TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

July 30, 1985

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

Enclosed are changes to the Watts Bar Nuclear Plant (WBN), units 1 and 2 Final Safety Analysis Report (FSAR) which are necessary for TVA to verify that the as-built plant is in conformance with the description in the FSAR as amended. These changes include revisions to Chapter 9, Auxiliary Systems, and revisions to tables 9.4-4, 9.4-7, 9.4-9, 9.4-10, and 9.4-11. These changes will be included in the next amendment (56) to the WBN FSAR.

If there are any questions, please get in touch with K. P. Parr at FTS 858-2682.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. A. Domer

J. A. Domer, Chief
Nuclear Licensing Branch

Sworn to and subscribed before me
this 30th day of July 1985

Paulette T. White
Notary Public
My Commission Expires 8-24-88

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attention: Dr. J. Nelson Grace, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

A001
1/1

to ensure safe handling of fuel assemblies:

1. Electrical Interlocks

a. Bridge, Trolley and Hoist Drive Mutual Interlocks

Bridge, trolley and winch drives are mutually interlocked, using redundant interlocks to prevent simultaneous operation of any two drives and therefore can withstand a single failure.

b. Bridge Trolley Drive - Gripper Tube Up

Bridge and trolley drive operation is prevented except when the gripper tube up position switches are actuated. The interlock is redundant and can withstand a single failure.

c. Gripper Interlock

An interlock is supplied which prevents the opening of a solenoid valve in the air line to the gripper except when zero suspended weight is indicated by a force gage. As back-up protection for this interlock, the mechanical weight actuated lock in the gripper, prevents operation of the gripper under load even if air pressure is applied to the operating cylinder. This interlock is redundant and can withstand a single failure.

d. Excessive Suspended Weight

Two redundant excessive suspended weight switches open the hoist drive circuit in the up direction when the loading is in excess of 110 percent of a fuel assembly weight. The interlock is redundant and can withstand a single failure.

e. Hoist-Gripper Position Interlock

An interlock in the hoist drive circuit in the up direction permits the hoist to be operated only when either the open or closed indicating switch on the gripper is actuated. The hoist-gripper position interlock consists of two separate circuits that work parallel such that one circuit must be closed for the hoist to operate. If one or both interlocking circuits fail in the closed position, an audible and visual alarm on the console is actuated. The interlock, therefore, is not redundant but can withstand a single failure since both an interlocking circuit and the mointoring circuit must fail to cause a hazardous condition.

P The hoist is also provided with a low-load safety circuit, which 9.1-20 will prevent down-travel of the hoist if the load cell weight is suddenly reduced by 300 pounds. This minimizes the possibility of fuel assembly damage if one fuel assembly were to be lowered on top of another fuel assembly.

9.2.1.5.6 Control Valves

All ERCW air operated and motor operated valves, open and closed positions, are displayed in the Main Control Room by means of lights incorporated either on the controlling hand switch or on a valve status light subpanel. All air operated temperature and flow control valves are designed to fail open on loss of electrical power and/or operating air, thereby providing maximum ERCW cooling flow to the equipment being supplied. 28

ERCW is supplied to each upper and lower containment and control rod drive ventilation cooler through a throttling action type valve controlled by a temperature indicating controller. Manual and/or automatic override to fully close the control valve is provided by means of a hand switch and/or logic signal (Figures 9.2-5 through 9.2-9).

ERCW is supplied to each air conditioner condensing unit through an automatic water regulating valve controlled by cooling coil pressure.

Each CCS heat exchanger incorporates a motor operated valve in its ERCW discharge line. Each valve may be placed in either of two intermediate, throttled positions in addition to the full open or closed positions. The desired position is selected manually from the control room for the particular plant operating condition. In addition, the heat exchanger C valve has automatic controls to ~~fully~~ open the valve in response to a loss of offsite power signal or a safety injection signal in either unit. Such automatic controls are not required for heat exchangers A or B since their valves are normally open, whereas heat exchanger C's valve may be normally closed. 52

to the low-flow intermediate position

ERCW is supplied to each additional cooler or heat exchanger through an on-off action type valve controlled by either a hand switch, a temperature switch, a manual valve, a logic signal, or various combinations of these.

9.2.1.6 Corrosion, Organic Fouling, and Environmental Qualification

No provision is made for prevention of the effects of corrosion on the structural integrity of this system, since allowances for such corrosion were made by increasing the wall thickness of the pump pressure boundary, pipe, heat exchanger shells and tubes, and other system pressure retaining components. However, measures have been taken to compensate for the effects of corrosion on the flow passing capability of the system. The normally wetted portion of the buried supply and discharge headers will be lined insitu with cement mortar, and much of the smaller diameter piping will be stainless steel. 49

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Control of organic fouling, including slime and Asiatic clam growth, is provided by use of periodic injection of sodium hypochlorite and by use of strainers in the supply headers. Each supply header section (1A, 2A, 1B, and 2B) is provided with a strainer (auto backwash type) capable of removing particles and organic matter larger than 1/32-inch diameter. The strainers are located in the intake pumping station downstream of the ERCW pumps. | 52

In order to inhibit growth of Asiatic clams, provisions are made for injection of sodium hypochlorite periodically during the spawning season to kill any clams which are small enough to pass through the ERCW strainer and still become established within the system. | 52

In order to maintain piping dead ends with a chlorine residual all of the normal non-operating heat exchangers will be operated periodically except the containment spray heat exchangers. Small bypass lines from upstream of the supply valve to downstream of the discharge valve provide a small flow to maintain a residual of chlorine in the dead-end sections of the piping to and from the heat exchangers. These drain lines are piped to the building floor drains and will be used periodically to maintain a residual of chlorine in these feedlines. | 52 | 52

The containment spray heat exchangers and piping between the motor-operated supply and discharge isolation valves are filled with demineralized water treated ~~to prevent corrosion.~~ with ammonium hydroxide and hydrazine. | 55

Backflushing capability of the supply headers from the component cooling heat exchangers to the pumping station is also provided to remove debris.

To the extent to which they are exposed to atmospheric conditions, all pumps and valves will be designed to operate under the most extreme climatic conditions that are expected to prevail in the southeastern United States.

9.2.1.7 Design Codes

The ERCW system components are designed to the codes listed in Table 3.2-2a. | 52

Cooling water for the CCS heat exchangers is supplied from the Essential Raw Cooling Water System, ensuring a continuous source of cooling medium.

During normal and post-accident conditions, component cooling water is provided for the following equipment:

1. CSS containment spray pump | 52
2. CVCS centrifugal (CNTFGL) charging pump
3. CVCS Reciprocating (RECIP) Charging Pump
4. CVCS Letdown Heat Exchanger (HE)
5. CVCS Excess Letdown Heat Exchanger
6. CVCS Seal Water Heat Exchanger
7. CVCS Gas Stripper and Boric Acid Evaporator Package (GSABAEP)
8. RCS Reactor Coolant Pump
9. RHRS Pump
10. RHRS Heat Exchanger
11. SFPCS Heat Exchangers
12. SIS Pump
13. Sample System (SS) Sample Heat Exchangers
14. SS Hot Sample Chillers
15. SS Gross Failed Fuel Detector (DET)
16. SS Post Accident Sampling System (PASS) Heat Exchanger
17. WDS Condensate Demineralizer Waste Evaporator (CDWE) | 52
18. WDS Waste Gas Compressor
19. SS High Temperature RCS Crud Sample Heat Exchanger (Unit 1 only)

Flow requirements for the preceding equipment are listed in Table 9.2-6. Tables 9.2-3, -4, and -5 specify which equipment requires cooling water during various operational modes.

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5. The CCS pump seal leakage collection tank is TVA Class L. The associated drain piping, valves, and seal leakage return pumps are TVA Class G from the collection point to the pumps outlet check valves, 1-70-535 and 2-70-536. 52

6. The high temperature RCS crud sample heat exchanger piping between valves 1-ISV-70-775 and 1-ISV-70-777 IS TVA Class G.

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An alternate vent path is afforded by an 8" diameter overflow line, which is mainly internal to the RWST and is therefore protected.

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~~The issue of containment sump vortexing is being investigated by model testing. The conclusions of the testing will be summarized in this section when the testing is completed and approved.~~

A 1:4 scale model study which demonstrates the acceptability of the revised sump, sump screen, and trash rack design has been performed. The report of the model study, and an NPSH ~~evaluation~~ evaluation were submitted by letter from J.E. Gilleland to S.A. Varga dated May 23, 1979. Additional detail, including a comparison of the final sump design with the provisions of Regulatory Guide 1.82, is provided in ~~Section~~ FSAR section 6.3.2.

TABLE 9.2-3

Equipment Requiring Component Cooling Water During Various Plant Operating Modes:
Unit 1 - Train 1A - CCS Heat Exchanger A

Equipment Receiving Cooling Water	No. Avail	Operating Modes: Startup	Normal Operation	Shutdown at 4 hrs	Shutdown at 20 hrs	Refueling	Hot Standby	Safety Injection	Recirculation (LOCA)
CSS PUMP	1	0[1]	0[1]	0[1]	0[1]	0[1]	0[1]	0[1]	0[1]
CVCS CNTFGI CHARGING PUMP	1	1	0[1]	1	1	1	0[1]		1
CVCS RECIP CHARGING PUMP	1	0[1]	1	0[1]	0[1]	0[1]	0[1]	0	0[1]
CVCS LETDOWN HE	1	1	1	1	1	0	0	0	0
CVCS EXCESS LETDOWN HE	1	1[1]	0	0	0	0	0	0	0
CVCS SEAL WATER HE	1	1	1	1	1	0[1]	1	0[1]	0[1]
CVCS GSABAEP	1	1	1	1	1	1	0[1]	0[1]	0[1]
RCS REACTOR COOLANT PUMP	4	4	4	4	0[1,4]	0	0[1]	0[1]	0
RHRS PUMP	1	1	0[1]	1	1	1	0[1]	1	1
RHRS HEAT EXCHANGER	1	1	0	1	1	1	0	0	1
SFPCS HEAT EXCHANGER	1	1	1	0[1]	0[1]	1	1	1	0
SIS PUMP	1	0[1]	0[1]	0[1]	0[1]	0[1]	0[1]	1	1
SS SAMPLE HE 1A	1	1	1	1	1	1	1	0[1]	0[1]
SS SAMPLE HE 1B	1	1	1	1	1	1	1	0[1]	0[1]
SS SAMPLE HE 1C	1	1	1	1	1	1	1	0[1]	0[1]
SS HOT SAMPLE CHILLERS	1	1	1	1	1	1	1	0[1]	0[1]
SS GROSS FAILED FUEL DET	1	1[5]	1[5]	1[5]	1[5]	1[5]	1[5]	0[1]	0[1]
WDS WASTE GAS COMPRESSOR Sample	1	1	1	0[1]	0[1]	0[1]	0[1]	0[1]	0[1]
SS High Temp RCS Crud Hx	1	1[2,5]	1[2,5]	1[2,5]	1[2,5]	1[2,5]	1[2,5]	0	0
HEAT LOAD - 10^6 BTU/HR		96.2	64.4	148.0	60.6	60.5	15.8	12.2	70.3

NOTES:

1. Not in service, however, equipment still receives cooling water.

2. This heat exchanger operates intermittently.

3. Cooling flow not normally required for the 20 hour cooldown period. If cooling flow is required, but not available, flow to the CVCS GSABAEP may be reduced to compensate.

4. Pumps shutoff when reactor coolant is approximately 160 to 170°F.

5. The high temp RCS Crud Hx and the GFFD are not used at the same time.

Table 9.2-6
(Continued)

EQUIPMENT COOLING REQUIREMENTS

	Heat Load Ea 10^6 B/HR	Total Heat Load 10^6 B/HR	Reqd Flow Ea GPM	Total Flow GPM
CVCS centfgl charging pump				
Motor cooler	-	.067		28
Bearing oil cooler	.046		-	
Gear oil cooler	.021		20	
Seal cooler	-		8	
CVCS recip pump			-	
Fluid drive cooler	.45	.471		81
Cooler	.021		73	
CSS pump	.02		8	
SS hot sample chillers	.216	.02	2	2
SS gross failed fuel detector	.21	.216	8	8
WDS CDWE package		.21	13	13
Condenser	15.72	15.944		1,600
Sub-cooler			1,572	
Vent gas cooler	0.224		28	
PAS heat exchanger	0.936	0.936	10	10
SS High Temp RCS Crud Sample Hx	0.27	0.27	20	20

[1]Varies, Unit start - 37.4 (discontinued after RC Pumps started)

Shutdown (4th hour) - 120.0
Shutdown (20th hour) - 37.4
Refueling - 28.0 (average heat load during refueling)
Recirculation (LOCA) - 70.0 (approximate initial value)

[2]Required flow decreases to 300 gpm during unit shutdown at 4 hrs, unit shutdown at 20 hrs, refuling, and hot standby

Revised by Amendment 52

TABLE 9.2-7

COMPONENT COOLING WATER SYSTEM
MINIMUM FLOW REQUIREMENTS, GPM

	Normal Two Units Full Power	One Unit LOCA One Unit Hot Standby
Residual heat removal heat exchanger(1)	-	5,000
Reactor coolant pumps	1,560	780
Seal water heat exchangers	400	400
Sample heat exchangers(5)	92	92
Letdown heat exchangers	2,000	1,000
Containment spray pumps	4(3)	4
Excess letdown heat exchangers	-	-
Spent fuel pool heat exchangers(2)	6,000	3,000
Residual heat removal pumps	10(3)	10
Safety injection pumps	30(3)	30
Charging pumps(4)	218	218
Gas stripper and boric acid evaporator package	3,342	3,342
Waste gas compressors	80	80
SS hot sample chiller	16	16
SS gross failed fuel det	26	26
SS High Temperature RCS Crud Sample Hx	20(6)	
Total	13,778	13,998
Number of pumps required	3	2
Number of pumps in service	2	2
Number of pumps installed	5	5
Pump capacity (each), 6,000 gpm 190 ft. head		
Pump motor horsepower, 350 hp		

Notes:

(1) The flow rates shown reflect the use of one subtrain of RHR equipment in the unit which suffered the LOCA and one RHR subtrain in the units(s) in the cooldown mode. In either case, the second RHR train may be placed in service provided the necessary pumps are operative. Single subtrain operation results in minimum safeguards requirements and a minimum cooldown rate.

(2) This item can be removed from service intermittently, dependent upon the amount of fuel in the pool, pool water temperature, and demands of other services.

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TABLE 9.2-7 (Continued)

Notes: (continued)

(3) Not necessary; however, it is assumed flow will not be shut off.

(4) The flows shown include cooling to the standby pump.

(5) Includes all SS equipment.

(6) Unit 1 only ; Also will not be used concurrently with the GFFD cooler.

application, Figures 9.3-3 and 9.3-4 for logic, and Figures 9.3-5 and 9.3-6 for the detailed flow diagrams.

9.3.2 Process Sampling System

9.3.2.1 Design Basis

The process sampling system or by the Reactor Coolant Crud Sampler is composed of both the routine and post accident sampling subsystems. The routine sampling subsystem is designed to obtain samples from the various process systems in each of the two units. The samples are obtained in the titration room, hot sample room, locally (grab samples) for laboratory analysis. This system has no safety-related function. During a loss-of-coolant accident, this system is isolated at the containment boundary. Fission product release will be kept within limits stated in 10CFR20 by limiting sample system discharges for all operational modes both normal and abnormal. 52 52

The postaccident sampling subsystem (PASS) will be used to acquire samples of the reactor coolant and containment atmosphere during a loss of coolant accident (LOCA). This system has no safety-related function. However, the operation of this subsystem will require the operation of various closed containment isolation valves. The PASS is discussed in Section 9.3.2.6. 52

9.3.2.2 System Description

The routine sampling subsystem consists of the following collection areas and equipment:

1. The titration room where secondary process system samples are routed for automatic analysis of several variables such as pH, conductivity, oxygen, etc. These variables are indicated and recorded, and any variable exceeding established limits is annunciated in the titration room.

In addition, nonradioactive grab samples maybe analyzed in this room.

2. The hot sample room where primary samples are routed for automatic analysis of such variables as pH and conductivity. These variables are indicated in the hot sample room and recorded in the titration room, except the evaporator condensate demineralizer samples which are recorded in the hot sample room. Any variable exceeding established limits is annunciated in the titration room. Most hot sample room samples are radioactive grab samples which are taken to the radiochemical laboratory for further analysis.

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3. Local grab samples are taken throughout the plant for detailed chemical and radiochemical analysis in the radiochemical laboratory, titration room, or offsite facility depending on where the samples are collected and the analyses required. 52

4. Boron concentration monitors (one per unit) are also located in the hot sample room. The RCS letdown system is sampled continuously by these boron concentration monitors and the boron concentration is recorded and displayed in the main control room (panels 1-M-6 and 2-M-6). 52

5. The Gas Analyzer System sequentially monitors points in the Waste Disposal and Chemical Volume and Control Systems for hydrogen and oxygen concentrations in a nitrogen atmosphere. The concentrations are displayed, and recorded, and an alarm is given at the analyzer when appropriate. 52

6. See attachment 2.

The routine sampling subsystem is to be operated manually throughout the full range of power operations. 52
All sample lines originating within containment have air-operated isolation valves near the sample point and inside and outside containment for automatic containment isolation. 47
All sample lines outside containment have manual isolation valves. All air-operated isolation valve hand switches are located on a wall panel in the hot sample room. 55
Each sample line to the titration or hot sample room cubicles has an indicator each for pressure, temperature, and flow rate. All samples, whether local or to a sample room, have pressure throttling valves and heat exchangers (if required).

To ensure that representative samples are obtained, the sample points are located in a free-flowing stream and the sample takeoff points are on the side of the horizontal pipes. Prior to the collection of a sample, each sample line is purged of stagnant process fluid. The volume of fluid purged and the volume of sample collected are dependent on the stream being sampled, length of sample line, and analysis to be performed. 52

Each sample is listed in Table 9.3-2 giving the sampled system, sample location, system design temperature and pressure, sample type (local, titration room, hot sample room, gas analyzer, or boron concentration monitor). All sampling lines from systems covered by TVA Classes A, B, C and D from root valve through first valve in sampling lines, or through second containment isolation valve if sample lines are extensions of containment, shall be the same class as the sampled systems. Also, sample lines which form a primary pressure boundary for the boron concentration monitor are TVA Class B. 52
Each of these sample lines which interface with TVA Class A piping has a 3/8 inch O.D. The sample line itself serves as a flow restrictor. 52
Sample lines in seismic Category I(L) structures are a minimum of TVA Class G.

SHEET ____ OF ____

Attachment 1

COMPUTED ____ DATE ____

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9.3.2.2

6. The Reactor Coolant Crud Sample Station obtains a sample from the reactor coolant hot legs 1 AND/OR 3 AND separates it into solid crud AND filtrate. These sample components are then sent to an off site facility for detailed chemical, radiochemical, and physical analyses.

with the exception of the RCS crud sampler which will be installed after fuel load,

9.3.2.4 Tests and Inspections

All system equipment is tested prior to plant operation, under both normal conditions and a simulated maximum flood condition. Periodic tests will be performed after plant operation begins, to ensure proper operation of the routine sampling subsystem equipment. 52

9.3.2.5 Instrumentation Applications

The routine sampling subsystem is designed to be operated manually except for the gas analyzer, boron concentration monitor, and the automatic analyzers (e.g. conductivity, pH, cation conductivity, silica, sodium, hydrazine, dissolved oxygen). 52

9.3.2.6 Postaccident Sampling Subsystem

The Postaccident Sampling Subsystem (PASS) provides samples of the reactor coolant, containment atmosphere, and containment sump during a LOCA. It is designed to meet the intent of and provide for sample acquisition, analysis, and disposal, as described in Section II.B.3 of NUREG-0737, and keep personnel exposures within GDC19 of 10CFR50, Part A, limits.

9.3.2.6.1 System Description

The PASS is composed of the following:

a. The Postaccident Sampling Facility (PASF) which contains Sentry Equipment Corporation (SEC) High Radiation Sampling System (HRSS) or equivalent and associated control panels. 52

b. Sample connections to the reactor coolant, containment sump, and containment atmosphere.

c. Tubing, valving, and fittings as required to convey samples to the PASF.

9.3.2.6.2 Postaccident Sampling Facility

The PASF is located in the auxiliary building on elevation 729 between columns A5, W, and X (for unit 1) and A11, W, and X (for unit 2). Each unit will have a separate PASF.

The PASF consists of piping, tubing, valves, components, and instrumentation necessary to obtain, do partial analysis, and dispose of the samples described in Section 9.3.2.6. The major equipment used for these activities is the SEC HRSS. It is described in Section 9.3.2.6.3. The ventilation exhaust is filtered with charcoal absorbers and high-efficiency particulate air (HEPA) filters. Liquid waste from the SEC HRSS, with the exception of the sampling panels' drip pans, is routed to waste holdup tank. From this tank the liquid can be routed back to 52 55

Surges in RCS inventory due to load changes are accommodated for the most part in the pressurizer. The volume control tank provides surge capacity for reactor coolant expansion not accommodated by the pressurizer. If the water level in the volume control tank exceeds the normal operating range, a proportional controller modulates a three way valve downstream of the reactor coolant filter to divert a portion of the letdown to the Holdup Tanks in the Boron Recycle System. If the high-level limit in the volume control tank is reached, an alarm is actuated in the control room and the letdown flow is completely diverted to the Boron Recycle System Holdup Tanks.

The Boron Recycle System (Section 9.3.7) receives and processes reactor coolant effluent for reuse of the boric acid and purified water. The system decontaminates the effluent by means of demineralization and gas stripping, and uses evaporation to separate and recover the boric acid and reactor makeup water.

Low level in the volume control tank initiates makeup from the Reactor Makeup Control System. If the Reactor Makeup Control System does not supply sufficient makeup to keep the volume control tank level from falling to a lower level, a low alarm is actuated. Manual action may correct the situation or, if the level continues to decrease, an emergency low level signal from ~~either~~ level channels causes the suction of the charging pumps to be transferred to the refueling water storage tank. both of the

The reciprocating charging pump is also used to perform hydrostatic tests which verify the integrity and leak-tightness of the RCS. The pump can pressurize the RCS to the maximum designated test pressure. The hydrostatic test is performed prior to initial operation and is part of the periodic RCS in-service inspection program.

9.3.4.2.2 Chemical Control, Purification and Makeup System

Reactor Coolant Chemistry Specifications are given in Table 5.2-10.

pH Control

The pH control chemical employed is lithium hydroxide. This chemical is chosen for its compatibility with the materials and water chemistry of borated water/stainless steel/zirconium/inconel systems. In addition, Lithium-7 is produced in the core region due to irradiation of the dissolved boron in the coolant.

The concentration of Lithium-7 in the RCS is maintained in the range specified for pH control (Table 5.2-10). If the concentration exceeds this range, as it may during the early stages

This should be transmitted prior to FL DSE

and nitrogen purge connections are also provided. The tank can also accept the seal water return flow from the reactor coolant pumps although this flow normally goes directly to the suction of the charging pumps.

Volume control tank pressure and temperature are monitored with indication given in the control room. Alarm is actuated in the control room for high and low pressure conditions and for high temperature. The volume control tank pressure control valve is automatically closed by the low pressure signal.

Two level channels govern the water inventory in the volume control tank. These channels provide local and remote level indication, level alarms, level control, makeup control, and emergency makeup control.

If the volume control tank level rises above the normal operating range, one channel provides an analog signal to a proportional controller which modulates the three-way valve downstream of the reactor coolant filter to maintain the volume control tank level within the normal operating bank. The three-way valve can split letdown flow so that a portion goes to the holdup tanks and a portion to the volume control tank. The controller would operate in this fashion during a dilution operation when reactor makeup water is being fed to the volume control tank from the Reactor Makeup Control System.

If the modulating function of the channel fails and the volume control tank level continues to rise, the high level alarm will alert the operator to the malfunction and the full letdown flow will be automatically diverted by the backup level channel.

During normal power operation, a low level in the volume control tank initiates auto makeup which injects a pre-selected blend of boric acid solution and reactor makeup water into the charging pump suction header. When the volume control tank level is restored to normal, auto makeup stops.

If the automatic makeup fails or is not aligned for operation and the tank level continues to decrease, a low level alarm is actuated. Manual action may correct the situation or, if the level continues to decrease, a low-low signal from ~~either~~ level channels opens the stop valves in the refueling water supply line, and closes the stop valves in the volume control tank outlet line.

both of the

Chemical Mixing Tank

The primary use of the chemical mixing tank is in the preparation of caustic solutions for pH control and hydrazine solution for oxygen scavenging.

9.3-26

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Concentrates Filter

Two concentrates filters are provided to filter the completed batch of 12 wt. percent boric acid from the evaporator in transit to the boric acid tanks. The design flow rate is compatible with the design flow of the boric acid evaporator concentrates pumps and is chosen to enable transfer of a completed batch within about one- half hour. The vessels are constructed from austenitic stainless steel and connections are provided for venting and draining. The filter element is a disposable synthetic cartridge.

Ion-Exchange Filter

An ion-exchange filter is provided to collect resin fines and particulate larger than 25 microns from the feed to each gas stripper and boric acid evaporator package. The design flow rate is equal to the rated flow to the gas stripper and boric acid evaporator package. The vessels are provided with connections for venting and draining and are constructed of austenitic stainless steel. The filter elements are made of a disposable synthetic fiber.

Orifices

Boric Acid Tank Orifice

Each boric acid tank orifice is designed to pass the minimum flow required to provide sufficient recirculation through the piping and tanks with the transfer pumps. The orifice is constructed of austenitic stainless steel.

Gas Stripper and Boric Acid Evaporator Packages

The gas stripper and boric acid evaporator package (one per unit) removes nitrogen, hydrogen, and fission gases from the evaporator feed and then concentrates the weak boric acid solution to 12 weight percent boric acid for re-use. The package consists of a feed pre-heater, stripping column, vent condenser, evaporator, absorption tower, evaporator condenser, distillate cooler, distillate pumps, boric acid concentrates pumps, and vent compressor associated piping, valves and instrumentation.

The borated feed water from the holdup tanks flows into the package to the feed preheater which heats the feed stream with process steam. The steam flow is controlled by temperature control of the feed exiting from the feed preheater.

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The preheated feed flows into the stripping column where nitrogen, hydrogen, and fission gases are stripped from the borated water. The feed flow is controlled by the evaporator liquid level. The stripped gases are vented via the vent header to the Waste Disposal System. This venting is aided by the vent compressor during periods of high vent header pressure. The evaporator concentrates the borated liquid to 12 weight percent boric acid. The evaporator bottoms are continuously recirculated by one of the boric acid concentrates pumps, and are monitored by a density meter. When a batch is completed it is transferred to the boric acid tanks if sample analysis indicates that it is suitable for re-use. If it cannot be re-used, the concentrated boric acid solution can be returned to the holdup tanks for further processing or transferred to the Waste Disposal System.

Except for vapors used as stripping steam, all vapors leaving the evaporator flow through the absorption tower and then are condensed in the evaporator condenser. The distillate is pumped through a distillate cooler and out of the unit. A portion of the distillate is recycled to the absorption tower to serve as the absorption medium. After the distillate leaves the gas stripper-boric acid evaporator package, it goes to the primary makeup water storage tank for re-use. If analysis of the distillate is required, it is sent to the monitor tank.

All lines and miscellaneous equipment in the system containing concentrated boric acid are heat traced to prevent boric acid precipitation at low temperatures.

9.3.7.2.2 System Operation

The Boron Recycle System is employed, when required to process the contents of the holdup tanks. Sufficient instrumentation readouts and alarms are provided to properly operate the system.

Evaporation

Water is accumulated in the holdup tank until sufficient quantity exists to warrant an evaporator startup. Prior to startup of the evaporator, the contents of the recycle holdup tank are analyzed and, if necessary, are recirculated through the evaporator feed demineralizers and filter. The flow can be discharged back to the holdup tank or to the evaporator. The evaporator is then operated to produce a batch of 12 weight percent boric acid.

During the operation of the evaporator, condensate is continuously sent to the primary water storage tank via the evaporator

System or Component	480V Input Source	
Chemical Volume and Control System	C & A bldg vent bds 2A1-A, 2B1-B	41
~~Safety Injection System~~	~~C & A bldg vent bds 1A1-A, 1B1-B~~	
Ice Condenser System	C & A bldg vent bds 1A1-A, 1B1-B	
Refueling Water Storage Tank	C & A bldg vent bds 1A1-A, 1B1-B	4
Essential Raw Cooling Water System	C & A bldg vent bds 2A1-A	
Waste Disposal System	Chem and Vol Cont Bd A	
Makeup Water Treatment Plant	Water Treatment Building D-MCC-281-1	

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TABLE 9.3-2
(Continued)

PROCESS SAMPLING SYSTEM SAMPLE LOCATIONS AND DATA

Sampled System	Sample Location	Design Pressure, psig Temperature, °F	Sample Type (See Note 1)
RCS	Hot Leg Loop 3	P = 2485 T = 650	Hot Sample Room
RCS	Pressurizer Liquid	P = 2485 T = 650	Hot Sample Room
RCS	Pressurizer Gas	P = 2485 T = 650	Hot Sample Room
Main Stream	Steam Gen No. 1 to H.P. Turbine	P = 1185 T = 600	Titration Room
Main Steam	Steam Gen No. 1 to H.P. Turbine	P = 1185 T = 600	Local
Main Steam	Steam Gen No. 2 to H.P. Turbine	P = 1185 T = 600	Titration Room
Main Steam	Steam Gen No. 2 to H.P. Turbine	P = 1185 T = 600	Local
Main Steam	Steam Gen No. 3 to H.P. Turbine	P = 1185 T = 600	Titration Room
Main Steam	Steam Gen No. 3 to H.P. Turbine	P = 1185 T = 600	Local
Main Steam	Steam Gen No. 4 to H.P. Turbine	P = 1185 T = 600	Titration Room
Main Steam	Steam Gen No. 4 to H.P. Turbine	P = 1185 T = 600	Local
Main Steam	Steam Gen No. 1, 2, 3, & 4 Downcomers	P = 1185 T = 600	Hot Sample Room
Main Steam	Steam Gen Blowdown No. 1, 2, 3, & 4	P = 1185 T = 600	Hot Sample Room
Blowdown	Steam Gen Blowdown Flash Tank	P = 500 T = 300	Local
RCS	HOT LEG LOOP 1	P = 2485 T = 650	RCS Crud Sampler
RCS	HOT LEG LOOP 3	P = 2485 T = 650	RCS Crud Sampler

Revised by Amendment 52
Sheet 4

Upon receipt of an accident signal, both emergency pressurizing fans are started by the same accident signal that starts the air cleanup units. ~~(Emergency pressurization is not initiated upon a high chlorine signal).~~ The capability is provided to place either of the operating air cleanup units and either of the operating emergency pressurizing fans in the standby mode. The standby components start automatically in the event of a failure of the operating air cleanup unit or its pressurizing fan.

During control room isolation, the building normal air pressurizing supply system fan will continue to operate to supply fresh air to the electrical board rooms air-conditioning system. Double isolation dampers, mounted in the normal air pressurizing supply duct to the Main Control Room air-conditioning system and spreading room supply duct will automatically close to prevent the leakage of unfiltered outdoor air to the control room. | 24

The battery rooms ventilation system consists of three 100 percent capacity exhaust fans, with two on standby (except during El 692 smoke removal operations), discharging approximately 2200 cfm of battery room air to the outdoors. The fans are located on the El 692 floor with two located near the west end of the building and one located near the east end. | 55

Air to replace that exhausted from each battery room is taken from the electric board rooms air-conditioning system return air. Fire dampers, provided in each room's air exhaust duct and air supply opening, operate to isolate the room upon high temperature.

The battery room exhaust fans are the centrifugal type, each rated at 2200 cfm against 1.25-inch water gauge static pressure and each direct driven by a 1.5-hp motor.

The battery rooms ventilation system is required to operate at all times except during the design basis flood and during and during a 72-hour period following a fire, El 692 smoke removal operations. A standby fan will automatically start upon failure of the operating fan to produce airflow; however, during El 692 smoke removal operations, the two standby fans are not available for use nor required. The battery room fans are ESF equipment and are connected to the emergency power system. | 55

The spreading room is ventilated by two spreading room exhaust fans located at the east end of the spreading room at El 729. These 50 percent capacity fans each exhaust approximately 2000 cfm of air to the outdoors for a total of 4000 cfm. One spreading room supply fan, located in the mechanical equipment room at El 755, supplies approximately 1200 cfm of air from the control room air- conditioning return air system. An additional 2000 cfm of air is supplied by the pressurizing supply fans. The room is thus maintained at a slight negative pressure and approximately 800 cfm enters the spreading room via leakage from the adjoining rooms. | 52

Upon receipt of an accident signal, both emergency pressurizing fans are started by the same accident signal that starts the air cleanup units. ~~(emergency pressurization is not initiated upon a high chlorine signal).~~ The capability is provided to place either of the operating air cleanup units and either of the operating emergency pressurizing fans in the standby mode. The standby components start automatically in the event of a failure of the operating air cleanup unit or its pressurizing fan.

During control room isolation, the building normal air pressurizing supply system fan will continue to operate to supply fresh air to the electrical board rooms air-conditioning system. Double isolation dampers, mounted in the normal air pressurizing supply duct to the Main Control Room air-conditioning system and spreading room supply duct will automatically close to prevent the leakage of unfiltered outdoor air to the control room. | 24

The battery rooms ventilation system consists of three 100 percent capacity exhaust fans, with two on standby (except during El 692 smoke removal operations), discharging approximately 2200 cfm of battery room air to the outdoors. The fans are located on the El 692 floor with two located near the west end of the building and one located near the east end. | 55

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The battery room exhaust fans are the centrifugal type, each rated at 2200 cfm against 1.25-inch water gauge static pressure and each direct driven by a 1.5-hp motor.

The battery rooms ventilation system is required to operate at all times except during the design basis flood and during El 692 smoke removal operations and during a 72-hour period following a fire. A standby fan will automatically start upon failure of the operating fan to produce airflow; however, during El 692 smoke removal operations, the two standby fans are not available for use nor required. The battery room fans are ESF equipment and are connected to the emergency power system. | 55

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conditions to conserve heat. Supply air is ducted to various clean or accessible areas of the Auxiliary Building from which it flows to areas of progressively greater contamination potential before being exhausted through a duct system by the building exhaust fans. In the event of a fuel-handling accident, radiation monitors in the vicinity of the spent fuel pool will signal for system isolation before the first contaminated airborne particles and gases reach the normal exhaust stack. See Section 9.4.2.

The building supply air is provided by belt-driven centrifugal fans located downstream of the heating/cooling coils. Each fan is rated at 100,000 cfm at 4.0 inch water gauge static pressure and is driven by a nominal 100-hp motor. These fans are not Engineered Safety Features and are not energized from emergency power. The building supply filters are composed of two parallel banks with 102 individual filter cells per filter bank. Each filter bank is rated at 85 percent efficiency based on NBS atmospheric dust spot tests. | 52

The general exhaust air from the Auxiliary Building is provided by four exhaust fans each rated at 50 percent of system capacity. These fans are controlled in blocks of two; during normal operations one fan is in operation with the remaining fan in the standby mode. These fans are located on the roof of the Auxiliary Building and discharge into the auxiliary building exhaust stack. | 35 | 41 | 35

An inlet damper in series with each auxiliary building exhaust fan is used to regulate the volume of air exhausted as required to maintain 1/4 inch water gauge negative pressure within the building. ~~These dampers are automatically operated by static pressure controllers.~~

Each of the centrifugal exhaust fans is a belt-driven unit rated at 84,000 cfm against a 5.75-inch water gauge static pressure and driven by a nominal 125-hp motor. | 35

The isolation dampers and the ductwork between these dampers that make up part of the Auxiliary Building Secondary Containment Enclosure are designed to the requirements of Safety Class 2b and Seismic Category I. All other portions of this system are Seismic Category I(L).

However, during the interim between unit 1 and unit 2 fuel loading, only a slight negative pressure will be maintained due to continued unit 2 construction. The inlet dampers are automatically operated by static pressure controllers.

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This ventilation system is designed to limit the temperature in the transformer rooms to 104°F when the entering air temperature is 97°F. Electric heaters are provided to maintain temperatures at not less than 60°F when the outside air temperature is 15°F or less. 28 52

The system is designed to meet Safety Class 2b and Seismic Category I standards.

9.4.3.2.7 Miscellaneous Ventilation and AirConditioning Systems

The control rod drive equipment room design maximum ambient temperature is 90°F DB, 67°F WB. To maintain these limits, two 100-percent-capacity air-conditioning units are located within each room. During normal operation, one of the air-conditioning units in each room is in operation with the other on standby. Each unit is automatically controlled by a self-contained thermostat. Electric unit heaters are located in each room to maintain the rooms at no less than 60°F during cold weather.

The instrument shop's design maximum ambient temperature is 80°F. To maintain this, a chilled water cooling coil has been selected which utilizes 100 percent makeup air to prevent the recirculation of any contaminants. The rated capacity of the air-conditioning unit is 74,600 Btu/h with 1250 cfm of air supply. The hot instrument shop exhaust is provided by a lab exhaust hood which is connected to the general building exhaust duct system. 52 55

The sample room is ventilated by five lab hoods, each with an exhaust fan. Three fans are located on the Unit 1 side and each is rated at 900 cfm at 3.5 inches water gauge static pressure. Two fans are located on the Unit 2 side and each is rated at ~~900~~ 1350 cfm at 3.5 inches water gauge static pressure. Air enters the sample room through doors with transfer grilles and back draft dampers. Each hood is provided with a separate exhaust fan and HEPA filter assembly. The HEPA filters located upstream from each fan have a nominal efficiency of 99.97 percent. A differential pressure gauge is used to indicate the need for filter replacement. Each hood exhaust fan discharges into the general building exhaust system. 55

The additional equipment building for Unit 1 is served by three air-conditioning units. The first provides 3500 cfm to the spaces on El. 729.0, 740.5, and 752.0. The second provides 6100 cfm of cooled air to El. 763.5 and El. 775.25. The third provides 9450 cfm to the equipment spaces on El. 786.5. The Unit 1 additional equipment building air-conditioning units are each designed to cool the intake air from 92°F DB and 73°F WB to 67°F DB and 74°F WB when supplied with 85°F cooling water.

2. Supply fresh air for breathing and contamination control when the primary or secondary containment is or will be occupied.

3. Exhaust primary or secondary containment air to the outdoors whenever the purge air supply system is operated.

4. Clean up containment exhaust during normal operation by routing the air through HEPA-carbon filter trains before release to the atmosphere to keep releases well below 10 CFR 20 limits and to comply with 10 CFR 50 Appendix I. 55

5. Provide a reduced quantity of ventilating air to permit occupancy of the instrument room during reactor operation. The provisions for 2, 3, and 4 above will apply.

6. Assure an unimpeded closure during a LOCA or a fuel handling of the isolation accident valves installed in the system penetrations. 52

Items 1 and 6 above are safety-related functions. 55

The primary containment penetrations for the ventilation supply and exhaust subsystems are designed to primary containment structural standards. These are discussed in detail in Section 6.2.4, "Containment Isolation Systems."

The containment purge system was sized to maintain a safe working environment within the containment during all normal operations. This makes the system capacity more than twice as large as needed for preserving safety and cleaning up containment during a fuel handling accident. In the event of a fuel handling accident, approximately 200 percent of the purging capacity needed to clean up the containment atmosphere in the postaccident period is already in operation or can shortly be brought into operation. 55

To prevent excessive radiation releases to the environment due to a fuel handling accident, the supply fans, exhaust fans, and air cleanup filter assemblies for each unit are controlled in two trains. The controls are designed to have simultaneous starting and stopping of the matching supply and exhaust equipment and to initiate an automatic shutdown and isolation upon receipt of the containment ventilation isolation signal. Following a fuel handling accident, failure of a single component will not prevent full air processing through the remaining purge exhaust/supply train, if desired. 52 55

The containment purge exhaust cleanup equipment will assure that activity released inside containment from a refueling accident or a fuel handling accident will be processed through both HEPA filters and carbon adsorbers before release to the atmosphere. No fuel handling operations inside the primary containment will be allowed unless either the containment purge ventilation system is in an operational status, or the primary containment is isolated. 52 55

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TABLE 9.4-4

FAILURE MODES AND EFFECTS ANALYSIS

DIESEL GENERATOR VENTILATION SYSTEM

	Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
1.	Intake Structure	To channel incoming air flows into the Diesel Generator Building supply air system.	Blocked	Loss of ventilation to one diesel generator train.	None. The remaining diesel generator will be capable of providing adequate power to safely shut down the affected unit.	Possible loss of one diesel generator function ~~central~~ until failure is repaired.
2.	Fire Damper	To prevent a fire from spreading into the diesel generator room.	Open (during a fire)	Fire may spread through ductwork.	Same as Item 1	Possible loss of diesel generator unit's function because of fire.
			Closed (during normal operations)	Same as Item 1	Same as Item 1	Same as Item 1
3.	Motor-Operated Damper	To prevent backflow through the diesel generator room when the ventilation system is idle.	Closed (during normal operation)	Same as Item 1	Same as Item 1	Same as Item 1
			Open (during shutdown)	None	None	
4.	Diesel Generator Room Space Heaters	To maintain the diesel generator rooms at or above 60 F during periods of cold weather.	No output (during cold weather)	None. Reduced ventilation air flows and remaining heater can maintain adequate temperature.	None	Heaters perform no safety-related function.
			Both Heaters fail	Reduced (or no) airflow from ventilation system can maintain adequate Temperatures	None	Can result from Loss of Offsite Power (LOP) or seismic event. In these cases D/G will provide All Necessary heating.

Sheet 1

Added by Amendment 26

TABLE 9.4-4 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

DIESEL GENERATOR VENTILATION SYSTEM

Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
5. Temperature Sensor	To sense the temperature of air as it leaves the diesel generator room and to activate or deactivate fans as necessary to maintain required temperatures.	High (senses A higher than Actual Temperature)	Associated fan will operate continuously until manually turned off.	None	Space heaters will prevent excessive cooling during cold weather.
		Low (senses A longer than Actual Temperature)	None. Second fan and the generator and electrical panel cooling fan and its associated temperature sensor will provide necessary ventilation up to the maximum design outdoor temperature of 97°F.	None	
6. Fire Damper	To prevent a fire from spreading into the diesel generator room.	Same as Item 2	Same as Item 2	Same as Item 1	Same as Item 1
7. ~~Exhaust Fan(s)~~	~~Air exhaust prime mover.~~	~~No output~~	~~None. Redundant train.~~	~~None~~	See Attachment 1
~~7A. Generator and Electrical panel cooling fan~~	~~To maintain acceptable at the generator inlet and inside the electrical panels~~	~~No output~~	~~None. The 2 exhaust fans will provide the necessary ventilation up to the maximum design outdoor air temperature of 97°F.~~	~~None~~	See Attachment 2
8. Flow Sensor	Senses loss of air flow in duct.	High (while associated fan is operating)	None	None	

TVA 11030 (WM-7-75)

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SYSTEM	EFFECT ON PLANT	REMARKS
7. EXHAUST FAN	AIR EXHAUST PRIME MOVER	NO OUTPUT & OUTSIDE TEMP $\leq 97°F$	SECOND FAN AND THE GENERATOR AND ELECTRICAL PANEL COOLING FAN WILL PROVIDE THE NECESSARY VENTILATION	NONE	
		NO OUTPUT & OUTSIDE TEMP $> 97°F$	EXCESSIVE OPERATING TEMPERATURES WILL CAUSE ACCELERATED DEGREDATION AND EARLY FAILURE OF THE ELECTRICAL PANEL AND DIESEL GENERATOR.	NONE: THE SAFETY RELATED SYSTEMS IN THE AFFECTED REACTOR UNIT CAN BE POWERED BY THE REDUNDANT DIESEL GENERATOR OUTPUT.	

DGB FMEA ATTACHMENT 1

SHEET 10.1 OF 14

TI-628 R2

COMPUTED WCC DATE 11/4/84

CHECKED _____ DATE _____

VA 11030 (WM-7-75)

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SYSTEM	EFFECT ON PLANT	REMARKS
7A. GENERATOR AND ELECTRICAL PANEL VENTILATION FAN	TO MAINTAIN ACCEPTABLE TEMPERATURES AT THE GENERATOR INLET AND INSIDE THE ELECTRICAL PANELS	NO OUTPUT & OUTSIDE TEMP ≤ 80°F	NONE. EXHAUST FANS WILL PROVIDE ADEQUATE VENTILATION	NONE.	
		NO OUTPUT & OUTSIDE TEMP > 80°F	EXCESSIVE OPERATING TEMPERATURES WILL CAUSE ACCELERATED DEGREDATION AND EARLY FAILURE OF THE ELECTRICAL PANEL AND THE DIESEL GENERATOR	NONE. THE SAFETY RELATED SYSTEMS IN THE AFFECTED REACTOR UNIT CAN BE POWERED BY THE REDUNDANT DIESEL GENERATOR OUTPUT.	

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ATTACHMENT 2

DGB FMEA

SHEET 10.2 OF 14

TI-628 R2

COMPUTED WJK DATE 11/28/84

CHECKED [signature] DATE 11/30/84

TABLE 9.4-4 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

DIESEL GENERATOR VENTILATION SYSTEM

Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
17. Electrical Board Room Exhaust Fan	Board room ventilation prime mover.	No output	Same as Item 13	Same as Item 13	Same as Item 13
18. Isolation Damper	To prevent backflow through non-operating fans.	Closed	Same as Item 13	Same as Item 13	Same as Item 13
		Open	None	None	
19. Fire damper	To prevent a fire from penetrating the barrier between the diesel generator room and the air exhaust room.	Fail closed (During normal operation)	Air flow through the exhaust hood will be greatly reduced	None	SAME AS Item 1 ~~Redundant fusible links will be used in this damper to eliminate the possibility of a single failure causing a loss of air flow~~
		Fail open (during a fire)	Fire may spread through ductwork	None. The remaining diesel generator will be capable of providing adequate power to safely shut down the affected unit.	Possible loss of one diesel
20. Entire Diesel Generator Building Ventilation System	To maintain plant safety in the event of a loss of offsite power due to a natural diaster or plant accident.	Seismic Event	Essential portions of this system will remain functional because of their design to Seismic Category I requirements.	None	Nonessential components of this system are designed to Seismic Category I(L) if they are located close to essential components or systems.

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Revised by Amendment 33

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
Main Control Room Pressurization and Air Conditioning Subsystem					
1. Tornado damper FCO 31-32, -33	Isolation during tornado conditions	Open (During tornado)	Loss of one of two redundant dampers in duct.	None.	Redundant damper ~~in series with failed damper~~ will keep flow path closed
		Closed (Normal operation)	Loss of fresh air supply to Control Building Pressurization Fan A-A.	None. Redundant fan with parallel flow path.	Control Building Pres. Fan B-B starts upon low flow signal from fan A-A.
~~2. Tornado damper FCO 31-33~~	~~Same as item 1.~~	~~Same as item 1.~~	~~Same as item 1.~~	~~Same as item 1.~~	~~Same as item 1.~~
2. Isolation damper FCO 31-1	Isolate Pressurization Fan A-A supply	Open (Fan A-A on standby)	None	None	Fan B-B, redundant to Fan A-A is operating. Backdraft damper, item 4 prevents backflow through Fan A-A.
3. Control Building Pressurization Fan A-A	To provide fresh air and pressurize Control Building during normal operation; to provide air to lower floors of Control Building during emergency operation modes.	No or low flow	Loss of flow from Fan A-A	~~Momentary decrease of flow~~ Decrease in ventilation & loss of postive ventilation	Fan B-B starts upon low flow signal; alarm initiated in Main Control Room
		Incorrect Vane modulation resulting in reduced flow.	Decreased flow from Fan A-A	Loss of normal positive pressure	If reduction in flow is great enough, redundant pressurization fan starts due to low flow signal. MCR positive pressure is indicated in habitability area.
4. Backdraft damper 31-2097	Precludes backflow from Fan B-B through Fan A-A	Closed (Fan A-A operating)	Loss of flow path for Fan A-A	None	Fan B-B starts upon low flow signal from fan A-A; alarm initiated in MCR.
		Open (Fan A-A on standby)	None	None	Isolation damper FCO 31-1 prevents backflow.

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
5.6. 144-kW Heating Coil	Tempers fresh air supplied to control building during normal operation.	On (Normal operation)	Fresh air warmed too much prior to introduction to air handling units.	None. Cooling coils remove excess heat.	Cooling Coils remove access heat
		Off or no heat	Fresh air not heated prior to entry to air handling units.	None	Control Building equipment will produce sufficient heat to maintain acceptable temperature. Operators will notice departure from optimum comfort conditions and investigate.

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
9. Tornado damper FCO 31-34, -35	Same as item 1.	Open (During tornado)	Same as item 1.	Same as item 1.	same as item 1.
		Closed (Normal operation)	Same as item 1 except fan B-B affected.	Same as item 1.	same as item 1.
		Closed (Emergency operation modes, Emergency Pressurization Fan A-A operating)	Loss of fresh air supply to Control Building Pressurization Fan B-B and ~~loss of flow to~~ Control Building Emergency Pressurization Fan A-A	None	Control Building Emergency Pressurization Fan A-A automatically starts upon low-flow emergency pressurization Fan B-B and supplies air to lower floors of the Control Building. Control Building Emergency Pressurization Fan B-B automatically starts upon low-flow signal from Emergency Pressurization Fan A-A to maintain habitability area positive pressure. Each Control Building Emergency Pressurization is duct connected to a separate air intake to provide two 100-percent capacity air supply systems. If it is desired to utilize the emergency air intake associated with Emergency Pressurization Fan A-A (refer to Section 15.5.3), the failed tornado damper is accessible from within the Control Room habitability area and can be mannally opened.
~~8. Tornado damper FCO 31-35~~	~~Same as item 1.~~	~~Same as item 7.~~	~~Same as item 7.~~	~~Same as item 7.~~	~~Same as item 7.~~

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
7. 8.	Isolation damper FCO 31-2	Isolate Pressurization Fan B-B supply	Open (Fan B-B on standby)	None	None	Fan A-A, redundant to fan B-B is operating. 9. Backdraft damper, item 11, prevents backflow through fan B-B.
8 10.	Control Building Pressurization Fan B-B	Same as item ~~4.~~ 3.	Same as item ~~4.~~ 3.	Same as item ~~4.~~ 3. except Fan B-B.	Same as item ~~4.~~ 3.	Same as item ~~4.~~ 3; except Fan A-A. starts upon low flow signal from Fan B-B.
9 11.	Backdraft damper 31-209~~0~~ 8	Precludes backflow from fan A-A through fan B-B	Closed (Fan B-B operating)	Loss of flow path for Fan B-B	None	Fan A-A starts upon ~~loss of~~ low-flow signal from Fan B-B, alarm initiated in MCR.
			Open (Fan B-B on standby)	None	None	Same as item ~~5.~~ 7, except FCO 31-2.
10 12.	Isolation damper (2) FCO 31-3, -4	Isolates habitability area from fresh air supply to lower floors in emergency modes.	Closed (Normal operation)	Loss of fresh air supply to MCR air handling unit.	Reduced flow through MCR air handling unit and loss of MCR positive press.	Position of damper is indicated in MCR.
			Open (Emergency mode)	One of two redundant damprs in duct is lost.	None. ~~Redundant damper in series.~~	Redundant damper in series
~~13.~~	~~Isolation damper FCO 31-4~~	~~Same as item 12.~~	~~Same as item 12.~~	~~Same as item 12.~~	~~Same as item 12.~~	

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Revised by Amendment 45

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
11 ~~14~~. Tornado damper(2) FCO 31-21, -22	Same as item 1.	Open (During tornado)	Same as item 1.	Same as item 1.	same as item 1
		Closed (Normal operation)	None	None	Emergency air intake not required during normal operations.
		Closed (Emergency operation modes, Emergency Pressurization Fan B-B operating)	Loss of flow to Control Building Emergency Pressurization Fan B-B.	None	Emergency Pressurization Fan A-A starts on low flow from fan B-B. If it is desired to utilize east emergency air intake, the failed tornado damper is accessible from within the Control Room habitability area and can be manually opened.
~~15. Tornado damper FCO 31-22~~	~~Same as item 14.~~	~~Same as item 14.~~	~~Same as item 14.~~	~~Same as item 14.~~	~~Same as item 14.~~
12. ~~16~~. Balancing damper ~~(in Emergency Pressurization fan cross-conn.)~~ 31-2114	Permits either Emergency Pressurization fan to be used with either emergency air intake.	Open	Operating emergency press. fan will draw air from both emergency air intakes.	None	There is no requirement for taking emergency press. Air from a particular emergency air intake initially. If it is necessary to choose a particular intake during the course of the emergency, the damper is accessible from within the Control Room habitability area and can be adjusted. The damper is normally locked closed.
13. ~~17~~. Isolation damper FCO 31-6 V	Isolates Emergency Pressurization Fan A-A from supply.	Open (Fan A-A on standby)	None	None	
		Closed (Fan A-A operating)	Loss of flow from Emergency Press. Fan A-A.	~~Momentary~~ Decrease in emergency press. flow.	Redundant fan B-B starts on low flow from fan A-A; alarm sounds in MCR.

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Revised by Amendment 45

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~14. 18. Balancing damper 31-2095~~	~~Balance flow to Emergency press. Fan A-A.~~	~~Closed (Fan A-A operating)~~	~~Loss of flow from Emergency Press. Fan A-A.~~	~~Same as item 17.~~	~~Same as item 17. Balancing dampers are locked in place after proper initial adjustment; subsequent slipping of damper position is unlikely. This damper is accessible from within the Control Room habitability area.~~
~~14. 19.~~ Control Building Emergency press. Fan A-A	Pressurize Control Room habitability area in emergency operation modes.	No or low flow	Loss of flow from fan A-A.	~~Momentary~~ Decrease in emergency press. flow.	Same as item ~~17.~~ 13
~~14 20.~~ Isolation damper FCD 31-~~25~~ 5 V	~~Isolate Emerg. Press. Fan B-B from supply.~~ Same as item 13 except Fan B-B	~~Same as item 13 Same as item 20, except Fan B-B,~~ except Fan B-B	~~Same as item 13 Same as item 20, except Fan B-B,~~ except Fan B-B	None Same as item 13	Same as item 15 ~~Fan A-A starts upon low flow signal from Fan B-B; alarm initiated in MCR.~~
~~21. Balancing damper 31-2096~~	~~Balances flow to Emerg. Press. Fan B-B,~~	~~Same as item 18, except Fan B-B,~~	~~Same as item 18, except Fan B-B,~~	~~Momentary decrease in emergency pressure flow.~~	~~Same as item 18.~~
~~15 22.~~ Control Bldg. emerg. press. Fan B-B	Same as item ~~19.~~ 14	Same as item ~~19.~~ 14	Same as item ~~19,~~ 14 except Fan B-B.	Same as item ~~19.~~ 14	~~Same as item 21.~~ Redundant Fan A-A starts on low flow signal Fan B-B; alarm initiated in MCR 49
~~17. 25.~~ Backdraft damper 31-2103	Precludes untreated air flow from Emerg. Press. Fans to Mech. Equip. Rm. via spreading room supply fan air intake.	Closed (Emerg. air cleanup fans operating)	No recirculation air ducted to air cleanup units.	Increased flow of outside air processed by air cleanup unit.	This failure mode is unlikely. Frequent tests of the emergency ventilation and pressurization system (at least once per 30 days) will verify operability of system and decrease probability of damper being frozen in the closed position. Damper is seismically qualified to prevent failure due to seismic event.

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
18. ~~24.~~	Isolation damper FCO 31-8	Isolates air cleanup unit from duct system during maintenance and standby conditions.	Closed (Emergy. air cleanup fan A-A operating)	Loss of flow path for emerg. air cleanup fan A-A.	None	Redundant fan B-B starts on low flow signal from fan A-A. Initiates alarm in MCR.
			Open (Emerg. Air cleanup Fan A-A on standby. Fan B-B operating)	Flow path to air cleanup unit A-A is opened.	None	~~Backdraft damper downstream of air cleanup unit fan A-A prevents backflow through air cleanup unit.~~ Flowpath will Not be ... due to the Negative pres... of the MCR ai... handling UNI...
19. ~~25.~~	Control Bldg. Emerg. Air cleanup unit A-A	Processes potentially contaminated outside air prior to release to habitability area, during emergency op. modes.	Blocked	Reduced or no flow through air cleanup unit Fan A-A.	None	Redundant Fan B-B starts on low flow signal from Fan A-A; alarm initiated in MCR. Blockage of flow through filters is highly unlikely.
			Leaking	Some air may bypass filters.	May release contaminated air to habitability area.	Air cleanup units tested with DOP/freon at least once per operating cycle to ensure leakage criterion is met.
20. ~~26.~~	Control Bldg. emerg. air cleanup unit Fan A-A	Draws recirc. and fresh air through air cleanup unit in emerg. op. modes.	No or low flow.	Low flow through air cleanup unit A-A.	~~Momentary~~ decrease in flow ~~from air cleanup units.~~	Redundant Fan B-B starts on low flow signal from Fan A-A.
21. ~~27.~~	Isolation damper FCO 31-7	Same as item ~~26.~~ 18	Same as item 18 ~~26.~~, except Fan BB.	Same as item 18 ~~26.~~, except Fan B-B.	None	Same as item 18 ~~27.~~ Except Fan B-B
22. ~~28.~~	Control Bldg. Emerg. air cleanup unit B-B	Same as item ~~27.~~ 19	Same as item ~~27.~~ 19	Same as item 19 ~~27.~~, except Fan B-B.	Same as item 19 ~~27.~~	Same as item 19 ~~27.~~, except Fan A-A. starts on low flow signal from Fan B-B

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~23~~ 20. Control Bldg. Emerg. Air cleanup unit Fan B-B	Same as item ~~28.~~ 20	Same as item ~~28.~~ 20	Same as item ~~28.~~ 20 except air cleanup unit B-B.	Same as item ~~28.~~ 20	Same as item 20 ~~Fan A-A starts upon low flow signal from Fan B-B. Alarm initiated in MCR.~~
30. Balancing damper (typical of 2) 31-2101,-2102	Balances recirc. flow to emerg. air cleanup unit during emerg. operating modes.	Closed	No flow through one of two intake grilles.	Increased flow through redundant grille, overall flow reduced slightly.	Balancing dampers will be locked in the proper position following initial system balancing. Dampers are seismically qualified. Probability of failure is very small.
		Partly closed	Reduced flow through one of two intake grilles.	Same as above.	Same as above.
~~31. Balancing damper 31-2106~~	~~Balances pressurizing fresh air supply prior to entry to MCR air handling units during normal op.; balances cleaned air in emerg. op. modes.~~	~~Closed~~	~~No fresh and/or pressurizing air supply to Control Bldg.~~	~~Loss of positive press. in habitability area.~~	~~Same as item 34.~~
		~~Partly closed~~	~~Low flow for pressurizing and fresh-air-supply.~~	~~May lose positive pressure.~~	~~Same as item 34.~~
~~32. Balancing damper 31-2107~~	~~Balances return air from Mech. Equip. Rm. to MCR air handling units.~~	~~Closed~~	~~No flow from mech. equip. rm. to MCR air handling units.~~	~~May eventually lead to overheating of mechanical equipment room.~~	~~Other terminals throughout habitability area will draw insufficient flow to make up the difference; also see item 34. Damper is accessible from within habitability area.~~

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
24 ~~35~~.	Isolation damper FCO 31-12	Isolates MCR air handling unit A-A while on standby or during maintenance.	Closed (Air handling unit (AHU) A-A operating)	No flow through AHU A-A.	~~Momentary~~ decrease in flow from MCR AHU's.	Redundant AHU, B-B, starts on low flow signal from AHU A-A.
			Open (AHU A-A on standby)	Flow path opened to AHU A-A.	None	Backdraft damper, item 40, prevents backflow.
25 ~~34~~.	Modulating damper FCO 31-82 (bypass type)	Modulates flow over cooling coils to maintain air temp at thermostat setting.	Closed (coil portion)	All flow bypases cooling coil.	Temporary increase in temp in the habitability area.	High temperature initiates start of redundant AHU.
			Spurious modulation	Air not maintained at thermostat setting.	None	Same as above.
28 ~~35~~. move to Number 24	Main Control Room air Handling Unit A-A	Cool, humidify, and circulate ventilation air to control room habitability area	No or low flow.	Loss of flow from AHU A-A.	Same as item 24 ~~37~~ (closed failure)	Same as item 24 ~~37~~ (closed failure)
			No humidification	Low humidity air released to MCR.	None	Ambient humidity conditions should be acceptable. Relative humidity is not a safety-related parameter.
			Over humidification	High humidity air released to MCR.	None	Cooling coils should remove sufficient moisture to maintain acceptable conditions.
			No or under cooling	Air released from AHU A-A is above acceptble temp.	Temporary increase in temp. in habitability area.	Same as item 24 ~~38~~ (spurious modulation failure) Redundant AHU starts on low chilled water flow or high temp.
			Overcooling	Air released from AHU A-A is below acceptable temp.	None	Duct heaters and/or equipment loads provide sufficient heating to offset overcooling. Overcooling is not a safety-related concern.

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
24 ~~36.~~	Backdraft damper 31-2105	Precludes backflow through MCR AHU A-A when A-A is on standby.	Closed (AHU A-A operating)	Flow path from AHU AA is blocked.	Same as item 24 ~~37.~~ (closed failure).	Same as item 24 ~~37.~~ (closed failure).
			Open (AHU A-A on standby)	Backflow path opened to AHU A-A from AHU B-B.	~~None~~	Damper FCO 31-12 closes when AHU A-A is on standby.
27 ~~37.~~	Isolation damper FCO 31-11	Same as item 24 ~~37.~~ except AHU B-B.	Same as item 24 ~~37.~~ except AHU B-B.	Same as item 24 ~~37.~~ except AHU B-B.	Same as item 24 ~~37.~~	Same as item 24 except ~~Redundant AHU A-A starts upon low flow signal from AHU B-B. Backdraft damper, item 44, prevents backflow.~~ AHU A-A & Backdraft Damper, item
Insert #28 from previous page → ~~38.~~ 29	Modulating damper FCO 31-91	Same as item 25 ~~38.~~	Same as item 25 ~~38.~~	Same as item 25 ~~38.~~ ~~except AHU B-B.~~	Same as item 25 ~~38.~~	Same as item 25 ~~38.~~
30 ~~39.~~	Main Control Room Air Handling unit B-B	Same as item 28 ~~39.~~	Same as item 28 ~~39.~~	Same as item 28 ~~39.~~ except AHU B-B.	Same as item 28 ~~39.~~	Same as item 28 ~~39.~~
31 ~~40.~~	Backdraft damper 31-2104	Same as item 26 ~~40.~~ except AHU B-B.	Same as item 26 ~~40.~~ except AHU B-B.	Same as item 26 ~~40.~~ except AHU B-B.	Same as item 26 ~~40.~~	Redundant AHU A-A starts upon low flow signal from ~~from AHU B-B.~~ Damper FCO 31-11 closes when AHU B is on standby
32 ~~41.~~	Isolation damper (2) FCO 31-19 FCO 31-20	Isolate Control Bldg. ducting from Shutdown Board Rm. in Aux. Bldg. (air supplied to Shutdown Bd. Rm. only in flood condition)	Open	Air supplied to shutdown Bd. Rm. Aux. Bldg.	Decreased total flow to Main Control R. habitability area.	Damper normally closed, accessible from within Control Room habitability area.
			Closed	Emergency supply to Shutdown Bd. Rm. not available.	Insufficient cooling for Shutdown Bd. Rm.	Flood conditions give sufficient warning to permit manual opening if damper fails closed.
~~42.~~	~~Isolation damper FCO 31-20~~	~~Same as item 45.~~	~~Same as item 45.~~	~~Same as item 45.~~	~~Same as item 45.~~	~~Same as item 45.~~

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~43.~~ Balancing damper (typical of several)	~~Balances flow to MCR linear diffusers.~~	Closed	No flow to the portion of linear diffuser to which duct is connected.	None	Other connections experience slightly increased flow.
		~~Partly closed~~	Reduced flow to one portion of diffuser.	None	Same as above.
33. ~~44.~~ 5-kW Heater	Heats air supplied to ~~Inst. Calib. Rm., Cht. Stg. Shift Engr. Ofc.,~~ Conference RM	Off	Rooms served are not maintained at optimum comfort conditions.	None	Rooms served are nonessential; ambient temp in adjacent rooms will maintain temp in affected rooms above minimum acceptable levels.
		On	Same as above.	None	
~~45.~~ Balancing damper (3) 31-2124;-2125; -2127	~~Balances flow to Inst. Calib. Rm. Cht. Stg. or Shift Engr. Ofc. as applicable.~~	Closed	Flow blocked to room served. Non-optimum conditions maintained.	None	Rooms served are nonessential; dampers are accessible from within Control Room habitability area. See also item 34.
34 ~~46.~~ 10-kW Heater	Heat air supplied to locker room and toilet.	Same as item ~~44.~~ 33	Same as item ~~44.~~ 33	Same as item ~~44~~ 33	Same as item ~~44.~~ 33
~~47. Balancing damper (4) 31-2110;-2111; -2119;-2123~~	~~Balances flow to toilet or locker room.~~	Same as item ~~45.~~	Same as item ~~45.~~	Same as item ~~45.~~	Same as item ~~45.~~
35 ~~48.~~ 5-kW Heater	Heat air supplied to kitchen.	Same as item ~~44.~~ 33	Same as item ~~44.~~ 33	Same as item ~~44.~~ 33	Same as item ~~44.~~ 33
49. Balancing damper (2) 31-2116;-2117	Balances flow to kitchen.	Same as item ~~45.~~ 45	Same as item ~~45.~~ 45	Same as item ~~45.~~ 45	Same as item ~~45.~~ 45

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~50. Balancing damper (2) 31-2137;-2142~~	~~Balances flow to Relay Room or PSO Eng. Shop.~~	~~Same as item 49.~~ 45	~~Same as item 49.~~ 45	~~Same as item 49.~~ 45	~~Same as item 49.~~ 45
36. ~~51.~~ 25-kW Heater	Heats air supplied to ~~Relay Room and PSO Eng. Shop.~~ NRC Office, Conference Rm	~~Same as item 46.~~ 3344	~~Same as item 48.~~ 3344	~~Same as item 48.~~ 3344	~~Same as item 48.~~ 3344
~~52. Balancing damper (7) 31-2138 thru 2141, 31-2143 thru 2145~~	~~Balances flow to Relay Room.~~	~~Same as item 48.~~ 45	~~Flow through one of seven terminals blocked.~~	~~None~~	~~Other terminals supply sufficient air to maintain acceptable conditions.~~
37. ~~53.~~ 10-kW Heater	Heats air supplied to ~~Record Stg. Room.~~ TSC	~~Same as item 46.~~ 3344	~~Same as item 46.~~ 3344	~~Same as item 46.~~ 3344	~~Same as item 46.~~ 3344
~~54.~~ Balancing damper (2) 31-2149,-2150	Balances flow to Record Stg. Room.	~~Same as item 49.~~ 45	Same as item 56.	Same as item 56.	Same as item ~~56.~~ 52
55. Balancing damper 31-2148	Balances exhaust flow from Record Stg. Rm.	Closed	Flow blocked from room served. Non-optimum conditions maintained.	None	Same as item ~~49~~ 45 and item 34.
56. Balancing damper (2) 31-2159;-2160	Balances exhaust flow from Relay Room.	Closed	Flow through one of two terminals blocked.	None	Same as item ~~56~~ 52, except exhaust.
57. Balancing damper 31-2128	Balances exhaust flow from MCR.	Closed	Flow blocked from 5 of 10 terminals.	None	Remaining terminals exhaust sufficient air to maintain acceptable conditions.
58. Balancing damper 31-2109	Same as item ~~51.~~ 57	Closed	Same as item ~~61.~~ 57	None	Same as item ~~61.~~ 57

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
Toilet and Locker Room Exhaust Subsystem					
38, ~~59.~~ Isolation damper (2) FCO 31-17 31-16	Isolates habitability area from outside during emerg. operating modes.	Closed (Normal operation)	No outside exhaust from toilet and locker room.	None	Same as item 39 (closed Failure)
		Open (Emergency operating mode)	One of two redundant isolation dampers lost.	None	Redundant damper in series serves isolation functions.
~~60. Isolation Damper FCO 31-16~~	~~Same as item 63.~~	~~Same as item 63.~~	~~Same as item 63.~~	~~Same as item 63.~~	~~Same as item 63.~~
39, ~~61.~~ Backdraft damper 31-2108	Prevents backflow from outside to habitability area.	Closed (Normal operation)	Same as item ~~63~~ 38 (Closed failure).	None	Exhaust From Toilet Room and Locker Room is not essential
		Open (Emerg. op. mode)	Flow path from outside to isolation damprs is opened.	None	Same As item 38 ~~items 63 and 64 accomplish isolation function.~~ (open Failure)
40, ~~62.~~ Tornado damper (2) FCO 31-18 FCO 31-15	Isolation during tornado conditions.	Open (during tornado)	Same as item 1 (open failure).	~~Same as item 1.~~ NONE	Redundant Damper will Keep Flow Path Closed
		Closed (Normal operation)	Same as item ~~65~~ 39 (closed failure).	None	Item 38 accomplishes Isolation Function
~~63. Tornado damper FCO 31-15~~	~~Same as item 66.~~	~~Same as item 66.~~	~~Same as item 66.~~	~~Same as item 66.~~	
~~Electrical Board Room Subsystems~~					
~~64. Balancing damper (3) 31-2055, 2056, 2057~~	~~Balances exhaust flow from Unit 2 Aux. Inst. room.~~	~~Closed~~	~~Flow through 1 of 3 terminals blocked.~~	~~None~~	~~Same as item 56, except exhaust.~~

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~65. Balancing dampers (3) 31-2081,-2082 -2085~~	~~Balances exhaust flow from Unit 1 Aux. Inst. Room.~~	~~Closed~~	~~Same as item 68.~~	~~None~~	~~Same as item 56, except exhaust.~~
41. ~~66.~~ Backdraft damper ~~36~~-2086 31	Prevents backflow of fresh air through Aux. Inst. Rm. exhaust ducting.	Closed	No flow from Aux. Inst. Rms, and Computer Room.	Spaces served may overheat.	Door may be opened to permit sufficient cooling.
		Open	Path open for backflow to Aux. Inst. Rms.	None	Negative pressure of Elec. Bd. R. AHU should induce flow in proper direction.
~~67.~~ Balancing damper 31-2087	Balances exhaust flow from Aux. Inst. Rms and Computer Rms.	Closed	Same as item 70 (closed failure).	Spaces served may overheat.	Same as item 34.
~~68.~~ Balancing damper (3) 31-2040 thru -2042	Balances exhaust flow from Mech. Equip. Rm.	Closed	Same as item 68.	None	Same as item 56, except exhaust. See also item 34.
~~69.~~ Balancing damper 31-2004	Balances exhaust flow from Mech. Equip. Rm.	Closed	Lose one branch of return air to Elec. Bd. R. AHU.	Non-optimum conditions maintained.	Additional flow passes through corridor and into Mechanical Equi. Room to Elec. Bd. R. AHU.
~~70.~~ Balancing damper (2) 31-2002,-2003	Balances exhaust flow from Mech. Equip. Rm.	Closed	Same as item 73.	Same as item 73.	Additional flow returned to AHU via recirc. duct serving other rooms on floor.
42 ~~71.~~ Isolation damper FCO 31-30	Isolates Elect. Bd. Rm. AHU's A-A and B-A while on standby.	Closed (AHU's A-A and B-A operating)	No flow through AHU's A-A and B-A.	Momentary decrease in flow from AHU's.	Redundant AHU's C-B and D-B start on low flow signal from A-A and B-A.
		Open (AHU's A-A and B-B on standby)	Flow path opened to AHU's.	None	Backdraft damper 31-2001A & 31-2001B prevents backflow.

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
43, 75.	Isolation damper FCO 31-31	Isolates Elec. Bd. Rm. AHU's C-B and D-B while on standby.	Same as item 43, 75, except C-B and D-B.	Same as item 43, 75, except C-B and D-B.	Same as item 43, 75.	Redundant AHU's ~~Same as item 75, except~~ A-A and B-A start on low flow signal from C-B and D-B. Backdraft dampers 31-3972 and 73 prevent flow into C-B and D-B.
44 75.	Modulating damper (2) FCO 31-335,-336 (bypass type)	Modulates flow to Elec. Bd. R. AHU's A-A (FCO 31-335) and B-A (FCO 31-336).	Closed (Coil portion)	All flow bypasses cooling coil on one of four 50% units (2 on standby).	Temperatures in spaces served may increase temporarily.	Redundant AHU's start on high temperature signal.
			Spurious modulation	Air not maintained at thermostat setting.	None	Associated 50% unit will make up for decreased capacity under less than full load conditions. Redundant set of AHU's will start on high temperature signal.

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
45. 44.	Elec. Board Room Air Handling Unit (2) A-A and B-A	Cool, humidify, and circulate ventilation air to Elec. Bd. Rms, Aux, Inst. Rms, and Computer Room.	No or low flow.	Loss of flow from AHU A-A or B-A (whichever is failed unit).	Same as item 44 (closed failure).	Same as item 44.
			No humidification.	Low humidity air released to spaces served.	None	Same as item 28 (low humidity failure).
			Over humidification	High humidity air released to spaces served.	None	Cooling coils should remove sufficient moisture to maintain acceptable conditions.
			No or under cooling	Air released from AHU is above acceptable temp.	Temporary increase in temp of air supplied to spaces.	Redundant set of AHU's will start on high temp signal or low chilled water flow.
			Overcooling	Air released from AHU is below acceptable temp.	None	Duct heaters and/or equipment loads provide sufficient heating to offset overcooling. Overcooling is not a safety-related concern.
46 35.	Modulating damper (2) FCO 31-337,-338	Modulates flow to Elec. Bd. R. AHU's C-B (FCO 31-337) and D-B (FCO 31-338)	Same as item 44.	Same as item 44.	Same as item 44.	Same as item 44.
47. 36.	Elec. Bd. Rm. AHU (2) C-B and D-B	Same as item 45.	Same as item 45.	Same as item 45 except C-B or D-B.	Same as item 45.	Same as item 45.
48. 37.	Backdraft damper 31-2001A & 31-2001B	Prevent backflow to standby AHU's.	Closed (A-A and B-A operating)	Flowpath from A-A and B-A blocked.	*Momentary decrease in flow.	Redundant AHU's C-B and D-B start upon low flow signal from A-A and B-A.
			Open (A-A and B-A on standby)	Backflow path opened to AHU's A-A and B-A.	None	FCO 31-30 is closed and prevents significant backflow.

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~78. Balancing damper 31-2007~~	~~Balances flow to Batt. Bd. Rds. and Communications Room.~~	~~Closed~~	~~Loss of cooling flow to spaces served.~~	~~May lose equipment in effected spaces.~~	~~Same as item 34. In addition, personnel in Comm. Rm. will notice increase in temperature. Rooms served not essential for safe shutdown.~~
49. ~~79.~~ 20-kW Heater	Heats air supplied to Comm. Rm. and Batt. Bd. Rms.	Off	Rooms served are not maintained at optimum comfort conditions.	None	Equipment loads and surrounding spaces will maintain temp. above minimum acceptable levels.
		On	Same as above	None	Cooling coils on AHU's will attempt to offset overheating.
80. Balancing damper (2) 31-2005, 31-2030	Balances flow to Mech. Equip. Rm. or 24V and 48V Batt. Bd. Rm.	Closed	Same as item 49.	None	Same as item 49.
81. Balancing damper (8) 31-2014, thru -2017 and 31-2032 thru -2035	Balances flow to 250V Batt. Bd. Rms. and Comm. Rm.	Closed	Same as item 83.	None	Same as item 34.
82. Balancing damper (2) 31-2089, -2091	Balances flow to Unit 1 Aux. Inst. Rm, and Unit 2 Aux. Inst. Rm.	Closed	Same as item 49.	None	Same as item 34.
50. ~~83.~~ 10-kW Heater (2)	Heats air supplied to Aux. Inst. Rms.	Same as item ~~83.~~ 49	Same as item ~~83.~~ 49	Same as item ~~83.~~ 49	Same as item ~~83.~~ 49
~~84. Balancing damper (12 per rm) 31-2067 thru 2078 and 31-2043 thru 2054~~	~~Balances flow to Aux. Inst. Rms.~~	~~Closed~~	~~Flow through 1 of 12 terminals blocked.~~	~~None~~	~~Same as item 56.~~

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~85.~~	~~Balancing damper 31-2090~~	~~Balances flow to Computer Room.~~	~~Closed~~	~~Same as item 49.~~	~~None~~	~~Same as item 34.~~
51. ~~86.~~	10-kW Heater	Heats air supplied to Computer Room.	Same as item 49 ~~83.~~	Same as item 49 ~~83.~~	Same as item 49 ~~83.~~	Same as item 49 ~~83.~~
~~87.~~	~~Balancing damper (6) 31-2059 thru -2064~~	~~Balances flow to Computer Room.~~	~~Same as item 56.~~	~~Flow through 1 of 6 6 terminals blocked.~~	~~None~~	~~Same as item 56.~~

~~Spreading Room Supply Subsystem and Fresh Air Supply to Elec. Bd. Rm. AHU's~~

52. ~~88.~~	Isolation damper (2) FCO 31-9,31-10	Isolates Control Rm. habitability area from Spreading Rm. supply.	Open (emergency op. mode)	One of two redundant damprs is lost.	None	Redundant damper in series.
			Closed (Normal operation)	Partial loss of flow to Spreading Room.	None	Adequate flow is provided to prevent excessive temperature in Spreading Room.
53. ~~89.~~	Isolation damper (2) FCO 31-36,31-37	Isolates Elec. Bd. Rm. fresh air supply from Spreading Room.	Same as item 52 ~~92.~~	Same as item 52 ~~92.~~	None	Same as item 52 ~~92.~~
~~90.~~	~~Backdraft damper 31-2157~~	~~Prevents backflow from lower elevations.~~	~~Closed~~	~~No fresh air supplied to Elec. Bd. R. AHU's.~~	~~Loss of pressurization in lower elevations.~~	~~Cooling function not affected.~~
~~91.~~	~~Balancing damper 31-2156~~	~~Balances fresh air supplied to Elec. Bd. Rm. AHU's.~~	~~Closed~~	~~Same as item 94.~~	~~Same as item 94.~~	~~Same as item 94.~~

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
Battery Room Exhaust Subsystem					
~~92. Balancing damper (6) 31-2008,-2023 -2026,-2027 -2022,-2009~~	~~Balances exhaust flow from 250V Batt. Rm 1 (2008,2009), 250V Batt. Rm 2 (2022,2023) or 24V and 48V Batt. Rm. (2026,2027).~~	~~Closed~~	~~Lose vent flow from affected Batt. Rm.~~	~~May result in buildup of hydrogen.~~	~~Same as item 34.~~
~~54.~~ 95. Battery Rm. Exhaust Fan (3) A-A, B-B C-B	Exhaust air from battery rms to prevent hydrogen buildup.	No or low flow.	Lose one of three redundant fans (2 on same power train).	~~Momentary~~ decrease in exhaust flow.	Redundant fan starts on low flow signal from failed fan.
~~55.~~ 96. Backdraft damper (2) 31-2162,-2163	Prevents backflow to Batt. Rm. Exh. Fan A-A or B-B, as applicable.	Closed (Associated fan operating)	Loss of flow from affected fan.	Same as item 54 97.	Same as item 54 97.
		Open (Assoc. fan standby)	None	None	Fan isolation damper closes when fan on standby.
~~56.~~ 95. Isolation damper (3) FCO 31-27,-28 -29	Isolates associated batt. rm. exh. fan from rest of subsys. while on standby.	Open (Fan on standby)	None	None	Backdraft damper precludes backflow.
		Closed (Fan operating)	Lose flow from operating fan.	Same as item 54 97.	Same as item 54 97.
~~57.~~ 96. Backdraft damper (~~2~~ 3) 31-2151,-2152 31-2162	Precludes backflow through Batt. Rm. exh. duct or Spreading Room exhaust.	Closed	Lose flow from Batt. Rm. Exh. Fan or Spreading Rm. exhaust fan, as applicable.	None	If failed damper is 31-2151, redundant exh. fan starts on low flow signal. Exhaust from Spreading Room is not essential.
		Open (Fan on standby)	None	None	Isolation damper associated with fan closes when fan is on standby.

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
58. 97.	Tornado damper (4) FCO 31-13,14, 23, 24	Same as item 1.	Open (During tornado)	Same as item 1 (open failure).	Same as item 1 (open failure).	Same as item 1.
			Closed (Normal operation)	Loss of exhaust path from spreading room and battery room.	None	Spreading Room exhaust is not essential; ~~Loss of flow initiates~~ battery Rooms have alarm in MCR. alternate exhaust Path. Alarm will initiate in MCR.
59 98.	Fire Damper (East Emerg. Air Intake) 31-2147 3431	To preclude possibility fire from roof of Control Bldg could be drawn into Control.	Open (Fire on roof) (Fire on Roof)	Smoke and fire may be drawn into duct system.	May release smoke and/or fire into MCR.	Probability of having a fire on Control Bldg. roof is extremely small. Isolation dampers can be closed and west Emerg. Air Intake can be utilized.
			Closed (Emerg. op. modes, no fire)	Emerg. pres. flow from east Emerg. Air Intake blocked.	None	Control Bldg. Emerg. pres. fan A-A starts on low flow signal from ~~redundant~~ fan B-B.
60 99.	Fire Damper 31-2134 XFD 31-76	Prevents ~~transmission~~ spread of ~~of fire from MCR to Relay Rm or vice versa.~~ fire between TSC & Conference Rm.	Closed (No Fire)	~~Flow path to Relay Rm, PSO Eng. Shop Record Storage Rm blocked. Rooms not maintained at optimum conditions.~~	None	~~Same as item 49, except item 34 does not apply.~~ 49 This area is not safety-related; if temperature becomes uncomfortable, occupants can move to MCR
			Open (Fire)	Fire may spread ~~from Relay Rm to MCR or vice versa.~~ To or From TSC	None	~~Defense in depth is provided in accordance with Branch Technical Position 9.5-1.~~ If MCR becomes uninhabitable due to a fire, plant can be shut down from Aux. Control Rm

Overheating may result in Technical Support center

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
100.	Fire Damper 31-2166	Prevents transmission of fire from Relay Rm to PSO Engineer Shop or vice versa.	Closed (No Fire)	Flow path to PSO Eng. Shop blocked. Room not maintained at optimum conditions.	None	Same as item 49, except item 34 does not apply.
			Open (Fire)	Fire may spread from Relay Rm to PSO Eng. Shop or vice versa.	None	Same as 103 (Open Failure).
101.	Fire Damper 31-2164	Prevents spread of fire from Relay Room to PSO Eng. Shop or vice versa.	Closed (No Fire)	Flow path to Record Storage Rm blocked. Room not maintained at optimum conditions.	None	Same as item 49, except item 34 does not apply.
			Open (Fire)	Same as item 106 (Open Failure).	Same as item 106 (Open Failure).	Same as item 106 (Open Failure).
102.	Fire Damper (2) 31-2165 and XFD 31-76	Prevents spread of fire from PSO Eng. Shop to Record Storage Rm or vice versa.	Closed (No Fire)	Flow path to Record Stg. Rm. blocked. Room not maintained at optimum conditions.	None	Same as item 49, except item 34 does not apply.
			Open (Fire)	One of two dampers in series lost.	None	Second damper provides fire isolation.
61. ~~103.~~	Fire Damper ~~31-2158~~ XFD 31-75 ~~0-31-2158~~	Prevents spread of fire ~~from Record Stg. Rm. to PSO Eng. Shop or Relay Rm or vice versa.~~ Between Attic & Conference Rm	Same as item ~~106.~~ 60.	Same as item ~~106~~ 60. except for Attic instead of TSC	None	~~Same as item 106.~~ Defense in Depth provided in Accordance with Branch Technical Position 9.5-1

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~104. Fire Damper 31-2136~~	~~Prevents spread of fire from Relay Rm to MCR or vice versa.~~	~~Closed (No Fire)~~	~~Same as item 62.~~	~~None~~	~~Relay Rm nonessential. Dampers are accessible from within habitability area.~~
		~~Open (Fire)~~	~~Same as item 103 (Open Failure).~~	~~Same as item 103 (Open Failure).~~	~~Same as item 103 (Open Failure).~~
62. ~~105.~~ Fire Damper (4) 31-2058, 3968, 3956, 3969	Prevents spread of fire between ~~Unit 1~~ Aux. Inst. Rm. and Computer Rm.	Closed (No Fire)	Flow blocked from rm served.	Rm may overheat.	Doors may be opened to permit sufficient cooling.
		Open (Fire)	Fire may spread.	None	Defense in Depth Provided in accordance with Branch Technical Position 9.5-1 ~~Same as item 103.~~
63. ~~106.~~ Fire Damper (8) 31-3957, 3958, 3959, 3961, 3955, 3960, 4296, 4297	Prevents spread of fire between Computer Rm, ~~and Unit 1~~ Aux. Inst. Rm., and Surrounding Area	Closed (No Fire)	~~Same as item 109 (Closed Failure).~~ Flow blocked From RM served	Rm. may overheat.	~~Computer operators will notice non-optimum conditions and investigate computer.~~ Doors may be open to permit sufficient cooling
		Open (Fire)	~~Same as item 109 (Open Failure).~~ Fire May Spread	~~Same as item 109 (Open Failure).~~ None	Same as item 103. 62 (open Failure)
~~107. Fire Damper (3) 31-3958, 3959, 3961~~	~~Prevents spread of fire from Unit 1 Aux. Inst. Rm. into duct system.~~	~~Closed (No Fire)~~	~~Same as item 68.~~	~~Same as item 109.~~	~~Same as item 109.~~
64. ~~108.~~ Fire Damper XFD 31-159	Prevents a fire from penetrating the barrier between the elevation 692 corridor and the Battery Room Exhaust Fan Rooms.	Closed (No Fire)	Same as item ~~109~~ 62 (Closed Failure).	~~Spaces served may overheat.~~ Same as item 62	Same as item ~~109~~ 62 (Closed Failure).
		Open (Fire)	Fire may spread to ~~Comm. Rm or Mech. Equip. Rm.~~ Areas Served	None	Same as item ~~103~~ 62 (Open Failure).
~~109. Fire Damper (2) 31-3955, 3960~~	~~Prevents spread of fire between rms served and other areas.~~	~~Same as item 109.~~	~~Same as item 109.~~	~~Same as item 109.~~	~~Same as item 109.~~

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~110. Deleted~~					
~~111. Fire Damper 31-3956~~	~~Prevents spread of fire between Aux. Inst. Rm and Computer Rm.~~	~~Same as item 109.~~	~~Same as item 109.~~	~~Same as item 109.~~	~~Same as item 109.~~
65. ~~111.~~ 9 Fire Damper (V) 31-2010, 2013, 2018 2021, 2028 2029, 2037 3378, 3379	Prevents spread of fire between areas served.	Closed (No Fire)	Flow blocked to ~~Same as item 109.~~ Areas served	Rooms may ~~Same as item 109.~~ overheat	Doors can be opened to provide ~~Same as item 109.~~ sufficient cooling
		Open (Fire)	Fire may spread across boundary of separated system.	May result in loss of non-essential system.	Same as item ~~59~~ 62 ~~except item 34 does not apply.~~ (open failure)
66 ~~113.~~ 12 Fire Damper (for 31-2007 2011, 2012 2019, 2020, 2024, 2025 2031, 2039, 2038, 3345, 3346	Prevents spread of fire between Batt. Rms and other rms or between Mech. Equip. Rm. and other rms.	Closed (No Fire)	~~Same as item 96.~~ Lose vent flow from attached battery Rm.	~~Same as item 96.~~ May result in buildup of Hydrogen	If failed fire damper affects all Battery Rms, low flow signal starts redundant exhaust fan. Or separate exhaust path
		Open (Fire)	Fire may spread between adjacent rooms.	May lose batteries, may result in battery fire.	Batteries affected are non Class IE. ~~(Same as item 1C).~~
67. ~~114.~~ Fire Damper 31-3934	To prevent a fire from entering the Spreading Room.	Closed (Normal Operation)	No fresh air supplied to Electrical Board Room AHU's. Loss of pressurization in lower elevations.	Spreading room pressurization may be afected.	Spreading room pressurization is not Necessary for safe plant shutdown.
		Open (Fire Present)	A fire may penetrate the boundary.	A fire may enter the Spreading Room.	Defense in depth is provided in accordance with Branch Technical Position 9.5-1.

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
68. ~~115.~~	Fire Damper 31-3938	To prevent a fire from penetrating the boundary between elevation 708 and elevation 729.	Closed (Normal Operation)	Loss of ventilation flow path.	No fresh air supplied to Electrical Board Room AHU's.	Loss of pressurization in lower elevations. Cooling function not affected.
			Open (Fire Present)	Loss of fire boundary.	A fire may penetrate the boundary between elevation 708 and elevation 729.	Same as item ~~118~~ 67 (Fail Open).
69. ~~116.~~	Fire Damper 31-3935 31-3936	To prevent a fire from being transmitted down the duct system from the Control Building emergency ACU.	Closed (With ACU Operating)	Loss of air flow through the ACU.	Loss of one of the redundant ACU systems.	Redundant ACU starts on low flow signal.
			Open (With Fire Present)	Fire may cross the boundary.	Possible fire in ACU.	Water deluge system is located in ACU. Redundant ACU will be available for operation.
70. ~~117.~~	Fire Damper XFD 31-79	To prevent a fire ~~or smoke~~ from penetrating the barrier between the Main Control Room and the Relay Room.	Closed (Normal Operation)	Loss of flow path for emergency supply to shutdown board room in Auxiliary Building.	Emergency supply to shutdown board room in Auxiliary Building not available.	~~Same as item 30 (Fail Closed).~~ Emergency supply not required during normal operation
			Open (With Fire Present)	Loss of fire barrier.	Fire or smoke may penetrate the barrier between the MCR and the Relay Room.	Same as item ~~118~~ 67 (Fail Open).

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
71, ~~116.~~	Fire Damper XFD 31-78A XFD 31-78B XFD 31-92A XFD 31-92B	To prevent a fire ~~[illegible]~~ from passing between the Auxiliary Building and the Control Building. Two sets of serial dampers.	Closed (Normal Operation)	Same as item ~~121~~ 70 (Fail Closed).	Same as item ~~121~~ 70 (Fail Closed).	Same as item ~~121~~ 70 (Fail Closed).
			Open (With Fire Present)	None (Series Dampers)	None	Same as item ~~118~~ 67 (Fail Open).
72, ~~117.~~	Fire Damper 31-2036 31-3951 31-3950	To prevent a fire from penetrating the Communications Room wall through ventilation ducting.	Closed (Normal Operation)	Ventilation flow path blocked.	Loss of ventilation to Communications.	This room is not essential for nuclear safety.
			Open (With Fire ~~Fire Present~~)	No fire barrier in the flow path.	A fire may penetrate the Communications Room Wall.	Same as item ~~118~~ 67 (Fail Open).
73, ~~120.~~	Fire Damper 31-3943 31-3944 31-3947 31-3948 31-3949	To prevent a fire from penetrating the boundary between Battery Rooms.	Closed (Normal Operation)	Ventilation flow path blocked.	Loss of ventilation to Communications Room and 24 and 48 volt battery board and charger room.	Same as item ~~119~~ 72 (Fail Closed).
			Open (With Fire Present)	No fire barrier in the flow path.	Fire may penetrate the boundary between the Battery Rooms.	Same as item ~~118~~ 67 (Fail Open).

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
74. ~~107~~.	Fire Damper 31-3942	To prevent a fire from penetrating the boundary between the 250 V Battery Room 1 and the Battery Room Exhaust Fans Room.	Closed (Normal Operation)	Ventilation flow path blocked.	Same as item ~~124~~ T3 plus 250 V Battery Board Rooms.	Same as item ~~123~~ T2 (Fail Closed).
			Open (With Fire Present)	No fire barrier in the flow path.	A fire may penetrate the boundary between the 250 V Battery Room 1 and the Battery Room Exhaust Fan Room.	Same as item ~~118~~ 67 (Fail Open).
75. ~~108~~.	Fire Damper XFD 31-83 XFD 31-153	To prevent a fire or smoke from penetrating the barrier between the Relay Room and the Main Control Room.	Open	No smoke and fire barrier in the flow path.	Fire or smoke may penetrate the barrier between the Relay Room and the MCR.	Same as item ~~118~~ 67 (Fail Open).
			Closed	Ventilation flow path blocked.	Prevent exhaust air flow from Relay Room and ~~Record Storage Room~~ Attic.	Same as item ~~123~~ T2 (Fail Closed).
76. ~~109~~.	Flow Control Damper FCO 31-206	Diverts flow to or around the smoke removal fan.	Open (With Fan Operating)	Improper flow direction control.	Air flow may not be properly diverted.	Head supplied by Battery Room exhaust fan will assure no recirculation flow of smoke. There are also pack draft and isolation dampers which will prevent reverse air flow through the system.
			Closed (With Fan not Operating)	Air flow path blocked.	No air flow.	Air flow can be diverted through the smoke removal fan housing (Damper FCO 31-205 must be open).

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
77. ~~124.~~	Flow Control Damper FCO 31-205 (FCV)	Same as item 76 ~~103~~.	Open (With Fan Not Operating)	Same as item 76 ~~127~~ (Fail Open).	Same as item 76 ~~127~~ (Fail Open).	Some Battery Room exhaust may be forced through the smoke removal fan ductwork. Control can be transferred to the Auxiliary Control Room to safely shutdown the plant.
			Closed (With Fan Operating)	Air flow path blocked.	No air flow.	Smoke will not be removed from the Mechanical Equipment Room. This is not a safety related function. Control can be transferred to Auxiliary Control Room to safely shutdown the plant.
~~125.~~	~~Balancing Damper 31-3962~~					~~Passive Element.~~
78 ~~126~~	Isolation Dampers FCV ~~FCO~~ 31-204 ~~FCO 31-204B~~	~~To aid in maintenance of a positive pressure in the Main Control Room habitability area during Main Control Room emergency operation.~~	Open (During Main Control Room Isolation)	Loss of barrier in flow path through smoke removal fan. One of two redundant dampers lost.	None	Tornado dampers FCO 31-14, 13 can do: Redundant Dampers. Flow path and prevent loss of positive pressurization
			Closed (During smoke removal)	Air flow path blocked.	No ~~air flow~~ smoke removal	Same as item 77 ~~126~~ (Fail Closed).
79 ~~127~~.	Fan (Smoke Removal)	To remove smoke from the Mechanical Equipment Room.	No flow.	No air exhausted by smoke removal fan.	Smoke will not be removed from Mechanical Equipment Room.	Same as item 77 ~~126~~ (Fail Closed).
			Spurious Operation	Air removal by fan.	Additional exhaust from Mechanical Equipment Room.	Spurious operation of this will be a nuisance but will not affect nuclear safety.

To facilitate use of smoke removal fan in Equipment Rm & to aid in positive pressurization of the MCR habitability area during MCR emergency operation

Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
80. ~~128.~~	Fan (Toilet and locker room exhaust)	To provide exhaust from toilet and locker rooms.	Fail off.	No flow.	Air not exhausted from area.	This fan serves no safety function and is not safety related.
~~81. 129.~~	~~Fire Damper (2) 0-31-3997 0-31-4608 0-31-3958~~	~~To prevent a fire from entering the Spreading Room.~~	~~Open (Fire Present)~~	~~No fire barrier in the flow path.~~	~~A fire may enter the Spreading Room.~~	~~Same as item 120 (Fail Open).~~
			~~Closed (No Fire)~~	~~Reduced air supply to the Spreading Room.~~	~~None~~	~~Air is also supplied to the Spreading Room via another route.~~
81. ~~130.~~	Fire Dampers ~~XFD-31-179 XFD-31-180~~ 0-31-4608 0-31-3968	To prevent a fire or smoke from entering the Control Building emergency air cleanup units.	Open (Fire Present)	A fire may enter one of the redundant CB emergency ACU's.	None	100% redundant air cleanup unit available.
			Closed (No Fire)	Isolation of one air cleanup unit.	None (Redundant unit)	
82 ~~132.~~	Fire Damper XFD 31-168	~~Same as item 133.~~ To prevent a fire from entering Spreading RM.	Open (Fire Present)	~~Same as item 133.~~ (Fail Open)	None	Redundant fire damper.
			Closed (No Fire)	Reduced air supply to the Spreading Room.	None	~~Same as item 133 (Fail Closed).~~ Air is also supplied to the Spreading RM. via the control bldg. Pressurization fans
83. ~~134.~~	Fire Damper 31-3933	Same as item 82 ~~133.~~	Same as item 82 ~~133.~~	Same as item ~~133.~~ 82	Same as item ~~135.~~ 82	Same as item ~~135.~~ 82.
~~133.~~	~~Balancing Dampers 31-2155 31-2154~~					~~Passive Elements.~~

84. Will not be used.

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~114.~~ Fire Damper XFD 31-167	To prevent smoke or fire from the Mechanical Equipment Room (El 755) from being circulated into the Main Control Room.	Open (With Smoke Present)	Negligible. Filters in AHU's may load up.	Some smoke may be introduced into the Main Control Room.	Control can be transferred to the Auxiliary Control Room.
		Open (With Fire Present)	No fire barrier in the flow path.	Fire may enter the MCR.	Same as item 118 (Fail Open). Control can be transferred to the Auxiliary Control Room.
		Closed (No Fire)	Reduced ventilation air flow through the Mechanical Equipment Rm.	Gradual heat-up of Mechanical Equipment Room with possible loss of equipment function.	Same as Fail Open (Smoke Present).
95. ~~118.~~ Fire Damper XFD 31-99 (Shift Eng office & conference rm.)	To prevent smoke or fire from the ~~Chart Storage Room and Instrument Calibration Room~~ from being introduced into the air recirculation system.	Open (With Smoke Present)	No smoke barrier in flow path.	Smoke will be distributed by the Main Control Room Air Handling units.	The affected rooms are not essential to safety. Control can be transferred to Auxiliary Control Room.
		Open (With Fire Present)	No fire barrier in flow path.	Fire can enter the exhaust ductwork.	The room which this ductwork traverses are not essential. Control can be transferred to Aux. Control Rm.
		Closed (No Fire)	Loss of exhaust flow path.	Design ventilation rate of these rooms will not be maintained.	The affected rooms are not essential to nuclear safety.

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
86. ~~104.~~	Fire Damper 31-~~3941~~ 3941	To prevent ~~passage~~ transmission of fire ~~down the duct system.~~ between El 642 corridor & battery rm exhaust fan room	~~Open~~ Closed (No Fire)	None	None	This fire damper appears to serve no functional purpose.
			~~Closed~~ Open	Loss of normal exhaust from unit 2 Auxiliary Instrument Room.	Loss of Auxiliary Instrument Room.	Control can be transferred to Auxiliary Control Room.
87 ~~105.~~	Fire Dampers XFD 31-181 XFD 31-182	Deleted by ECN-5523 ~~To prevent fire or smoke in the Mechanical Equipment Room (El. 692) from being circulated with air supplied to elevations 692 and 708.~~	~~Open (Fire Present)~~	~~Loss of fire barrier in flow path.~~	~~Smoke will be circulated.~~	~~Smoke in these areas will not affect nuclear safety.~~
			~~Closed (No Fire Present)~~	~~One of two 100% systems will be lost.~~	~~None. The redundant system will be started.~~	
88 ~~106.~~	Flow Control Damper FCO 31-202	To divert flow during removal of smoke from the elevation 692 Mechanical Equipment area.	Open (With Smoke Present)	Not all flow will come from the Mech. Eqp. Room.	The rate of smoke removal will be reduced.	
			Closed (With No Smoke)	Blocked exhaust flow path.	Reduced air exhaust from Battery Rooms.	An alternate exhaust air flow path is provided.
89. ~~107.~~	Fire Damper 31-3940	To prevent a fire from passing from Elevation 692 to 708 through the exhaust duct work.	Open (Fire Present)	Loss of fire barrier in flow path.	A fire may enter the unit 1 Auxiliary Instrument Room.	Control can be transferred to the Auxiliary Control Room.
			Closed (No Fire Present)	Blocked exhaust flow path.	88. Same as item ~~102~~ (Fail Closed).	88 Same as item ~~102~~ (Fail Closed).

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Table 9.4-7

FAILURE MODES AND EFFECTS ANALYSIS
CONTROL BUILDING HVAC SYSTEM

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
90, [illegible]. Flow Control Damper FCO 31-203	To divert flow during removal of smoke from the Elevation 692 Mechanical Equipment area and Battery Room exhaust fan room.	Open (With No Smoke Present)	Exhaust flow not properly diverted.	Reduced air flow from the Battery Rooms.	An alternate exhaust air flow path is provided.
		Closed (With Smoke Present)	Exhaust flow path blocked.	Smoke may accumulate in the Mechanical Equipment area.	Smoke removal from the Mechanical Equipment area is not a nuclear safety related function.
91, [illegible]. Fire Damper 31-3939	To prevent a fire from passing from Elevation 708 to 729 via the exhaust ductwork.	Open (Fire Present)	Loss of fire barrier in flow path.	A fire may enter the Spreading Room.	Defense in depth is provided.
		Closed (No Fire Present)	Blocked exhaust flow path.	Same as item 88 (Fail Closed).	Same as item 88 (Fail Closed).
92 [illegible]. Fire Damper 31-3932	To prevent a fire from passing from Elevation 729 to 755 via the exhaust ductwork.	Open (Fire Present)	Loss of fire barrier in flow path.	A fire may enter the EL. 755 Mechanical Equipment Room.	Defense in depth is provided.
		Closed (No Fire Present)	Blocked exhaust flow path.	Same as item 88 (Fail Closed).	Same as item 88 (Fail Closed).
93, [illegible]. Fire Damper XFD 31-98	To prevent air containing smoke from being supplied to various rooms on El. 755.	Open (Smoke Present)	Smoke barrier in flow path will be lost.	Smoky air will be supplied.	The rooms served by this damper are not essential to nuclear safety.
		Closed (No Smoke Present)	Blocked supply air path.	Reduced ventilation air flow through various rooms on El. 755.	

*Momentary shall be defined as the time required for (1) failure detection, (2) automatic switchover to a redundant, standby unit, and (3) standby unit to reach required operating capacity. Generally this time is less than 1 minute.

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Table 9.4-7 (cont.)
Failure Modes [illegible]
Control Building HVAC System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
94. Fire Damper D-31-3953	To preclude Spread of fire between spreading Rm & East turbine Rm	Open (Fire)	None	None	Redundant dampers in Series
		Closed (No Fire)	Loss of flow from Spreading Room	None	Spreading Room Exhaust is Non-Essential
95. Spreading Room Exhaust Fans, A-A, B-B	Provides Ventilation of Spreading Room	No or Low Flow	Decrease in Exhaust Flow	None	Redundant Unit Starts upon Low flow Signal from failed Unit
96. Isolation Damper(s) FCO 31-25,26	Isolates Spreading Room Exhaust Fans	Closed (Applicable Fan Operating)	Same as Item 95	None	Same as Item 95
		Open (Applicable Fan on Standby)	Back flow Path Through applicable fan Opened	Reduced Efficiency in Spreading Room Exhaust	Same as Item 103, Closed Failure
97. Spreading Room Supply Fan	Provides fresh air to Spreading Room	No or Low Flow	Reduced or Loss of Supply to Spreading Room	None	Control Bldg Pressurization Fans A-A and B-B can Supply Air if Necessary
98. Fire Damper XFD-31-86	Reverts Spreading of Fire between MCR AND Relay Room	Closed (No Fire)	Flow Path to Relay Rm AND Records Rm Blocked	Rooms Not Maintained at Optimum Conditions	Rooms Served are Non-Essential Dampers are Accessible From Control Room Habitability Area
		Open (Fire)	Fire May Spread Between Areas Served	None	Defense in depth is Provided in Accordance with Branch Technical Position 9.5-1
99. Isolation Damper FCO 31-1 A	Modulate the Control Bldg. Pressure	Improper Modulation	Loss of Proper Flow	Decrease in Ventilation And Loss of Proper	Upon Loss of Proper Pressurization Fan B-B will start and Alarm will Sound in MCR

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Table 9.4-7 (cont.)
Failure Modes And Effects Analysis
Control Building HVAC System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
100. Isolation Damper FCD-31-2A	Same as Item 99	Same As Item 99	Same As Item 99	Same As Item 99	Same as Item 99 Except FAN A-A
101. Backdraft Damper(2) 31-3972 31-3973	Prevents Backflow To Standby Electrical Board Room AHU's	Closed (C-B, D-B operating)	Flow Path from C-B, D-B blocked	Decrease in flow	Redundant AHUs, A-A & B-B START upon Low Flow Sign Alarm initiate in MCR
		Open (C-B, D-B on Standby)	Back flow Path to C-B, D-B opened	None	FCD 31-31 is closed and prevents significant back flow
102. Will Not Be Used					
103. Fire Damper (4) 0-31-3952, 3966 -3970, 3971	Prevents Spreading of fire between two Elevations via ductwork	Closed (No Fire)	Loss of flow to or from areas served	Areas Not Maintained AT OPTIUM Conditions	Areas Served are Non-Essential
		Open (Fire)	Loss of fire Barrier	Fire May Spread, May Lose Non-Essential Rooms	Same as Item 98 Open Failure
104. Fire Damper (2) 0-31-3976 -3977	Prevents Spread of fire to Communications Rm from Adjacent Room	Closed (No fire)	Flow through 1 of 2 supply ducts blocked	None	Remaining duct will Supply Adequately
		Open (Fire)	Loss of Fire Barrier	Fire May Spread	May lose Non-Essential Air Same as Item 98, Open Failure

Table 9.4-7 (cont.)
Failure Modes and Effects Analysis
Control Building HVAC System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
105. Fire Damper D-31-4404	To Prevent fire from spreading into NRC office	Closed (No fire)	Loss of flow to this Area	NONE	This Area is NON-essential to the Control Building Safety Function
		Open (Fire)	Loss of fire barrier	Fire may spread to Non-essential area.	Same as item 98 open failure
106. Fire Damper D-31-4402	To Prevent fire from spreading to Conference Rm	Closed (No fire)	Same as item 105	Same as item 105	Same as item 105
		Open (Fire)	Same as item 105	Same as item 105	Same as item 105

TABLE 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
1. Isolation damper Unit 1 (supply) 30-106 30-107 30-86 30-87 Unit 2 (supply) 30-108 30-109 30-21 30-22 Unit 1 (exhaust) 30-160 30-161 30-166 30-167 Unit 2 (exhaust) 30-271 30-272 30-275 30-276	Secondary containment isolation dampers provide isolation during the accident mode. Establishes boundary for the ABGTS.	Open (Emergency operation)	One of two redundant dampers will be lost.	None	
		Closed (Normal operation)	No supply air service to spaces downstream of damper.	Temperature in spaces served may increase.	General exhaust and fuel handling exhaust systems will provide adequate ventilation. also, fuel handling area receives supply air fr[redacted] both unit 1 and unit 2 general supply systems.
2. Isolation damper Unit 2 (supply) 30-129 30-130	Secondary containment isolation dampers provide isolation for the cask loading area during an accident.	Open (Emergency operation)	One of two redundant dampers will be lost.	None	
		Closed (Normal operation	No supply air service to cask loading area.	Temperature in the cask loading area may increase.	Fuel handling area exha[redacted] system will provide adequate ventilation and, if necessary railroad door can be o[redacted]ened.

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TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
3. Isolation damper Unit 1 (supply) 30-117 30-118 30-28 30-29 30-3 30-6 30-13 30-18 Unit 2 (supply) 30-98 30-112 ~~30-32~~ ~~30-33~~ 30-34 30-35 30-76 30-79 *30-36 *30-41 30-60 30-69 Unit 1 (exnaust) 30-119 30-120 Unit 2 (exhaust) 30-91 30-96	Interim secondary containment isolation dampers provide necessary isolation during an accident when unit one is on line and unit two is still in the construction stage.	Open (Emergency operation)	One of two redundant dampers will be lost.	None	
		Closed (Normal operation)	No supply air service to spaces downstream of damper.	Temperature in related spaces may increase.	Corresponding exhaust system will provide adequate ventilation. Note: These dampers will be locked in the open position upon completion of unit 2.
4. Isolation damper 30-137	Secondary containment isolation dampers provide isolation	Open (Emergency operation)	One of two redundant dampers will be lost.	None	

*Provides isolation for the Unit 2 additional equipment building.

TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL-HANDLING AREA~~ General Ventilation System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
30-138 30-140 30-141	during the accident mode. Establishes boundary for the ABGTS.	Closed (Normal operation)	No exhaust ventilation capability in one of the two FHA exhaust systems.	None Redundant subsystem.	On no flow signal MCR operator will activate standby exhaust fan.
5. Isolation damper 30-122 30-123	Secondary containment isolation dampers provide isolation for the cask loading area during an accident.	Open (Emergency operation)	One of two redundant dampers will be lost.	None	
		Closed (Normal operation)	No exhaust ventilation in the cask loading area.	None. General supply system will provide adequate ventilation.	Normally open hatch will prevent positive pressure buildup in the space. Failed closed damper not important to nuclear safety.
6. Isolation damper 30-115 30-125 30-116 30-128 30-121 30-131 30-124 30-132 30-49 30-113 30-55 30-114	Interim secondary containment isolation dampers provide isolation in the fuel handling area during an accident when unit 1 is on line and unit 2 is still in the construction stage.	Open (Emergency operation)	One of two redundant dampers will be lost.	None	
		Closed (Normal operation)	No exhaust ventilation in the fuel handling areas.	None. General supply system will provide adequate ventilation.	A damper failed in the closed position is not important to nuclear safety. Note: These dampers will be locked in the open position upon completion of Unit 2. 33

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TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
7. Isolation damper 30-157B 30-146B	Secondary containment isolation damper provides isolation for the ABGTS and prevents backflow thru a non-operating fan.	Open (Normal operation)	One of two redundant dampers will be lost.	None	
		Closed (Emergency operation)	One of two redundant sub-systems will be lost.	None	One ABGTS subsystem will provide adequate service.
8. Moisture separator	Eliminates direct water spray, mist, or entrained water droplets from the filter train inlet airstream.	Blockage	Reduces overall exhaust airflow and inhibits the ABGTS capability to perform its required function.	Reduction in ABGTS airflow will inhibit the fuel handling area clean-up operation and affect the 1/4 inch negative pressure.	The ABGTS will be tested at least once per operating cycle to confirm efficiency and operated a minimum of 10 hrs per month to confirm proper operation.
9. Humidity electric heating coil	Reduces the relative humidity of air prior to entering filters.	No heating	May result in reduced charcoal effectiveness.	Possible increase in release of contaminants to atmosphere.	See No. 8, also, radiation monitors in the shield building exhaust will indicate an ineffective adsorber. MCR operator can shut down faulty unit and activate standby unit.
		Overheating	May increase charcoal temperature to higher than normal.	Release dosage is not affected by charcoal temperatures in this range.	Heating element is sized to prevent ignition or breakdown of charcoal in the event of overheating failure.
10. Flow Switch 30-143	Sends signal to shut off Charcoal heating element when low flow is detected	No Signal	Overheating of Charcoal may result	None	Charcoal heater has over Temperature Cut off

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TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
11. ~~10.~~	Prefilter	Removes airborne particles and protects the HEPA filter from early overload.	Overload and high pressure drop	See No. 8	See No. 8	See No. 8
12. ~~11.~~	HEPA filter	Filters the air upstream of the charcoal beds.	Overload and high pressure drop.	See No. 8	See No. 8	See No. 8
13 ~~12.~~	Charcoal adsorbers	Removes radioactive iodine and iodides from the airstream.	Leakage	Reduces charcoal effectiveness to limit release of radioactive contaminants.	May result in contamination release in excess of maximum allowable.	See No. 8 and No. 9
14 ~~13.~~	HEPA filter	Filters the air downstream of the charcoal beds.	Overload and high pressure drop.	See No. 8	See No. 8	See No. 8
15 ~~14.~~	Backdraft damper 0-31-3296 0-31-3289	Prevents backflow thru a non-operating ABGTS exhaust fan.	Open (Unit on standby)	None	None	Isolation valves will prevent backflow.
			Closed (Unit operating)	No exhaust ventilation service to the areas requiring air clean-up.	None Redundant subsystem	The redundant subsystem will start on a low flow signal.
16 ~~15.~~	Single speed exhaust fan	Prime air mover for the ABGTS. Provides service to the ABSCE.	Inoperable	Subsystem cannot provide required air clean-up for the fuel handling area.	None Redundant subsystem	The redundant subsystem will start on a low flow signal.

(Sheet 8)

TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
17 ~~16~~.	Flow switch 30-146	Sends a signal to start the standby fan and activates an alarm in the MCR in event of fan failure.	Spurious signal, i.e. sends a false signal when fan is actually operating.	Possibility of both ABGTS units operating simultaneously.	None	It is not objectionable for both ABGTS units to operate simultaneously.
19. ~~17~~.	Isolation damper 30-157A 30-146A	See No. 7	See No. 7	See No. 7	See No. 7	See No. 7
20. ~~18~~.	Modulating damper 30-148 30-149	Modulates the airflow thru the vacuum relief duct during the accident mode such that a 1/4' building negative pressure can be maintained. (Minimum requirement 1/8')	Open	One of two modulating dampers will be lost.	None	Second damper will further restrict its airflow to offset this loss and maintain 1/4' negative. If the second damper closes completely and 1/4' negative cannot be maintained, the MCR operator will activate the standby ABGTS.
			Closed	No vacuum relief thru one of the two relief ducts.	None	Second damper will open to allow more flow.
18.	Flow Element 30-165 30-150	Sends signal to Isolate the gas decay tanks when ABGTS Flow Exceeds 3000 cfm	No signal	NONE	NONE Additional releases if any are significant	this component is not concerned with the ABGTS operation or ANY of its safety-related features.

TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
21 ~~19.~~	Isolation damper 30-279 30-280	Provides isolation for the vacuum relief duct. Remains closed at all times during normal conditions and opens only when the building differential pressure drops below a preset value during an accident.	Open	None	None	During the normal mode a failure in the open position will not be significant since the modulating damper will be closed.
			Closed	No vacuum relief thru one of the two relief ducts.	None Modulating damper in the second vacuum relief duct will open further to offset this failure.	
22 ~~20.~~	Backdraft damper 0-31-3317 0-31-3318	Prevents backflow thru the vacuum relief duct.	Open	None The isolation valve will be closed when vacuum relief is not required.	None	A failure in the open position during the normal mode will be inconsequential since the isolation valve will be closed.
			Closed	No vacuum relief thru one of the two relief ducts.	None Modulating damper in the second vacuum relief duct will open further to offset this failure.	
23, ~~21.~~	Isolation dampers 65-4 65-52 65-5 65-53	Provide isolation between the ABSCE and the EGTS during an accident.	See remarks	See remarks	See remarks	Failure mode and effects for these dampers are addressed in the EGTS FMEA.
24.	Charcoal Heater	Maintains Charcoal Temperature above the entering dew point temperature in order to prevent condensation	No heat	See No.9	See Remarks	Possible Temporary increase the relative Humid Heater will soon in Containment release, warm charcoa sufficiently to drive off thru one of two ABGTS Uni Moisture when ABGTS starts.
			Overheating	See No.9	See No.9	See No. 9

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Revised by Amendment 52

TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
25 ~~24~~.	Isolation valve Unit 1 1-30-294 1-30-295 Unit 2 2-30-294 2-30-295	Secondary containment isolation valves provide isolation for the Reactor Building Purge air supply system during an accident.	Open (Emergency operation) Closed (Normal Operation)	One of two redundant dampers will be lost. No supply air available for reactor building purge.	None None	A valve failed in the closed position is not important to nuclear safety. Valve can be repaired and RB then purged with no significant effects.
~~23. Not used~~						
~~24. Not used~~						
26 ~~25~~.	Fire damper 1-31-3806 1-31-3807 2-31-3882 2-31-3883	To prevent a fire from penetrating the boundary between the Mechanical Equipment Room and the elevation 737 General Spaces	Open (During a fire) Closed (Normal operation)	Loss of fire barrier in flow path. Blocked air flow path.	Fire may penetrate the boundary Reduced ventilation rate	Defense in depth is provided in accordance with Branch Technical Position 9.5-1. Space coolers are provided to cool safety related areas.
27 ~~26~~.	Fire damper 1-31-3803 2-31-3869	To prevent a fire from penetrating the boundary between the Mechanical Equipment Room and the elevation 713 General Spaces.	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26
28 ~~27~~.	Fire damper 1-31-3804 2-31-3871	To prevent a fire from entering the Pipe Chase Cooler Room (Pipe Gallery)	Same as ~~26~~ 25	Same as ~~26~~ 25	Same as ~~26~~ 25	Same as ~~26~~ 25
29 ~~28~~.	Fire damper 1-31-3802 1-31-3862	To prevent a fire from entering the Penetration Room	Same as ~~26~~ 25	Same as ~~26~~ 25	Same as ~~26~~ 25	Same as ~~26~~ 25

TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
30. ~~29.~~ Fire damper 2-31-3884 2-31-3885	To prevent a fire from entering the EGTS Room.	Same as ~~25~~ 26	Same as 25 26	Same as 25 ~~26~~	Same as ~~25~~ 26
31 ~~30.~~ Fire damper 1-31-3119 2-31-3239	To prevent a fire from entering the CRD Equipment Room.	Same as 26	Same as 26	Same as 26	Same as 26
32 ~~31.~~ Fire damper 1-31-3976	To prevent a fire from entering the Pipe Gallery	Same as ~~25~~ 26	Same as 25 26	Same as 25 26	Same as ~~25~~ 26
33 ~~32.~~ Fire damper 1-31-3819 2-31-3827	To prevent a fire in the pipe chase from spreading to the elevation 737 General Spaces.	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26
34 ~~33.~~ Fire damper 0-31-3849	To prevent a fire from entering the ABGTS Room	Same as ~~25~~ 26	Same as 25 26	Same as 25 26	Same as ~~25~~ 26
~~35 34. Fire damper~~	~~To prevent a fire from penetrating the boundary between elevation 692 and elevation 729.~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~
35. Fire damper 0-31-3826	To prevent a fire from entering the cask loading area.	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as 25 26	Same as ~~25~~ 26
~~36. Fire damper~~	~~To prevent a fire from entering the fuel transfer valve area.~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~

TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
36 ~~37~~.	Fire damper 0-31-3835	To prevent a fire from penetrating the boundary between elevations 737 and 757.	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26
37 ~~38~~.	Fire damper 0-31-3837	To prevent a fire from entering the waste packaging area.	Same as 26	Same as 26	Same as 26	Same as 26
~~39. Fire damper~~		~~To prevent a fire from entering the fuel transfer valve area 2~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~
38 ~~40~~.	Fire damper 0-31-3839 0-31-3841	To prevent a fire from entering the Reactor Building Access Room 1	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26
39 ~~41~~.	Fire damper 2-31-3879	To prevent a fire from, entering the Penetration Room.	Same as 26	Same as 26	Same as 26	Same as 26
40 ~~42~~.	Fire damper 1-31-3988 2-31-3876	To prevent a fire from entering the Pipe Chase	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26
41 ~~43~~.	Fire damper 1-31-3117 2-31-3240	To prevent a fire from passing from the Control Rod Drive Equipment Room to the elevation 757 General Spaces	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26
42 ~~44~~.	Fire damper 1-31-3805 2-31-3870	To prevent a fire from entering the Pipe Chase	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26	Same as ~~25~~ 26

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TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING ~~FUEL HANDLING AREA~~ General Ventilation System

Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
~~45. Fire damper~~	~~To prevent a fire from entering the elevation 737 General Spaces.~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~
43 16. Fire damper 0-31-3834 0-31-3845	To prevent a fire from penetrating the boundary between the ABGTS Room and the El. 737 General Spaces.	Same as 26 ~~25~~	Same as 26 ~~25~~	Same as 26 ~~25~~	Same as 26 ~~25~~
44 17. Fire damper 0-31-3825	To prevent a fire from penetrating the boundary between the cask loading area and the elevation 729 General Spaces	Same as 26 ~~25~~	Same as 26 ~~25~~	Same as 26 ~~25~~	Same as 26 ~~25~~
45 18. Fire damper 1-31-3992	To prevent a fire from penetrating the boundary between the ~~fuel transfer valve~~ PASF area 1 and the elevation 729 General Spaces	Same as 26 ~~25~~	Same as 26 ~~25~~	Same as 26 ~~25~~	Same as 26 ~~25~~
46 19. Fire damper 0-31-3836	To prevent a fire from penetrating the boundary between the Reactor Building Access Room 2 and the elevation 757 General Spaces.	Same as 26 ~~25~~	Same as 26 ~~25~~	Same as 26 ~~25~~	Same as 26 ~~25~~

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TABLE 9.4-8 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

AUXILIARY BUILDING FUEL HANDLING AREA

	Item	Function	Failure Mode	Effect on Subsystem	Effect on System	Remarks
47 50.	Fire damper 0-31-3838	To prevent a fire from penetrating the boundary between the waste package area and the elevation 757 General Spaces	Same as 25 26	Same as 25 26	Same as 25 26	Same as 25 26
48 51.	Fire damper 2-31-3984	To prevent a fire from penetrating the boundary between the PASF ~~fuel transfer valve~~ area 2 and the elevation 729 General Spaces.	Same as 25 26	Same as 25 26	Same as 25 26	Same as 25 26
49 52.	Fire damper 0-31-3840	To prevent a fire from penetrating the boundary between elevations 737 and 757.	Same as 25 26	Same as 25 26	Same as 25 26	Same as 25 26
50. 53.	Fire damper 1-31-3813	To prevent a fire from penetrating the barrier between the Penetration Room Unit 1 and the elevation 737 General Spaces.	Same as 25 26	Same as 25 26	Same as 25 26	Same as 25 26
~~54.~~	~~Fire damper~~	~~To prevent a fire from penetrating the barrier between the Penetration Room and the elevation 737 General Spaces.~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~	~~Same as 25~~

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Revised by Amendment 52

Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
51 ~~56.~~ ISOLATION DAMPER 81-411, 344	SECONDARY CONTAINMENT ISOLATION DAMPERS PROVIDE ISOLATION FOR THE POST ACCIDENT SAMPLING FACILITY (PASF) DURING AN ACCIDENT.	OPEN (EMERGENCY OPERATION)	ONE OF TWO REDUNDANT DAMPERS WILL BE LOST.	NONE.	
		CLOSED (NORMAL OPERATION)	NO EXHAUST VENTILATION CAPABILITY RESULTING IN OVER PRESSURIZATION OF THE PASF	NONE	THIS OVER PRESSURIZATION HAS NO EFFECT ON PLANT SAFETY. PASF IS NOT USED DURING NORMAL OPERATION.
52 ~~57.~~ FIRE DAMPER 2-31-3957	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE PERSONNEL AND EQUIPMENT ACCESS LOCK AREA AND THE EL 757 GENERAL FLOOR AREA	OPEN (DURING A FIRE)	SAME AS #26	SAME AS #26	SAME AS #26
		CLOSED (NORMAL OPERATION)			
53 ~~58.~~ ISOLATION DAMPER 1-31-407 1-31-399 1-31-439 2-31-407 2-31-439 2-31-399	TO ISOLATE THE ACCIDENT EXHAUST OF THE POST ACCIDENT SAMPLING FACILITY DURING NORMAL OPERATION.	CLOSED (DURING AN ACCIDENT)	LOSS OF PROPER EXHAUST FROM POST ACCIDENT SAMPLING FACILITY SEE REMARKS	NONE	LOSS OF PROPER EXHAUST WILL RESULT IN EVACUATION OF THE PASF. (ALARM WILL SOUND)
		OPEN (NORMAL OPERATION)	ONE OF THE REDUNDANT DAMPERS WILL BE LOST	NONE	

COMPUTED WCC DATE 1/9/85
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FMEA FOR THE MGTS AND RELATED VENTILATION SYSTEMS

TI-630 R2

VA 11030 (WM-7-75)

Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
~~54~~ 59. ISOLATION DAMPER 30-159, 162, 274, 278	TO ISOLATE THE AUXILIARY BUILDING GENERAL EXHAUST FANS FROM THE EXHAUST STACK	CLOSED (NORMAL OPERATION)	NONE. REDUNDANT EXHAUST FAN CAN EXHAUST THE AIR.	NONE	
		OPEN (EMERGENCY OPERATION)	AIR FROM EXHAUST STACK CAN BACK UP FROM EXHAUST STACK TO THE FAN. SEE REMARKS	NONE	REDUNDANT ISOLATION DAMPER WILL PREVENT AIR FROM THE EXHAUST STACK FROM ENTERING THE AUXILIARY BUILDING
55 60. ISOLATION DAMPER 30-158 30-270 30-136	REMOTE MANUAL DAMPER USED TO ISOLATE EXHAUST FANS IF MAINTENANCE IS NECESSARY.	FAILS OPEN	NONE. ISOLATION DAMPERS PREVENT FLOW THROUGH SYSTEM.	NONE	
56 ~~61~~. FIRE DAMPER 1-31-3996	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN ELEVATION 713 AND 737	SAME AS #26	SAME AS #26	SAME AS #26	
57 ~~62~~. FIRE DAMPER 1-31-3995	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN ELE 692 & 713	SAME AS #26	SAME AS #26	SAME AS #26	

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FMEA FOR THE ABGTS AND RELATED VENTILATION SYSTEMS

TI-630 R2

COMPUTED WCC DATE 1/9/85
CHECKED RJT DATE 1/23/85

VA 11030 (WM-7-75)

Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
~~58~~ 58. FIRE DAMPER 31-3810 31-3811	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE HOT INSTRUMENT SHOP AND THE GENERAL SPACES OF ELE 737	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
59 ~~59~~. FIRE DAMPER 31-3963 31-3962 31-3965 31-3964	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE WASTE GAS COMPRESSOR RMS AND THE GENERAL SPACES OF ELE 713.	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
60 ~~60~~. FIRE DAMPER 31-3788	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE BION-DOWN TREATMENT ROOM AND THE GENERAL SPACES OF EL 757	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26

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FMEA FOR THE AGGTS AND RELATED VENTILATION SYSTEMS

TI-630 R2

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TVA 11030 (WM-7-75)

Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
61 GG. BACKDRAFT DAMPER 1-31-3080 2-31-3206	TO PREVENT FLOW FROM PIPE CHASE INTO THE PENETRATION ROOM.	OPEN	AIR CAN MOVE FROM PIPE CHASE INTO PENETRATION ROOM.	NONE	BACKDRAFT DAMPER IS PART OF THE AUXILIARY BUILDING GENERAL VENTILATION SYSTEM AND HAS NO EFFECT ON THE ABGTS.
2-31-3145		CLOSED	AIR CANNOT MOVE FROM PENETRATION ROOM TO THE PIPE CHASE.	NONE	SEE ABOVE
62 HH. FIRE DAMPER 1-31-3817 1-31-3818 2-31-3875 2-31-3861	TO PREVENT A FIRE FROM PENETRATION THE BOUNDARY BETWEEN THE PENETRATION ROOM AND THE PIPE CHASE	SAME AS # 26	SAME AS # 26	SAME AS # 26	SAME AS # 26
63 II. BACKDRAFT DAMPER 1-31-3087 1-31-3088 2-31-3208 2-31-3209	TO PREVENT FLOW FROM PIPE CHASE INTO THE HEAT EXCHANGER ROOMS	OPEN	AIR CAN MOVE FROM PIPE CHASE TO HEAT EXCHANGER ROOM	NONE.	SAME AS # 61 GG
		CLOSED	AIR CANNOT MOVE FROM HEAT EXCHANGER ROOM INTO PIPE CHASE	NONE.	SAME AS # 61 GG

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FMEA FOR THE ABGTS AND RELATED VENTILATION SYSTEMS.

TI-630 R2

Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
64 69. FIRE DAMPER 1-31-3814 1-31-3815 1-31-3816 2-31-3872 2-31-3873 2-31-3874	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE HEAT EXCHANGER ROOMS AND THE PIPE CHASE.	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
65 JO. FIRE DAMPER 0-31-3967	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE REFUELING PURIFICATION FILTER RMS AND THE EL 692 GENERAL SPACES	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
66 JP. Fire DAMPER 2-31-3970	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE PIPE GALLERY AND THE PENETRATION ROOM	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
67 Q. BACKDRAFT DAMPER 1-31-3204 1-31-3078	TO PREVENT FLOW FROM PIPE CHASE TO PIPE GALLERY	SAME AS #61 ~~66~~	AIR CAN MOVE FROM PIPE CHASE TO PIPE GALLERY AIR CANNOT MOVE FROM PIPE GALLERY TO PIPE	SAME AS #61 ~~66~~	SAME AS #61 ~~66~~

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SYSTEMS FOR THE NORMAL AND CONTROLLED VENTILATION

TI-630 R2

COMPUTED WSS DATE 1/9/85
CHECKED [signature] DATE 1/23/85

Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
68 ~~67~~. BACKDRAFT DAMPER 1-31-3020	TO PREVENT FLOW FROM VALVE GALLERY to EL 692 GENERAL SPACES	OPEN	AIR CAN TRAVEL FROM VALVE GALLERY to GENERAL SPACES	NONE	SAME AS #~~66~~ 61
1-31-3021		CLOSED	AIR CANNOT TRAVEL TO VALVE GALLERY FROM GENERAL SPACES	NONE	SAME AS #~~66~~ 61
69 ~~68~~. FIRE DAMPER 1-31-3928 1-31-3787 1-31-3924 1-31-3785	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE VOLVE GALLERY AND THE WASTE GAS DECAY TANK ROOMS	SAME AS # 26	SAME AS # 26	SAME AS # 26	SAME AS # 26
70 ~~69~~. FIRE DAMPER 1-31-3784	TO PREVENT A FIRE FROM PENETRATING the BOUNDARY BETWEEN the WASTE GAS DECAY TANK ROOM AND the EL 692 GENERAL FLOOR SPACES	SAME AS # 26	SAME AS # 26	SAME AS # 26	SAME AS # 26
71 ~~70~~. FIRE DAMPER 1-31-3789	TO PREVENT A FIRE FROM PENETRATING the BOUNDARY BETWEEN the WASTE GAS DECAY TANK ROOM AND THE HOLDUP TANK ROOM.	SAME AS # 26	SAME AS # 26	SAME AS # 26	SAME AS # 26

SYSTEMS AND DESIGNED VENTILATION

TI-630 R2

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TVA 11030 (WM-7-75)

Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
72 FIRE DAMPER 1-31-3792 1-31-3795 1-31-3796	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE HOLD UP TANK ROOMS AND THE EL 692 GENERAL SPACES	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
73 FIRE DAMPER 2-31-3987	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE FLOOR DRAIN COLLECTOR TANK ROOM AND THE CONSTR. TOOL ROOM	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
74 BACKDRAFT DAMPER 2-31-3158 2-31-3160	TO PREVENT FLOW FROM GAS STRIPPER RMS TO EL 692 GENERAL FLOOR AREAS.	OPEN	AIR FROM STRIPPER RM CAN MOVE TO EL 692 GENERAL FLOOR AREA.	NONE	SAME AS #61
		CLOSED	AIR CANNOT MOVE FROM GENERAL FLOOR AREA TO STRIPPER RM.	NONE	SAME AS #61
75 FIRE DAMPER 2-31-3986	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE CONSTR. TOOL RM AND THE GAS STRIPPER RM	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26

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Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
76 #26. FIRE DAMPER 2-31-3863	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE CONST. TOOL ROOM AND THE EL 692 GENERAL FLOOR AREA	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
77 #27. Fire DAMPER 2-31-3988	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE EL 692 & EL 715 GENERAL FLOOR AREAS	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
78 #28. Fire DAMPER 2-31-3956	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE WASTE EVAPORATOR RMS AND THE EL 692 GENERAL FLOOR AREAS	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
79 #29. ISOLATION DAMPER 30-269	TO ISOLATE V1 EXHAUST FROM V2 EXHAUST	OPEN (NORMAL OPERATION)	DESIGN FLOWPATHS ARE NOT MAINTAINED	NONE	SAME AS #61
(EE)		OPEN (ACCIDENT OPERATION	NONE	NONE	SAME AS #61

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Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
80 85. ISOLATION DAMPER 30-296 30-297 30-298 30-299	PROVIDES ISOLATION FOR THE CONE BUILDING DURING AN ACCIDENT.	OPEN (ACCIDENT CONDITION)	ONE OF TWO REDUNDANT DAMPERS WILL BE LOST.	NONE. REDUNDANT DAMPER WILL PROVIDE ISOLATION.	SAME AS #61 ~~68~~
		CLOSED (NORMAL OPERATION)	LOSS OF DESIGN AIR FLOW PATH.	NONE.	SAME AS #61 ~~66~~
81 ~~82~~. FIRE DAMPER 0-31-2427 0-31-2429	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE WASTE PACKAGING AREA AND THE CONE BUILDING	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
82 ~~83~~. FIRE DAMPER 0-31-3827	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE EL 713 AND EL 692 GENERAL SPACES.	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26.
83 ~~84~~. FIRE DAMPER 1-31-3966	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY BETWEEN THE PERSONNEL AND EQUIPMENT ACCESS LOCK AREA AND THE EL 757 GENERAL FLOOR AREA	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26

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Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
84 89. FIRE DAMPER 0-31-3843	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY Between the EL 737 General Spaces AND THE PENETRATION ROOM CONTAINING THE ABGTS.	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
85 90. FIRE DAMPER 1-31-3786	TO PREVENT A FIRE FROM PENETRATING THE BOUNDARY Between the Blowdown treatment RM & THE Personnel & EQUIPMENT ACCESS RM.	SAME AS #26	SAME AS #26	SAME AS #26	SAME AS #26
86 91. ISOLATION DAMPER 1,2-31-350 1,2-31-365 1,2-31-342 1,2-31-343	SECONDARY ISOLATION DAMPERS PROVIDE ISOLATION DURING NORMAL OPERATION. ESTABLISHES THE BOUNDARY FOR THE POST ACCIDENT SAMPLING FACILITY (PASF).	OPEN (NORMAL OPERATION) CLOSED (ACCIDENT OPERATION)	ONE OF TWO REDUNDANT DAMPERS WILL BE LOST LOSS OF Supply AIR TO PASF.	NONE NONE.	LOSS OF Supply to PASF WILL RESULT IN THE EVACUATION OF THE PASF. (Alarm will sound)
87 92. Prefilter	Filters the outside AIR Before it ENTERS the PASF	Overload & HIGH Pressure Drop.	NORMAL LOSS OF A Supply AIR TO PASF	NONE	86 SEE # 91.

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Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
88 ~~83~~. ISOLATION DAMPERS 1,2-31-425 1,2-31-438	TO ISOLATE PASF #1 FROM PASF #2 DURING EMERGENCY OPERATION	OPEN (NORMAL OPERATION)	ONE OF TWO REDUNDANT DAMPERS WILL BE LOST.	NONE	
		CLOSED (ACCIDENT OPERATION)	LOSS OF SUPPLY AIR TO PASF	NONE	SEE # ~~97~~ 86
89 ~~84~~. SUPPLY AIR FAN A-1	TO Provide Supply AIR TO PASF.	LOSS OF FAN	LOSS OF SUPPLY AIR TO PASF.	NONE	SEE # ~~97~~ 86
90 ~~85~~. ISOLATION DAMPER 1,2-31-420 1,2-31-422	TO ISOLATE THE AUXILIARY BUILDING DURING AN ACCIDENT	CLOSED (NORMAL OPERATION)	LOSS OF SUPPLY AIR TO PASF	NONE	THERE ARE NO SAFETY PROBLEMS WITH PASF DURING NORMAL OPERATION
		OPEN (ACCIDENT OPERATION)	ONE OF TWO REDUNDANT DAMPERS LOST.	NONE	
91 ~~86~~. FILTER BOOSTER FAN C-1 (NOT USED DURING ACCIDENT)	To Provide Supply AIR TO THE PASF	SAME AS # ~~87~~ 89	SAME AS # ~~87~~ 89	SAME AS # ~~87~~ 89	There ARE NO SAFETY Problems WITH PASF DURING NORMAL OPERATION
~~87~~. HEATING 92 COIL	SAME AS # 9	SAME AS # 9	SAME AS # 9	SAME AS # 9	PASF IS TESTED similarly to ABGTS IN # 8.
93 ~~88~~. HEPA FILTER	SAME AS # 12	SAME AS # 12	REDUCES EXHAUST AIRFLOW FROM PASF	NONE	Loss of Proper EXHAUST FROM PASF WILL RESULT IN THE EVACUATION OF THE PASF

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Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
94 99. CHARCOAL FILTER	SAME AS # 13	SAME AS # 13	SAME AS # 13	SAME AS # 13	SAME AS # 91 92
95 100. HEPA FILTER	SAME AS # 14	SAME AS # 14	SAME AS # 93 98	NONE	SAME AS # 93 98
96 101. ISOLATION DAMPER	TO ISOLATE THE AIR CLEANUP SYSTEM OF THE PASF	CLOSED (ACCIDENT OPERATION)	SAME AS H 93 98	NONE	SAME AS H 93 98
97 102. EXHAUST AIR FAN B-1	TO PROVIDE EXHAUST FROM THE PASF	LOSS OF FAN	LOSS OF EXHAUST FROM PASF	NONE	LOSS OF Proper EXHAUST FROM PASF WILL RESULT IN THE EVACUATION OF THE PASF (ALARM WILL SOUND)
98 103. BACKDRAFT DAMPER 0-31-4611	PREVENTS FLOW THROUGH NON OPERATING FUEL HANDLING EXHAUST FAN.	OPEN (UNIT NOT IN USE)	NONE	NONE	SEE # 15
		CLOSED (UNIT OPERATING)	NO EXHAUST VENTILATION	NONE	REDUNDANT SUBSYSTEM WILL START ON A LOW FLOW SIGNAL.
99 104. ISOLATION DAMPER 1,2-30-1A	TO PROVIDE ISOLATION FOR THE CONTAINMENT Purge Air Supply SYSTEM	OPEN (ACCIDENT OPERATION)	ONE OF TWO REDUNDANT ISOLATION DAMPERS will be LOST.	NONE	
		CLOSED (SYSTEM OPERATING)	LOSS OF FLOW FROM Supply FAN.	NONE	CONTAINMENT PURGE ADDITIONAL Supply FAN WILL Provide ADEQUATE PURGING CAPABILITIES.

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Table 9.4-8

FAILURE MODES AND EFFECTS ANALYSIS

ITEM	FUNCTION	FAILURE MODE	EFFECT ON SUBSYSTEM	EFFECT ON SYSTEM	REMARKS
100 109. BACKDRAFT DAMPER 1-30-102 1-30-103 2-30-104 2-30-105	TO PREVENT BACKFLOW THROUGH THE NON-OPERATING Supply FAN	CLOSED (FAN OPERATING)	BLOCK AIR FLOW PATH, SEE REMARKS	NONE.	REDUNDANT UNIT ON STANDBY WILL PROVIDE VENTILATION.
		OPEN (FAN NOT OPERATING)	AIR FLOW PATTERNS WHICH DO NOT MEET DESIGN REQUIREMENTS SEE REMARKS	NONE	TEMPERATURES IN SPACES SERVED MAY INCREASE.
101 108. BACKDRAFT DAMPER - 1-31-3057	TO PREVENT FLOW FROM VALVE Gallery TO EL 713 GENERAL SPACES.	OPEN	AIR CAN TRAVEL FROM VALVE Gallery TO GENERAL SPACES	NONE	SAME AS # 61 68
		CLOSED	AIR CANNOT TRAVEL TO VALVE Gallery FROM GENERAL SPACES.	NONE	SAME AS # 61 68

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TABLE 9.4-9

FAILURE MODES AND EFFECTS ANALYSIS

SHUTDOWN BOARD ROOM A/C SYSTEM

Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
1. Fan-coil Units	To cool air in the shutdown board rooms in order to maintain required temperatures for safety-related equipment.	Motor failure	None. Redundant fan-coil unit	None	Failure will be indicated in MCR.
		Chiller freeze up	Same as above.	None	Temperature rise in shutdown board room or Auxiliary Control Room will signal for start of redundant unit.
		Leak in chiller	Same as above.	None	Drain system will handle water accumulation.
		Loss of both chillers serving one shutdown board room.	Emergency cooling will be provided by Control Building ventilation system	None	
		Loss of cooler supplying air to Auxiliary Control Room.	None. Redundant units	None	Any one of the four fan-coil units can provide adequate cooling to the Auxiliary Control Room.
2. Backdraft damper 0-31-2760 0-31-2761 0-31-2704 0-31-2705	To prevent airflows through nonoperating fan-coil units.	Closed (when AHU is operating)	None. Redundant fan-coil unit	None	
		Open (when AHU is not operating)	Air may backflow through redundant unit and recirculate in equipment room.	Reduced cooling output to shutdown board area.	Operation can be switched to AHU with defective damper or both AHU's can be shut down until repairs are completed.

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NONE. Closed Damper may cause temperature increase in the Mechanical Equipment Room

NONE. If AHU's fail Due to rise in the temperature, the redundant 6.9 kV & 480V shutdown board Rm Equipment will begin operating & can safely shutdown both units.

TABLE 9.4-9 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

SHUTDOWN BOARD ROOM A/C SYSTEM

Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
3. Fire Damper (0-31-2759, 2815)	To prevent a fire from spreading into the Shutdown Board Room from the Mechanical Equipment Room	Closed (No Fire)	No cooling supply to corresponding Shutdown Board Rooms and Battery Board Rooms	Emergency air supply is available from Control Building	Failed damper can be opened manually before excessive heat buildup in these areas.
		Open (During a Fire)	Fire may spread into corresding shutdown board room.	Protected 480 V Shutdown Board Room (1B, 2A) and redundant 69 kV Shutdown Board Room can safely shutdown both units.	
4. Fire Damper (0-31-2720, 2771)	To prevent a fire from spreading between the Auxiliary Control Room and the corresponding Shutdown Board Room	Closed (Fire in Shutdown Board Room)	No cooling supply to Auxiliary Control Room from corresponding Shutdown Board Room.	None	Remaining Shutdown Board Room can supply all necessary cooling air.
		Open (During a Fire)	Fire may spread across wall boundary	None. MCR and remaining shutdown board room can safely shutdown both units.	
5. Fire Damper (0-31-2725, 2723, 2726, 2728, 2775, 2774, 2777, 2779)	To prevent spread of fire from the corresponding Auxiliary Control Room	Closed (No Fire)	Loss of cooling to corresponding Aux. Control Rm. Inst. Room	None. Redundant Aux. Control Rm. Instrument Room serves each unit.	A fire in the auxiliary Control Room will cut off cooling to all four Aux. Cont. Instrument Rooms and and Battery Board Rooms II and III. The MCR and Battery Board Rooms I and IV can safely shut down both units.
		Open (During a Fire)	Fire may spread into Auxiliary Control Room	None. MCR can safely shut down both units.	

TABLE 9.4-9 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

SHUTDOWN BOARD ROOM A/C SYSTEM

Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
6. Fire Damper (0-31-2721, (2772)	Same as Item 4	Same as item 4	Same as item 4	Same as item 4	Same as item 4
7A. Fire Damper (0-31-2733, 2785)	To prevent spread of fire between the corresponding Battery Board Room (I, IV) and its associated 69 kV Shutdown Board Rooms	Closed (No Fire)	Loss of cooling to corresponding Battery Board ~~Battery Board~~ Room	None. Redundant room serves each train.	
		Open (During a Fire)	Fire may spread between rooms	None. Remaining rooms on alternate train serving the same unit can accomplish shutdown.	
7B. Fire Damper (0-~~EFD~~-31-233, 237)	To prevent spread of fire between the associated Battery Board Room (I, IV) the opposite train 480 V Shutdown Board Room	Closed (No Fire)	Loss of cooling to corresponding Battery Board Room	None. Redundant room serves each train.	
		Open (During a Fire)	None	None	Defense in depth is provided in accordance with Branch Technical Position 9.5-1.
8. Fire Damper (0-31-2715, 2713, 2782, 2780)	To prevent the spread of a fire between the associated Battery Board Room (II, III) and the opposite train shutdown board rooms.	Closed (No Fire)	Same as item 7A	Same as item 7A	
		Open (During a Fire)	Same as item 7B	Same as item 7B	Same as item 7B

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Revised by Amendment 52

TABLE 9.4-9 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

SHUTDOWN BOARD ROOM A/C SYSTEM

Redundant 480V & 6.9KV shutdown board Rm can safely shutdown both units if excessive temperatures cause a failure

Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
9. Fire Damper (0-XFD-31-234, 238)	To prevent the spread of fire between the 6.9 kV Shutdown Board Room (A, B) and the 480 V Shutdown Board Room (~~1B, 2A~~) serving the opposite train (2A, 1B)	Closed (No Fire)	Loss of cooling air supply from normal cooling system to the 480 V Shutdown Board Room	None	~~A high temperature alarm which is now in the design phase will alert the operator to provide cooling via the control building ECS emergency supply.~~
		Open (During a Fire)	Fire may spread between the 480 V Shutdown Board Room and the MCR	None. Remaining 480 V Shutdown Board Room and the Auxiliary Control Room can accomplish a safe shutdown.	Same as 7B.
10. Fire Damper (0-XFD-31-78A, 78B, 92A, 92B)	To prevent the spread of fire between the 480 V Shutdown Board Room and the MCR.	Closed (No Fire)	None. This duct is needed only during emergency mode operations when the damper can be opened manually.	None	
		Open (During a Fire)	Fire may spread between the 480 V Shutdown Board Room and the MCR.	None. Remaining 480 V Shutdown Board Room and the Auxiliary Control Room can accomplish a safe shutdown.	
11. Fire Damper ~~0-XFD-31-235~~ 0-XFD-31-236 0-XFD-31-239 0-XFD-31-248	To prevent the spread of fire between the 480 V Shutdown Board Room AND the 6.9 KV Shutdown Board Room	Closed (No Fire)	None. Redundant opening	None	
		Open (During a Fire)	A fire may enter the ~~480 V Shutdown Board Room~~ 6.9 KV Shutdown Board Room	None. Redundant ~~Same as 7B.~~ 6.9KV & 480V shutdown Bd Rm can safely shutdown both units	

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TABLE 9.4-9 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

SHUTDOWN BOARD ROOM A/C SYSTEM

Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
~~12. Fire Damper (0-31-2735, 2815)~~	~~To prevent the spread of fire between the 480 V Shutdown Board Room (1A, 2B) and the Mechanical Equipment Room~~	~~Closed (No Fire)~~	~~None. Redundant air return route~~	~~None~~	
		~~Open (During a Fire)~~	~~Fire may spread between the Mech. Equipment Room and the 69 kV and 480 V Shutdown Board Rooms.~~	~~The remaining 480 V Shutdown Board Room (1B, 2A) in conjunction with the area served by~~ the redundant Board area (B,A) can safely shutdown both units.	
12. 13. Unit Heaters	To maintain the minimum design temperatures in these areas during periods of cold weather.	No output	None. Redundant heater	None	Heaters do not provide a safety-related function.
13. 14. Fire Damper (1-31-2500, 2-31-2500)	To prevent the spread of fire between the Auxiliary Board area and the Shutdown Board Area.	Closed (No Fire)	Loss of positive pressure	None	Pressurizing subsystem serves no safety function.
		Open (During a Fire)	Fire may spread between corresponding Mechanical Equipment Rooms	None. Each room and the area it serves is backed by a redundant spare.	

Revised by Amendment 52

TABLE 9.4-9 (Cont.)

FAILURE MODES AND EFFECTS ANALYSIS

SHUTDOWN BOARD ROOM A/C SYSTEM

	Item	Function	Failure Mode	Effect on System	Effect on Plant	Remarks
14 ~~15~~.	Tornado dampers (O-FCD-31-275, 276,277,278)	To prevent a tornado depressurization from reaching the shutdown board areas via the pressurizing fan supply.	Closed (No ~~Fire~~ Tornado)	No pressurizing air supply	None	
			Open (During a ~~Fire~~ Tornado)	None. Redundant damper.	None	
15 ~~16~~.	Pressurizing fan subsystem	To maintain the Shutdown Board area at a slight positive pressure during normal operation.	No output	Loss of positive pressure	None	Redundant fans, so loss of output is extremely unlikely. Pressurizing subsystem serves no safety function.
16 ~~17~~.	Fire Damper (O-31-2757, 2814)	Same as item 3	Closed (No Fire)	Loss of positive pressure	None	
			Open (During a Fire)	Same as item ~~17~~ 3	Same as Item ~~17~~ 3	

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TABLE 9.4-10

REGULATORY GUIDE 1.140, REV. 1, SECTION APPLICABILITY
FOR THE REACTOR BUILDING PURGE VENTILATION SYSTEM
NOTE 1

Reg. Guide Section	Applicability To This System	Comment Index
C.1.a	yes	--
C.1.b	yes	--
C.1.c	yes	--
C.1.d	yes	--
C.2.a	yes	Notes 1,2,7
C.2.b	yes	--
C.2.c	yes	--
C.2.d	yes	Note 3
C.2.e	yes	--
C.2.f	no	Notes 1,4
C.3.a	no	Notes 1,5
C.3.b	yes	Note 8
C.3.c	yes	Note 8
C.3.d	yes	--
C.3.e	yes	Note 8
C.3.f	no	Notes 4,8
C.3.g	yes	--
C.3.h	no	Note 8
C.3.i	no	Note 8
C.3.j	yes	--
C.3.k	yes	--
C.3.l	no	Note 8
C.3.m	no	Note 8
C.4.a	no	Note 6
C.4.b	no	Note 1
C.4.c	yes	Note 8
C.4.d	yes	--
C.5.a	yes	Note 9
C.5.b	yes	Note 9
C.5.c	yes	Note 9
C.5.d	yes	Note 9
C.6.a	yes	Note 9
C.6.b	yes	Note 8

Delete

NOTES

1. This table gives the reactor building purge system degree of compliance to Regulatory Guide 1.140. This system does not fully comply with all sections since the Reg. Guide was issued well after system design was complete.

2. Each air cleanup unit contains a prefilter bank, a HEPA filter bank and a carbon adsorber bank in the order listed.

TABLE 9.4-10 (Continued)

NOTES (Cont'd)

3. The amount of radioactive material collected by the filter and adsorber banks during a fuel handling accident inside containment will not be sufficient to create a radiation hazard when the time comes to replace the filters and adsorbers.

4. No safety enhancement is foreseen by the use of low leakage ducting in this system. In the event of a fuel handling accident, all system ducting carrying radioactive material will be at a pressure below atmospheric. Consequently, all ducting leakage in this part will be from the outside into the contaminated air stream. Furthermore, the probability of system equipment malfunctions such as a spurious, sudden damper closing that would cause the contaminated air stream to have a momentary positive pressure that would produce outward leakage is considered acceptably small because of the short duration of this accident.

5. No relative humidity control equipment is utilized in this system because moisture entrainment seems highly unlikely during fuel handling accident. Also, the purge system will be continuously monitored during operation by testing air samples taken from the exhaust effluents to assure that the limitations imposed by 10 CFR 20 and 10 CFR 50 appendix are not exceeded.

6. Compliance with this section is not a licensing requirement.

7. Two system requirements affect the sizing of the Reactor Building Purge Ventilation System. One of these is the fuel handling accident in the containment. The other is the ventilation needs to keep an acceptable air purity in the containment during normal fuel handling operations. In evaluating these needs, it was found that the ventilation capacity needed to maintain a safe working environmen in the containment is greater than that needed to mitigate the effects of a fuel handling accident. Therefore, the system was sized for the normal ventilation needs.

   Such a practice assures that ample capacity will be available to cope with a fuel handling accident. Since the fuel handling operation will take place only if the purge ventilation system is in operation, at least 200 percent of

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TABLE 9.4-10 (Continued)

the purging capacity needed to clean up the containment atmosphere in the post-accident period will be operating at the time the accident occurs. Redundancy is, therefore, assured to perform the only engineered safety feature task assigned to this sytem.

8. Compliance with ANSI N509 is not required since the system was designed and fabricated well before publication of the ANSI document. However, when possible, parts or components used as replacements will comply fully with the latest issue of ANSI N509.

9. Compliance with ANSI N510 is not required since the system was designed and fabricated well before publication of the ANSI document. However, the system will be tested, when possible, using the procedures outlined in ANSI N510.

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TABLE 9.4-11

NON-ESF AIR CLEANUP UNIT DATA

I. Reactor Building Purge System
Air Flow rate:
14,000 cfm each at 10.75 in. water gage

Type	Wt/ Unit	Banks/ Train	No./ Trains	Total Number	Total Wt
Prefilter	15 lb	1	14	28	420 lb
HEPA	40 lb	1	14	28	1120 lb
Carbon	100 lb	1	42	84	8400 lb

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Added by Amendment 49