EC-2188, R302)	
Capacity, Btu/hr. - Coil	49,800
←(EC-2188, R302)	
Code	ARI Standard 410 ASME Section III Class 3
4) Filters	
Quantity per Unit	1 Bank
No. of Cells, Size, in.	4 cells - (16 x 25 x 2)
Type	Disposable
Material	Glass Fiber

DESIGN DATA FOR EMERGENCY FEEDWATER PUMP AREA FAN COOLERS

A. Emergency Feedwater Pump A and B Areas

Fan Coolers Identification	AH-17(3A-SA) and AH-17(3B-SB)
1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow/fan, acfm	3700
Static pressure, in. WG	0.83
Code	AMCA and AFBMA

A. Emergency Feedwater Pump A and B Areas (Cont'd)

2) Motors	
Quantity per Unit	1
Size	3 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Codes	NEMA MG-1 IEEE 323-1974, IEEE 344-1975
3) Cooling Coils	
Quantity per Unit	1 Bank
Type	Chilled water, finned tube
Material	Copper tubes and fins
→(EC-2188, R302)	
Capacity Coil Btu/hr. - Coil	100,100
←(EC-2188, R302)	
Code	ARI Standard 410 ASME Section III Class 3
4) Filters	
Quantity per Unit	1 Bank
No. of Cells, Size, in.	4 cells - (16 x 25 x 2)
Type	Disposable
Material	Glass Fiber

<u>DESIGN DATA FOR COMPONENT COOLING WATER (CCW) AREA FAN COOLERS</u>

A. CCW Heat Exchanger A and B Areas

Fan Coolers Identification	AH-24(3A-SA) and AH-24(3B-SB)
1) Fans	
Quantity per unit	1
Type	Centrifugal, direct drive
Air flow, acfm	3800
Static Pressure, in. WG	0.723
Code	AMCA and AFBMA
2) Motors	
Quantity per Unit	1
Size	3 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class H
Enclosure	NEMA MG-1 IEEE IEEE 323-1974, IEEE 344-1975

TABLE 9.4-14 (Sheet 6 of 7) Revision 302 (12/08)

A.	CCW Heat Exchanger A and B Areas (Cont'd)	
	3) Cooling Coils	
	Quantity per Unit	1 Bank
	Type	Chilled water, finned tubing
	Material	Copper tube and fins
→(EC-2188, R302)		
	Capacity Btu/hr. - Coil	55,800
←(EC-2188, R302)		
	Code	ARI Standard 410 ASME Section III Class 3
	4) Filters	
	Quantity per Unit	1 Bank
	No. of Cells, Size, in.	4 cells (16 x 25 x 2)
	Type	Disposable
	Material	Glass Fiber
B	CCW Pumps A and B Areas	
	Fan Coolers Identification	AH-10(3A-SA) and AH-10(3B-SB)
	1) Fans	
	Quantity per Unit	1
	Type	Centrifugal, direct drive
	Air flow, acfm	5800
	Static Pressure, in. WG	0.95
	Code	AMCA and AFBMA
	2) Motors	
	Quantity per Unit	1
	Size	3 hp
	Type	Horizontal induction
	Electrical Characteristics	460V, 60 Hz, 3 phase
	Insulation	Class H
	Enclosure	TEFC
	Codes	NEMA MG-1 IEEE 323-1974, IEEE 344-1975
	3) Cooling Coils	
	Quantity per Unit	1 Bank
	Type	Chilled water, finned tubing
	Material	Copper tubes and fins
→(EC-2188, R302)		
	Capacity, Btu/hr. - Coil	146,600
←(EC-2188, R302)		
	Code	ARI Standard 410 ASME Section III Class 3
	4) Filters	
	Quantity per Unit	1 Bank
	No. of Cells, Size, in.	6 cells (20 x 20 x 2)
	Type	Disposable
	Material	Glass fiber

TABLE 9.4-14 (Sheet 7 of 7) Revision 302 (12/08)

C. CCW Pump Area A/B

Fan Coolers Identification	AH-20(3A-SAB) and AH-20(3B-SAB)
1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, acfm	5800
Static Pressure, in. WG	0.95
Code	AMCA and AFBMA
2) Motors	
Quantity per Unit	1
Size	3 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class H
Enclosure	TEFC
Codes	NEMA MG-1 IEEE 323-1974, IEEE 344-1975
3) Cooling Coils	
Quantity per Unit	1 Band
Type	Chilled water, finned tubing
Material	Copper tubes and fins
→(EC-2188, R302)	
Capacity, Btu/Hr. - Coil	146,600
←(EC-2188, R302)	
Code	ARI Standard 410 ASME Section III Class 3
4) Filter	
Quantity per Unit	1 Bank
No. of Cells, Size, in.	6 cells (20 x 20 x 2)
Type	Disposable
Material	Glass Fiber

TABLE 9.4-15 (Sheet 1 of 3)

DESIGN DATA FOR TURBINE BUILDING VENTILATION SYSTEM

A.	Intake Fan, Mezzanine Floor		
	Identification		S-10(3)
	1)	Fan	
		Quantity	1
		Type	Axial flow, direct drive
		Air flow, acfm	49,500
		Total Pressure, in. WG.	0.86
		Code	AMCA and AFBMA
	2)	Motor	
		Quantity	1
		Size	15 hp
		Type	Horizontal induction
		Electrical Characteristics	460V, 60 Hz, 3 phase
		Insulation	Class F
		Enclosure	TEAO
		Code	NEMA
B.	Exhaust Fans		
	Identification		E-6(3), E-4(3), E-10(3)
	a-1)	Axial Fans	
		Quantity	1 1 1
		Type	Axial flow, direct drive
		Air flow, acfm	65,200 65,200 32,600
		Total Pressure, in. WG.	2.27 2.05 1.19
		Code	AMCA and AFBMA
	a-2)	Motors for Axial Fans	
		Quantity	1 1 1
		Size	40 hp 30 hp 10 hp
		Type	Horizontal, direct drive
		Electrical Characteristics	460V, 60 Hz, 3 phase
		Insulation	Class F
		Enclosure	TEAO
		Code	NEMA
	b-1)	Propeller Exhaust Fans	
	Identification		E-7(3) E-3(3) E-5(3) E-8(3) E-2(3) E-11(3) E-1(3) E-44(3) E-9(3) E-12(3) E-45(3)

TABLE 9.4-15 (Sheet 2 of 3)

B. Exhaust Fans (Cont'd)

	Quantity, total	7	3	1
	Type	Propeller, direct drive		
	Air flow, each, acfm	53,700	43,000	28,530
	Static Pressure, in. WG.	0.75	0.75	0.75
	Code	AMCA and AFBMA		
b-2)	Motors for Propeller Fans			
	Quantity, per fan	1	1	1
	Size	20 hp	15 hp	10 hp
	Type	Horizontal induction		
	Electrical Characteristics	460V, 60 Hz, 3 phase		
	Insulation	Class B		
	Enclosure	TEAO		
	Code	NEMA		
c-1)	Power Roof Ventilators			
	Identification	PV-13(3), PV-1(3)		
	Quantity	1	1	
	Type			
	Air flow, acfm	225	2170	
	Static Pressure, in. WG.	0.375	0.5	
	Code	AMCA and AFBMA		
c-2)	Motors for Power Roof Ventilators			
	Quantity	1	1	
	Size	1/25 hp	1/2 hp	
	Insulation	Type A	Type A	
	Enclosure	TEFC	TEFC	
	Code	NEMA	NEMA	

C. Switchgear Room Supply

	Air Handling Units Identification	AH-15(3) and AH-29(3)
1)	Fans	
	Quantity per Unit	1
	Type	Centrifugal, direct drive
	Air flow, each acfm	48,900
	Static Pressure, in. WG.	4.5
	Code	AMCA and AFBMA

TABLE 9.4-15 (Sheet 3 of 3)

C. Switchgear Room Supply (Cont'd)

2) Motors	
Quantity per Unit	1
Size	60 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class B
Enclosure	TEFC
Code	NEMA
3) Medium Efficiency Filters	
Quantity per Unit	1 bank
No. of Cells, Size, in.	20 cells-(24 x 24 x 12)
Type	Disposable
Material	Glass Fiber

D. Condensate Pump Motor Cooling Exhaust Fan Units Identification — E-53(3A), E-53(3B); E-54(3A), E-54(3B); E-55(3A), E-55(3B)

1) Fans	
Quantity	6
Type	Axial flow, Direct drive
Air flow, each, acfm	15,000
Total Pressure, in. WG.	3.25
Code	AMCA and AFBMA
2) Motors	
Quantity, per fan	1
Size	20 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 cycle, 3 phase
Insulation	Class F
Enclosure	TEAO
Code	NEMA

TABLE 9.4-16 (Sheet 1 of 2) Revision 15 (03/07)

DESIGN DATA FOR AIRBORNE RADIOACTIVITY REMOVAL SYSTEM

A. Air Cleanup Filter Train

Filter Trains Identification	E-13(3A), E-13(3B)
1) Medium Efficiency Filter	
Quantity per train	1 bank
No. of Cells	10 cells
Type	Cartridge
Material	Glass Fiber
2) HEPA Filters	
Quantity per train	1 bank
No. of Cells	10
Cell Size, in.	(24x24x12)
Max. Resistance Clean, in. WG.	1.0
Max. Resistance Loaded, in. WG.	4.0
Material	Glass sheet, separatorless type supported on cadmium plated steel frame.
3) Charcoal Adsorbers	
Quantity per train	1
Type	4 in. deep bed welded construction

→(DRN 06-843, R15)
←(DRN 06-843, R15)

B. Recirculating Filter Fans Identification — E-13(3A), E-13(3B)

1) Fans	
Quantity per Unit	1
Type	Centrifugal, direct drive
Air flow, acfm/fan	8,500
Static Pressure, in. WG./fan	6.3
Code	AMCA and AFBMA

TABLE 9.4-16 (Sheet 2 of 2)

B. Recirculating Filter Fans (Cont'd)

2) Motors

Quantity per Unit	1
Size	25 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class F + PMR
Enclosure	TEFC
Code	NEMA

TABLE 9.4-17

DESIGN DATA FOR CONTAINMENT ATMOSPHERE PURGE SYSTEM

Containment Purge Makeup

1) Medium Efficiency Filter	
No. of Cells & Size, in.	30 - 24 x 24 x 12
Type	Disposable
Material	Glass Fiber
Efficiency	55 percent
2) Heating Coil Identification	EHC-50 (3)
Quantity	1
Type	Electric
Electrical Characteristics	480V, 60 Hz, 3 phase
Capacity, kw	390
Code	NEMA, NEC

TABLE 9.4-18

DESIGN DATA FOR REACTOR CAVITY COOLING SYSTEM

Supply Fans Identification	S-2(3A), and S-2(3B)
1) Fans	
Quantity	2
Type	Axial flow, direct drive
Air flow, acfm	35,925
Total Pressure, in. WG.	3.15
Code	AMCA and AFBMA
2) Motors	
Quantity per fan	1
Size	75 hp
Type	Horizontal induction
Electrical Characteristics	460V, 60 Hz, 3 phase
Insulation	Class RH
Enclosure	TEAO
Code	NEMA

TABLE 9.4-19 Revision 8 (5/96)

DESIGN DATA FOR CONTROL ELEMENT DRIVE MECHANISM (CEDM) COOLING SYSTEM

A.	Exhaust Fans Identification	E-16(3A), E-16(3B), E-16(3C), E-16(3D)
	1) Fans	
	Quantity	4
	Type	Centrifugal, direct drive
	Air flow, acfm/fan	41,430
	Static Pressure, in. WG./fan	28.6
	Code	AMCA and AFBMA
	2) Motors	
	Quantity per fan	1
	Size	250 hp
	Type	Horizontal induction
→	Electrical Characteristics	460V, 60 Hz, 3 phase
	Insulation	Class F or H
←	Enclosure	TEFC
	Code	NEMA
B.	Cooling Coil	
	Quantity, total	2 banks of 2 coils
	Type	Component Cooling Water, Finned Tube
	Material	Copper

TABLE 9.4-20

DESIGN DATA FOR ANNULUS NEGATIVE PRESSURE SYSTEM (ANPS)

1)	Exhaust Fans Identification	E-19(3A), E-19(3B)
	Quantity	2
	Type	Centrifugal, direct drive
	Air flow, each acfm	500
	Static Pressure in. WG.	13.84
	Code	AMCA and AFBMA
2)	Motors	
	Quantity per fan	1
	Size	3 hp
	Type	Horizontal induction
	Electrical Characteristics	460V, 60 Hz, 3 phase
	Insulation	Class F
	Enclosure	TEFC
	Code	NEMA

TABLE 9.4-21 (Sheet 1 of 3)

COMPARISON OF NORMAL VENTILATION SYSTEM AIR CLEANING UNIT WITH REGULATORY GUIDE 1.140 (MARCH, 1978)

Regulatory Position Item	Waterford 3 System Design Features
C.1.a	The system has been designed to maximum anticipated temperature, pressure and radiation levels and the cleanup system has been designed for continuous operation for the expected life of the plant.
C.1.b	The normal ventilation exhaust system is not located in a high radiation area.
C.1.c	The system complies with this regulatory position.
C.1.d	The system complies with this regulatory position.
C.2.a	The normal ventilation exhaust system is not redundant and is not designed to seismic Category 1 requirements, however, it is provided with redundant exhaust fans which assure continuous system operability. The filter train consists of the following sequential components: a) One bank of medium efficiency filters (90 cells) b) One bank of HEPA filters (90 cells) c)Activated charcoal adsorber. d) Exhaust air fans and ductwork and instrumentation. The system complies with this regulatory position to the extent described.
C.2.b	The 30,000 ft^3/min limitation was based on presumed inability to generate sufficient quantities of dioctyl phtalate (DOP) to perform an integrated leak test on larger HEPA filter banks. Testing companies state that DOP generators are available in capacities suitable for testing this system. Access, service platforms and the design adequately facilitate filter changeout and testing.
C.2.c	The system complies with applicable sections of USAEC Report, ORNL-NSIC-65, 1970 edition.

TABLE 9.4-21 (Sheet 2 of 3) Revision 2 (12/88)

Regulatory Position Item	Waterford 3 System Design Features
C.2.d	The system filter housing is leak tested in place until the test criteria of an allowable leak rate of 38.5 ft^3/min is satisfied. The system is designed with provisions for accessibility and ease of maintenance and is consistent with the ALARA guidelines set forth in Regulatory Guide 8.8.
C.2.e	The system complies with this regulatory position.
C.2.f	The system will comply with in place leakage testing criteria of Section 4.12 of ANSI N509-1980 and Section 6 of ANSI N510-1980.
C.3.a	The system complies with this regulatory position.
C.3.b.	The normal ventilation exhaust system complies with this regulatory position.
C.3.c	The normal ventilation exhaust system complies with this regulatory position. (See response to C.2.f above.)
C.3.d	The filter and adsorber banks are arranged in accordance with the recommendations of USAEC Report, ORNL-NSIC-65, 1970 edition. ERDA 76-21 publication was released after the design of the System.
C.3.e	The system filter housing and all appurtenances are constructed in accordance with the provision of Section 5.6 of ANSI N509 - 1976.
C.3.f	The system complies with this regulatory position.
C.3.g	The system complies with this regulatory position.
C.3.h	The system complies with this regulatory position.
C.3.i	The system complies with this regulatory position.
C.3.j	The system complies with this regulatory position.
C.3.k	The system complies with this regulatory position.
C.3.l	The system complies with this regulatory position.

TABLE 9.4-21 (Sheet 3 of 3) Revision 2 (12/88)

Regulatory Position Item	Waterford 3 System Design Features
C.4.a	Accessibility of components and maintenance has been considered in the design of the Exhaust System filtration and adsorption unit in accordance with Section 4.7 of ANSI N509-1976 and Subsection 2.3.8 of ERDA 76.21.
C.4.b	The system complies with this regulatory position.
C.4.c	The system complies with this regulatory position.
C.4.d	The installation of filters and adsorber charcoal will be delayed until after completion of construction to comply with this regulatory position.
C.5.a	The system complies with this regulatory position.
C.5.b	The system will comply with the provisions of Section 9 "Industrial Ventilation" and Section 8 of ANSI N510-1980.
C.5.c	The system complies with this regulatory position.
C.5.d	The system complies with this regulatory position.
C.6.a	The system complies with this regulatory position.
C.6.b	The system complies with this regulatory position.