52-001

GE Nuclear Energy

ABWR

Date 5/26/92

To Butch Burton 8D1

Fax No. —

This page plus 21 page(s)

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Subject FPC Open Items and "Missing" HVAC Marked Up Pages

Message

250063

D050 1/1

May 26, 1992

To: Jack Fox

From: E.V.Nazareno

Re: ABWR FPC System Open Items

Thermal transient analysis was performed to determine how long it will take for the pool temperature to exceed 140^{o}F (normal maximum heat load) or boil (abnormal maximum heat load) if one FPC train is lost, or no pool cooling is being performed.

Tabulated below are the results of the analysis. With the gates closed (21 days after shutdown), single failure was postulated for the normal and abnormal maximum heat loads. Also, thermal analysis was performed with no cooling for both the normal and abnormal cases.

The analysis showed that the operator has plenty of time to react (i.e.... fire hoses). Considering the proximity of the fire hoses (about 30 feet), it is expected that it will take about 30 minutes for the operator to deliver fire water into the pool. For the worst case (no cooling with abnormal maximum heat load), the pool temperature will reach boiling 16.2 hours after the start of the transient. During the transient, there will be no appreciable loss of pool water since there will be no boiling.

FPCS SINGLE PASSIVE PIPE FAILURE AND SINGLE ACTIVE FAILURE
THERMAL TRANSIENT ANALYSIS
21 DAYS AFTER SHUTDOWN

Case	Conditions	Decay Heat Removal Performed By	Initial Pool Temperature t_o=21 days	Time To Reach 140°F	Time To Reach 212°F	Heat Up Rate
1	Normal Max. Heat Load Pool Gates Closed Single Failure of FPC No RHR Supplemental Cooling No Emergency Make Up	1-FPC Train	125°F	1900 Min. (31.7 Hrs)	-	0.5°F Per Hr.
2	Normal Max. Heat Load Pool Gates Closed Passive Failure of Common RHR/FPC pipe No Emergency Make Up	NONE	125°F	400 Min. (6.7 Hrs)	-	2.24°F Per Hr.
3	Abnormal Max. Heat Load Pool Gates Closed Single Failure of FPC No RHR Supplemental Cooling No Emergency Make Up	1-FPC Train	125°F	-	4500 Min. (75 Hrs.)	1.16°F Per Hr.
4	Abnormal Max. Heat Load Pool Gates Closed Passive Failure of Common RHR/FPC pipe No Emergency Make Up	NONE	125°F	-	970 Min. (16.2 Hrs)	5.4°F Per Hr.

insert (a)

On a smoke in a division of the MCR HVAC, that division of HVAC system is put into smoke removal mode. For smoke removal, the exhaust fan is stopped, the recirculation duct valve is closed, and the fan bypass valve is opened. Either division of MCR HVAC can be used as a smoke removal system.

insert (b)

On a smoke alarm in a division of the Control Building Essential Electrical HVAC System, that division of HVAC shall be put into smoke removal mode. No other division is effected by this action. For smoke removal, the recirculation duct valve is closed, the fan bypass valve is opened, and the exhaust fan is stopped.

insert (c)

On a smoke alarm in a division of the Secondary Containment HVAC system, the HVAC system shall be put into smoke removal mode. To remove smoke from the secondary containment, the standby exhaust and supply fans are started to provide an increase in air flow through the secondary containment. The divisions that are not on fire shall have their exhaust dampers closed to a partial closed position. This position shall shall be set during system setup. When the exhaust valve are partially closed, the nonfire divisions pressure will be maintained at a negative pressure. The fire division will be maintained more negative with respect to the nonfire divisions.

insert (d)

On a smoke alarm in a division of the Reactor Building Essential Electrical HVAC System, that division of HVAC shall be put into smoke removal mode. No other division is effected by this action. For smoke removal, the recirculation duct valve is closed, the fan bypass valve is opened, and the exhaust fan is stopped.

insert (e)

On an alarm of exhaust fan or supply fan failure, the standby fan is automatically started, and an alarm is sounded inside the control room indicating fan failure.

9.4 AIR CONDITIONING HEATING, COOLING AND VENTILATION SYSTEMS

9.4.1 Control Building HVAC

The control building heating,ventilating and air-conditioning (HVAC) system is divided into two separate systems. A HVAC system for the control room equipment on the top two floors. Plus a HVAC system for essential electrical and heat exhanger equipment.

9.4.1.1 Control Room Equipment HVAC

9.4.1.1.1 Design Basis

(1) The control room (HVAC) system is designed with sufficient redundancy to ensure operation under emergency conditions assuming the single failure of any one active component.

(2) Provisions are made in the system to detect and limit the introduction of airborne radioactive material in the control room.

(3) Provisions is made in the system to detect and remove smoke and radioactive material from the control room.

(4) The HVAC system is designed to provide a controlled temperature environment to ensure the continued operation of safety-related equipment under accident conditions.

(5) The HVAC system and components are located in a Seismic Category I structure that is tornado-missile and flood protected.

430.241 (6) Tornado missle barriers are provided for intake and exhaust structures.

9.4.1.1.2 Power Generation Design Basis

(1) The HVAC system is designed to provide an environment with controlled temperature and humidity to ensure both the comfort and safety of the operators. The nominal design conditions for the control room environment are 75°F and 50% relative humidity.

(2) The system is designed to permit periodic inspection of the principal system components.

(3) The outside design conditions for the control room HVAC system are 115°F during the summer and -40°F during the winter.

9.4.1.1.3 System Description

The control room is heated, cooled and pressurized by a recirculated air system with filtered outdoor air for ventilation and pressurization purposes. The recirculated air and the outdoor air will be mixed and drawn through a filter section, a heating coil section, and a cooling coil section. Under normal conditions, sufficient air is supplied to pressurize the control room and exfiltrate to pressurize the control building.

The control building HVAC P&ID is shown in Figure 9.4-1. The control room flow rate is given in Table 9.4-3, and the system component descriptions are given in Table 9.4-4. The control building recirculation unit consists of a medium grade bag filter, a heating coil, cooling coil, two ~~50%~~ 100% capacity supply fans. 430.237

Two ~~50%~~ 100% capacity return exhaust fans draw air from the electrical area, corridors, control room, computer room, office areas, and the HVAC equipment room. This air is returned to the air conditioning unit during normal operations. Modulating dampers in the return duct work to the fans are controlled by a pressure controller to maintain the required positive pressure. The controller is located in the electrical equipment area. ~~During smoke removal mode, both fans are turned on and the air is discharged to atmosphere.~~

An emergency recirculation system consisting of an electrical heating coil, a prefilter, HEPA filter, charcoal adsorber, ~~and~~ HEPA filter, ~~with a booster fan, is~~ provided, is parallel to the normal mixed outdoor and return air path to the supply conditioning units. The charcoal adsorber will be 2 inches deep as a minimum. The system is normally on standby for use only during high radiation. A radioactivity monitoring system monitors the building intakes for radiation. The radiation monitor allows the control room operator to select the safest intake. The makeup air for pressurization can be diverted through the HEPA and charcoal adsorbing system before distribution in the control room areas.

Smoke detectors in the control room and the control equipment room exhaust systems actuate an alarm on indication of smoke. ~~Dampers must be positioned through a remote manual switch to allow the exhaust air fans to exhaust 100% of the conditioned air.~~

The HVAC equipment space is physically separated into divisional rooms. Each divisional room consists of an air intake room and an air exhaust room.

9.4.1.1.4 Safety Evaluation

The control building HVAC system is designed to maintain a habitable environment and to ensure the operability of components in the control room. All control room HVAC equipment and surrounding structures are of Seismic Category I design and operable during loss of the offsite power supply.

The ductwork which services these safety functions is termed ESF ductwork, and is of Seismic Category I design. ESF ducting is high pressure safety grade ductwork designed to withstand the maximum positive and/or negative pressure to which it can be subjected under normal or abnormal conditions. Galvanized steel ASTM A526 or ASTM A527 is used for outdoor air intake and exhaust ducts. All other ducts are welded black steel ASTM A570, Grade A or Grade D. Ductwork and hangers are Seismic Category I. Bolted flange and welded joints are qualified per ERDA 76-21.

430.238 Redundant and independent components are provided where necessary to ensure that a single failure will not preclude adequate control room ventilation.

A radiation monitoring system is provided to detect high radiation in the outside air intake ducts. A radiation monitor is provided in the control room to monitor control room area radiation levels. These monitors alarm in the control room upon detection of high radiation conditions. Isolation of the control room and initiation of the outdoor air cleanup unit fans are accomplished by the following signals:

(1) high radiation in the inside air intake duct, and

(2) manual isolation.

Under normal conditions, sufficient air is supplied to pressurize the control room and exfiltrate to pressurize the control building.

The safety-related isolation valves at the outside air intakes are protected from becoming inoperable due to freezing, icing, or other environmental conditions.

~~For information on fire protection and smoke removal methods for the control building HVAC system see Subsections 9.5.1.1.6 and 9.5.1.1.6.~~

9.4.1.1.5 Inspection and Testing Requirements

Provisions are made for periodic tests of the outdoor air cleanup fans and filters. These tests include determinations of differential pressure across the filter and of filter efficiency. Connections for testing, such as injection, sampling and monitoring are properly located so that test results are indicative of performance.

The high-efficiency particulate air (HEPA) filters may be tested periodically with dioctyl phthalate smoke (DOP). The charcoal filters may be periodically tested with freon for bypasses.

The balance of the system is proven operable by its use during normal plant operation. Portions of the system normally closed to flow can be tested to ensure operability and integrity of the system.

9.4.1.1.6 Instrumentation Application

The area exhaust fan is started manually and the fan discharges the air to atmosphere.

A high radiation signal automatically starts the outdoor air cleanup system, closes the normal air inlet damper and closes the exhaust air dampers.

A temperature indicating controller senses the temperature of the air leaving the air cleanup system. The controller then modulates an electric heating coil to maintain the leaving air temperature at a preset limit. A limit switch will cause an alarm to be actuated on high air temperature. A moisture-sensing element working in conjunction with the temperature controller measures the relative humidity of the air entering the charcoal absorber.

Differential pressure indicators show the pressure drop across the prefilters and the HEPA filters. A differential pressure indicating switch also measures the pressure drop across the entire filter train. The switch causes an alarm to be actuated if the pressure drop exceeds a preset limit. A flow switch in the outdoor air cleanup system fan discharge duct automatically starts the standby system and initiates an alarm on operating fan failure.

The electrical equipment area and the control room area return exhaust fans start automatically when the air-conditioning unit is started. Each fan inlet damper is open automatically. The exhaust dampers to the conditioning unit are opened automatically.

Differential pressure-indicating controllers modulate dampers in the return air ducts to maintain space positive pressure requirements.

The cooling unit starts automatically on a signal from the temperature-indicating controller installed in the HVAC room. The controller modulates a three-way chilled water valve to maintain the space conditions.

During winter, the electric unit heaters are cycled by temperature-indicating controller switches, located within the filter rooms and the air-handler rooms.

The supply and return air duct work has manual balancing dampers provided in the branch ducts for balancing purposes. The dampers are locked in place after the system is balanced.

9.4.1.1.7 Regulatory Guide 1.52 Compliance Status

The control room ESF filter trains comply with all applicable provisions of Regulatory Guide 1.52, Section C except as noted below.

The revisions of ANSI N509 and N510 listed in Table 1.8-21 are used for ABWR ESF fliter train design; the Regulatory Guide references older revisions of these standards.

The control room ESF fliter trains are in compliance with the system design criteria except for the heater and demisters. The heaters and demisters are put into systems to regulate the relative humidity of the air as it enters the ESF filter train. Since the control room air-handling units are designed to maintain the control room temperature and humidity within limits, additional controls are not necessary for the ESF filter train.

9.4.1.1.8 Standard Review Plan 6.5.1 Compliance Status

The control room ESF system complies with SRP 6.5.1, Table 6.5.1-1. The only exceptions are for heater and moisture separator instrumentation requirements. Since these components are not necessary for the ABWR design, no instrumentation has been supplied to monitor their operation. Relative humidity and temperature of the inlet air is maintained by the control room air-handling system.

9.4.1.2 Essential Electrical and Reactor Building Cooling Water Equipment HVAC

9.4.1.2.1 Design Basis

(1) The HVAC system is designed with sufficient redundancy to ensure operation under emergency conditions assuming the failure of any one active component.

(2) The HVAC system is designed to provide a controlled temperature environment to ensure the continued operation of safety-related equipment under accident conditions.

(3) The HVAC system and components are located in a Seismic Category I structure that is tornado-missle and flood protected.

(4) Tornado missle barriers provided for intake and exhaust structures. 430.241

9.4.1.2.2 Power Generation Design Basis

(1) The HVAC system is designed to provide an environment with controlled temperature during normal operation to ensure the comfort and safety of plant personnel and the integrity of the essential electrical and RCW equipment.

(2) The system is designed to facilitate periodic inspection of the principal system components.

(3) Design outside air temperature for the heat exchanger building HVAC system are 115°F during the summer and -40°F during winter.

9.4.1.2.3 System Description

430.238 The essential electrical HVAC system is divided into 3 independent subsystems with each subsystem serving a designated area. Each Subsystem serve as essential electrical heat exchanger equipment HVAC for divisions A, B, C, and D.

The control building essential elctrical HVAC system flow rates are given in Table 9.4-3, and system component descriptions are given in Table 9.4-4.

9.4.1.2.3.1 Safety-Related Subsystem 1

Subsystem 1 specifically serves:

(1) Safety-related battery room 1,

(2) Essential chiller room A,

(3) ~~RB cooling water~~ RCW pump and heat exchanger room A,

(4) HVAC equipment room,

(5) Safety-related electrical equipment room,

(6) Passages,

(7) Non-essential battery room,

(8) Non-essential electrical equipment rooms.

Recirculation unit for subsystem 1 consists of a prefilter section, a high efficient filter section, ~~an electric heater~~, a cooling coil, and two ~~50%~~ 100% capacity supply fans.

Two ~~50%~~ 100% capacity return exhaust fans discharge to the atmosphere.

9.4.1.2.3.2 Safety-Related Subsystem 2

Subsystem 2 specifically serves:

(1) Safety-related battery rooms 2 and 4,

(2) Essential chiller room B,

(3) RCW pump and heat-exchanger room B,

(4) HVAC equipment room,

(5) Safety-related-electrical equipment room,

(6) Passages,

430.264 (7) Remote Shutdown Panel Room.

Recirculation unit for Subsystem 2 consists of a prefilter section, a high efficient filter section, ~~an electric heater~~, a cooling coil, and two ~~50%~~ 100 capacity supply fans.

Two ~~50%~~ 100 capacity return exhaust fans discharge to the atmosphere.

9.4.1.2.3.3 Safety-Related Subsystem 3

Subsystem 3 specifically serves:

(1) Safety-related battery room 3,

(2) Essential chiller room C,

(3) RCW water pump and heat-exchanger room C,

(4) HVAC equipment room,

(5) Safety-related electrical equipment room,

(6) Passages,

(7) ~~SGTS equipment~~ MG-Sets at EL. 7200 in CB.

Recirculation unit for Subsystem 3 consists of a prefilter section, a high efficient filter section, ~~an electric heater~~, a cooling coil, and two ~~50%~~ 100 capacity supply fans.

Two ~~50%~~ 100 capacity return exhaust fans discharge to the atmosphere.

9.4.1.2.4 Safety Evaluation

The essential electrical HVAC system is designed to ensure the operability of the essential electrical equipment, and to limit the hydrogen concentration to less than 2% by volume in the battery rooms. All safety-related HVAC equipment and surrounding structures are of seismic category I design and operable during loss of the offsite power supply, 435.43

The ductwork which services these safety functions is termed ESF ductwork, and is of Seismic Category I design. ESF ducting is high pressure safety grade ductwork designed to withstand the maximum positive and/or negative pressure to which it can be subjected under normal or abnormal conditions. Galvanized steel ASTM A526 or ASTM A527 is used for outdoor air intake and exhaust ducts. All other ducts are welded black steel ASTM A570, Grade A or Grade D. Ductwork and hangers are Seismic Category I. Bolted Flange and welded joints are qualified per ERDA 76-21.

Redundant components are provided where necessary to ensure that a single failure will not preclude adequate heat-exchanger building ventilation.

9.4.1.2.5 Inspection and Testing Requirements

Provisions are made for periodic tests of the outdoor air cleanup fans and filters. These tests include determinations of differential pressure across the filter and of filter efficiency. Connections for testing, such as injection, sampling and monitoring are properly located so that test results are indicative of performance.

The balance of the system is proven operable by its use during normal plant operation. Portions of the system normally closed to flow can be tested to ensure operability and integrity of the system.

9.4.1.2.6 Instrumentation Application

The area exhaust fans are started manually and the fans discharge the air to atmosphere.

insert (c)

A temperature indicating controller senses the temperature of the air leaving the air cleanup system. The controller then modulates an electric heating coil to maintain the leaving air temperature at a preset limit. A limit switch will cause an alarm to be actuated on high air temperature.

The essential electrical return exhaust fans start automatically when the air-conditioning unit is started. Each fan inlet damper is open automatically. The exhaust dampers are closed automatically and the return air dampers to the conditioning unit are opened automatically.

~~For information on fire protection and smoke removal methods for the heat exchanger building HVAC systems, see Subsections 9.5.1.1.5 and 9.5.1.1.6.~~

insert (b)

The chiller room cooling unit starts automatically on a signal from the temperature-indicating controller installed in the chiller room. The controller modulates a three-way chilled water valve to maintain the space conditions.

~~During winter, the electric unit heaters are cycled by temperature indicating controller switches, located within the chiller rooms and the air handler rooms.~~

9.4.2 Spent Fuel Pool Area Ventilation System

The spent fuel pool area ventilation system is part of the reactor building ventilation system described in Subsection 9.4.5.

9.4.3 Auxiliary Area Ventilation System

The auxiliary area ventilation system is part of the reactor building ventilation system described in Subsection 9.4.5.

9.4.4 Turbine Island Ventilation System

The turbine island ventilation system consists of the turbine building ventilation system (TBVS) and the electrical building ventilation system (EBVS).

9.4.4.1 Design Bases

9.4.4.1.1 Safety Design Bases

The TBVS and EBVS do not serve or support any safety function and have no safety design bases.

9.4.4.1.2 Power Generation Design Bases

(1) The TBVS and EBVS are designed to supply filtered and tempered air to all turbine island spaces during all modes of normal plant operation, including plant startup and shutdown. The systems are also designed to maintain inside air temperatures above 60°F and below the following upper design limits:

- General Turbine Building Areas: 104°F
- Condenser Compartment: 110°F
- Resin Tank Room: 110°F
- Steam Tunnel: 120°F
- Moisture Separator Compartments: 120°F
- Electrical Building Areas: 104°F

(2) The EBVS is designed to provide independent supply and exhaust ventilation to the electrical switchgear, chillers and air compressor rooms, and independent exhaust for the gas turbine generator and boiler rooms. The ventilation exhaust for these areas is discharged directly to atmosphere. Recirculation from clean areas is provided for as appropriate.

(3) The TBVS is designed to direct air flow from areas of low potential radioactivity to areas of high potential radioactivity. The TBVS design is based on supplying air from the turbine building periphery (outer walls) both above and below the operating floor and ventilating areas radially inwards towards the return/exhaust air inlet points located below the operating floor in equipment rooms, the condenser area and under the building roof. The main stairwells that are designed for personnel evacuation routes are pressurized to prevent infiltration of smoke from other turbine building areas, during a fire situation.

(4) The TBVS is designed to minimize exfiltration by maintaining a slightly negative pressure by exhausting 10% more air than is supplied to the turbine building.

(5) Exhaust air from potentially high airborne contamination turbine building areas or component vents is collected, filtered and discharged to the atmosphere through the turbine building compartment exhaust (TBCE) system.

(6) Exhaust air from other (low potential airborne contamination) turbine building areas and component vents, except lube oil areas, is either exhausted to the atmosphere through a medium efficiency filter or, is returned to the supply air unit and mixed with outside air.

(7) Exhaust air from the lube oil areas is exhausted to the atmosphere without filtration.

(8) All turbine building exhaust air is directed to the plant vent stack where it is monitored for radiation prior to being discharged to the atmosphere.

(9) Upon high radiation alarm from the plant vent stack radiation monitoring system, the operator will shutdown the plant, investigate and take corrective action.

(10) The TBVS is designed to provide for local air recirculation and cooling in high heat load areas using local unit coolers. A minimum of 50% standby cooling capacity is provided in areas where a loss of cooling would interfere with plant power generation objectives.

9.4.4.2 Description

9.4.4.2.1 TBVS General Description

The TBVS air flow diagram is shown on Figure 9.4-2a; the system instruments and controls are illustrated on Figure 9.4-2b; equipment design parameters are listed in Table 9.4-5.

The turbine building supply air units, main exhaust fans, equipment compartment exhaust fans, filters, and control panels are located in the HVAC equipment rooms at elevation T.M.S.L 30.3m, and the floor above. The lube oil area exhaust fans are located in the vicinity of lube oil reservoir room. Individual unit coolers and unit heaters are located in the areas that they serve.

Potentially high contamination exhaust air is always discharged to the atmosphere. Exhaust air form clean and low potential airborne contamination areas is either discharged to atmosphere or recirculated.

All turbine building ventilation systems and subsystems that are required to sustain normal plant operation are provided with redundant fans on automatic standby.

9.4.4.2.1.1 Turbine Building Supply (TBS) System

The TBS system consists of outside air intake louvers; return and exhaust air modulating dampers with minimum outside air damper position; low and high efficiency filters; hot water heating coil; chilled water cooling coils, and three 50% capacity constant volume supply fans.

Two out of three fans are normally operated to supply filtered and, if required, temperature adjusted air to all levels of the turbine building. The third fan is a standby unit, which starts automatically upon failure of either operating fan. Each supply fan is provided with pneumatically operated inlet vanes, that maintain a constant air flow rate, and pneumatically operated isolation shutoff dampers.

The TBS runs with 100% outside air during normal plant operation whenever outside air temperature is moderate enough to contribute to maintaining suitable inside air conditions at the minimum operating cost. The TBVS modulates the return, exhaust and outside air dampers to maximize inside air temperature control by outside air, and minimize the energy used for either cooling by the chilled water system or heating by the auxiliary boiler system.

On extreme outside air temperature conditions (either high or low), the outside air intake dampers are at their minimum position. Maximum inside air, as available from the building clean and low potential airborne contamination areas only, is recirculated by the TBVS exhaust/return fans to the supply air inlet plenum.

The TBS fans are started by handswitches located on local control panels. The supply fans are interlocked with the TBVS exhaust fans and TBVS compartment exhaust fans to ensure that the exhaust fans are running before a supply fan is started.

The TBS air handling heating and cooling coil operating duties are modulated by temperature controllers located at the coils air outlet.

The TBS fans are started by handswitches located on a local control panel.

9.4.4.2.1.2 Turbine Building Exhaust (TBE) System

The air drawn by TBE fans from the building clean and low potential contamination areas is filtered through medium efficiency particulate filters (bag type) and either exhausted through the monitored vent stack or returned to the TBVS supply plenum to mix with outside air.

The TBE system is provided with three 50% capacity fans downstream of the filter train. Two fans are normally in operation and one is on automatic standby.

A filter bypass is provided to allow smoke purging from turbine building in case of fire. All three TBE fans can be operated simultaneously to provide maximum smoke removal, is desired.

The TBVS exhaust fans are provided with inlet vanes and isolation dampers. A pressure differential controller automatically adjusts the blade pitch of the operating fans to maintain the desired negative pressure in the turbine building. Failure of one operating exhaust fan automatically starts the standby fan and associated controls. The TBVS exhaust fans are interlocked with the TBVS supply fans, as noted earlier.

9.4.4.2.1.3 Turbine Building Compartment Exhaust (TBCE) System

The TBCE system consists of two 100% capacity exhaust fans, one common medium efficiency filter unit and associated controls. One fan is normally in operation, and the other one on automatic standby. The system also includes a 100% capacity filter bypass duct for purging smoke in case of fire.

Except when smoke removal is required, air exhausted from the building high potential airborne contamination compartments and equipment vents is filtered through a medium efficiency filter (bag type) before it is released to the atmosphere through the plant vent stack.

The two exhaust fans are provided with inlet vanes and isolation dampers. An air flow controller automatically adjusts the inlet vanes of the operating fan to maintain a constant system exhaust at flow rate. In the automatic mode, loss of flow from the operating fan starts the standby fan and associated controls.

9.4.4.2.1.4 Turbine Building Lube Oil Area Exhaust (TBLOE) System

The TBLOE system includes two 100% capacity fans, isolation dampers and exhaust ductwork. The TBLOE fans discharge the exhaust air directly to the atmosphere through the plant vent stack. One fan is designed to continuously exhaust at a constant volumetric flow rate from the lube oil process and storage rooms and rooms having electro-hydraulic fluids. Supply air to these rooms is delivered by the TBVS supply fans. A bypass duct is provided around the lube oil exhaust fans for purging high temperature combustion products and limiting room pressurization in case of fire in one of the rooms.

9.4.4.2.1.5 TBVS Unit Coolers and Electric Unit Heaters

Localized unit coolers and electric unit heaters are provided as required in the following rooms: condenser compartments, condensate pump room, heater drain pump rooms, filter valve room, demineralizer pump and valve rooms, TCW heat exchanger areas, condensate control station, RFP power supply room, demineralizer room and filtermaintenance area, TCW pump area, SJAE and recombiner rooms, upper level above the turbine operating floor. The unit coolers are supplied with chilled water from the chilled water system.

Temperature controls for the unit coolers and electric unit heaters are located in the unit inlet air path or installed nearby.

9.4.4.2.2 EBVS General Description

The EBVS schematic diagram is shown on Figure 9.4-2c.

9.4.4.2.2.1 Electrical Building Ventilation System

The electrical building ventilation system is provided with two 100% capacity air supply fans and two 100% capacity exhaust fans.

The ventilation air supply draws outside air through air louvers, control dampers, low efficiency filters, and chilled water coils, and discharges directly into the switchgear, chiller, gas turbine generator, auxiliary boiler and air compressor rooms. Ductwork and bypass dampers are provided to allow recirculation of ventilation air from the switchgear and chiller rooms.

The ventilation exhaust system exhausts air directly to atmosphere through shutoff dampers and outside louvers.

9.4.4.2.2.2 EBVS Unit Coolers and Electric Unit Heaters

Localized unit coolers and/or electric unit heaters are provided as required in the chiller, air compressor and gas turbine generator rooms. The unit coolers are supplied with chilled water from the chilled water system.

Temperature controls for the unit coolers and electric unit heaters are located in the unit inlet air path or installed nearby.

9.4.4.3 Evaluation

The TBS and EBVS have no safety design bases and serve no safety function.

The TBVS is designed to maintain air flows from low airborne radioactivity potential areas to areas of higher potential radioactivity. Ventilation system releases are monitored at the plant vent in compliance with GDC 60 and 64. Where a system is provided with a redundant fan, failure of an operating fan automatically starts the standby fan to maintain continuity of ventilation.

The exhaust air from the TBVS is monitored for radioactivity prior to discharge to the plant vent. Upon detection of high radiation, alarms are annunciated locally and in the main control room. Refer to Section 11.5 for a description of the radiological monitoring system.

Evaluation of the TBVS and EBVS with respect to fire protection is discussed in Subsection 9.5.1.

9.4.4.4 Tests and Inspections

All major components are tested and inspected as separate components prior to installation, and as integrated systems after installation, to ensure design performance. Ductwork system air flows are measured and adjusted to meet design requirements within +/- 10%, and all instruments are calibrated to the design setpoints. The systems are preoperationally tested in accordance with requirements of Chapter 14.

Periodic inspections and measurements include air flows, water flows, air and water temperatures, filter pressure drops, controls positions, to verify the systems condition, and ensure operability and integrity of the systems for normal plant operation.

9.4.4.5 Instrumentation Application

All control actuations, indicators, and alarms for normal plant operation are located in local control panels in the TBVS and EBVS equipment areas. Any one or more alarms at a local control panel will be retransmitted to the main control room as a single alarm.

Controls and instrumentation for the TBVS and EBVS includes:

(1) heating and cooling temperature indicators and controls for the entering mixed air and recirculated air;

(2) local low and high temperature switches and alarms for heated and cooled air supply with summary panel trouble alarm to the control room computer;

(3) differential pressure indicators, differential pressure switches, and high alarm for the air filters;

(4) air flow indicator and control for each supply fan; and

(5) air flow failure switch and alarm for each exhaust fan, with summary panel trouble alarm to the control room computer.