6.5 FISSION PRODUCT REMOVAL AND CONTROL SYSTEMS

6.5.1 ENGINEERED SAFETY FEATURE (ESF) FILTER SYSTEMS

6.5.1.1 Standby Gas Treatment System (SGTS)

6.5.1.1.1 Design Bases

The SGTS is designed to accomplish the following safety related objectives:

a) Exhaust sufficient filtered air from the reactor building to maintain a negative pressure of about 0.25 in. w.g. in the affected volumes following secondary containment isolation (see Subsection 9.4.2 for the secondary containment isolation signals) for the following design basis events:

   (1) spent fuel handling accident in the refueling floor area

   (2) LOCA

b) Filter the exhausted air to remove radioactive particulates and both radioactive and non-radioactive forms of iodine to limit the offsite dose to the guidelines of 10CFR50.67.

Non-safety-related objectives for design of the SGTS are as follows:

a) Filter and exhaust air from the primary containment for purging and ventilating.

b) Filter and exhaust discharge from the HPCI barometric condenser.

c) Filter and exhaust from the primary containment pressure relief line.

d) Filter and exhaust nitrogen from the primary containment for nitrogen purging.

The design bases employed for sizing the filters, fans, and associated ductwork are as follows:

a) Each train is sized and specified for treating incoming air mixture at a maximum of 125°F, and containing fission products and incoming particulates equivalent to 1.0 volume percent per day of the fission products available in the primary containment as determined in accordance with Regulatory Guide 1.183 using activity release assumptions for the design bases loss of coolant accident.

b) System capacity to match the maximum air flow rate required for the primary containment purge.

c) The system capacity to be maintained with all filters fully loaded (dirty).

d) For HEPA filters, maximum free velocity not to exceed 300 fpm, with maximum airflow resistance of 1 in. w.g. when clean and 3 in. w.g. when dirty, and minimum efficiency of 99.95 percent by DOP test method.

e) For prefilters, maximum face velocity not to exceed 300 fpm, with maximum airflow resistance of 0.5 in. w.g. when clean, and 1.0 in. w.g. when dirty.

f) Initial design including sizing of the associated ductwork was performed using the equal friction method.

g) Charcoal adsorber is rated for 99 percent trapping of radioactive iodine as elemental iodine (I_3), and 99 percent trapping of radioactive iodine as methyl iodide (CH_3I) when passing through charcoal at 70 percent relative humidity.

h) Each equipment train contains the amount of charcoal required to absorb the inventory of fission products leaking from the primary containment, based on a one unit LOCA.

i) Media cooling arrangement for each SGTS train is designed to remove heat generated by fission product decay on the HEPA filters and charcoal adsorbers during shutdown of the train.

j) Relative humidity at charcoal adsorber is limited to maximum of 70 percent by removing moisture entrained in the air stream and by preheating the air.

Failure of any component of the filtration train (i.e., from the SGTS filter inlet to the fan discharge), assuming loss of offsite power, cannot impair the ability of the system to perform its safety function. The system remains intact and functional in the event of a Safe Shutdown Earthquake (SSE).

6.5.1.1.2 System Design

Each of the two redundant SGTS trains consists of a mist eliminator, an electric air heater, a bank of prefilters, two banks of HEPA filters, upstream and downstream of charcoal adsorber, and a vertical 8 in deep charcoal adsorber bed with fire detection temperature sensors, water spray system for fire protection, and associated dampers, ducts, instruments, and controls. The airflow diagram for the SGTS is shown on Dwg. M-175, Sh. 2. The instruments and controls are shown on Dwg. VC-175, Sh. 3. The system design parameters are provided in Table 6.5-1.

The work, equipment and materials conform to the applicable requirements and recommendations of the guides, codes, and standards listed in Section 3.2.

Compliance of the system design with Regulatory Guide 1.52, is described in Section 3.13. Also see Table 6.5-2.

Each redundant SGTS train has a controllable capacity of 3,000 cfm to 10,500 cfm, and each is capable of treating required amount of air from both Unit 1 and Unit 2 reactor building volumes. (see Subsection 6.5.3). Components for each SGTS are designed as explained in the following paragraphs.

The fan performance and motor selection is based on the maximum air density and the maximum system pressure drop, that is, 70°F air temperature at the fan (55°F air at the inlet of the SGTS train plus approximately 15°F constant temperature pickup across the heater), and the pressure drop is based on maximum pressure drops across dirty filters.

The charcoal adsorber is a gasketless, welded seam type, filled with impregnated, activated carbon. The bank holds a total of approximately 6,920 lb carbon assuming a density of 28 lb/ft^3, having an ignition temperature of not less than 330°C. The charcoal adsorber is designed for a maximum loading capacity of 2.5 mg of total iodine (radioactive plus stable) per gram of activated carbon.

Six test canisters are provided for each adsorber. These canisters contain the same depth of the same charcoal that is in the adsorber. The canisters are mounted, so that a parallel flow path is created between each canister and the adsorber. Periodically one of the canisters is removed and laboratory tested to verify the adsorbent efficiency.

Thirty by fifty inch access doors into each filter compartment are provided in the equipment train housing. The doors have transparent portholes to allow inspection of components without violating the train integrity.

The housing is of all welded construction.

Gas tight interior lights with external light switches and fixture access are provided between all train filter banks to facilitate inspection of components.

Filter housings, including water drains, are in accordance with recommendations of Section 4.5 of Ref. 6.5-1.

Ductwork is designed in accordance with recommendations of Section 2.8 of Reference 6.5-1, except for sheet metal gauges that are slightly less, and the round duct reinforcements. The ductwork, however, has been seismically qualified by analysis and testing of duct specimens.

Outdoor makeup air supplements low exhaust airflow rates for most of the SGTS operational modes to satisfy the SGTS fan minimum airflow requirement. The outdoor makeup air is also used for charcoal bed cooling after a charcoal pre-ignition temperature is detected.

The purpose of the mist eliminator is to remove entrained water droplets from the inlet air stream, thereby protecting prefilters, HEPA filters and the charcoal adsorbers from water damage and plugging.

The electric heater reduces the relative humidity of the entering air to below 70 percent for charcoal adsorber operation, by maintaining a constant temperature rise across the heater. An analysis of heater capabilities for various entering saturated air conditions yields a peak heating requirement of 150,000 Btu/hr, at maximum 10,500 cfm airflow. In addition, approximately 36,000 Btu/hr heat loss is calculated from the section of SGTS housing between the heater and the charcoal bed. Overall required capacity is approximately 186,000 Btu/hr. A 90 kW heater is provided.

The charcoal bed is provided with an integral water spray system connected to the station fire protection system. A deluge valve and Seismic Category I backup valve are mounted in series adjacent to the charcoal adsorber. The backup valve is provided to prevent charcoal flooding if the deluge valve fails in an open position. Fire protection for the SGTS filter trains is also discussed in Subsection 9.5.1.

A continuous type thermistor is provided on the inlet and outlet of the charcoal bed.

The SGTS is actuated either automatically (safety related mode), or manually (non-safety related mode). The automatic actuation is originated by the reactor building isolation signal, or by detection of pre-ignition temperature in the charcoal adsorber bed, the latter for charcoal cooling purposes. The manual actuation is controlled by administrative procedures in such a way that the SGTS is started and airflow established (outdoor makeup air) prior to introduction of air or gas to be exhausted from a reactor building source.

Both SGTS fans are in lead; automatic actuation will result in the simultaneous start of both fans and manual actuation will result in the start of one fan. After actuation by either means, associated controls will be activated to open or modulate appropriate dampers, so that the system function is accomplished.

The SGTS inlet header pressure is monitored and controlled to a negative pressure to preclude the possibility of non-filtered gas or air bypassing the filtration train through the outdoor air makeup duct during system operation. The lead SGTS is started automatically and an alarm sounded in the control room, if this pressure rises to 1.5 in. w.g. positive when the system is not in operation, and the negative pressure will be established and maintained. The system will be stopped manually once the cause of the high inlet header pressure is identified and eliminated.

Outside air is used for either charcoal cooling or making up the total system flow. SGTS fans are operated at a constant air flow rate. The variable inlet vane dampers provided in the fan suction are modulated to compensate for filter pressure drop.

Any section of the charcoal bed inlet or outlet thermistors sensing a temperature higher than preset charcoal pre-ignition or ignition temperatures will result in the following:

a) The pre-ignition temperature will actuate an alarm in the control room, and will automatically initiate the affected SGTS train's charcoal cooling mode of operation by establishing a flow of outdoor makeup air across the charcoal bed.

b) The ignition temperature will actuate an alarm in the control room and open the deluge valve and the backup valve, thus introducing the fire protection water to the charcoal spray system. Four drain valves provided to drain the deluge water will be opened automatically by the ignition temperature signal. The operation of the deluge system will continue until the charcoal temperature falls below the ignition temperature. The deluge water flow will be controlled by the backup valve; the deluge valve will remain open after the initial actuation.

The SGTS is designed to Seismic Category I requirements.

The power supply meets IEEE-308 criteria and ensures uninterruptible operation in the event of loss of normal, onsite, ac power.

6.5.1.1.3 Design Evaluation

The SGTS is designed to preclude direct exfiltration of contaminated air from either reactor building, following an accident or abnormal occurrence which could have resulted in abnormally high airborne radiation in the secondary containment. Equipment is powered from essential buses and all power circuits will meet IEEE-308. Redundant components are provided where necessary to ensure that a single failure in the SGTS initiation signal or filter trains will not impair or preclude system operation. SGTS failure mode and effect analysis is presented in Table 6.5-3.

6.5.1.1.4 Tests and Inspections

Except for Items 5, 15, and 16, all tests and inspections described in Table 9.4-1 apply to the SGTS.

The system was preoperationally tested in accordance with the requirements of Chapter 14. Refer to the Technical Specifications for periodic test requirements for the SGTS.

6.5.1.1.5 Instrument Requirements

The SGTS can be actuated manually from the control room. Each SGTS train is designed to function automatically upon receipt of an ESF system actuation signal. The status of system equipment, which is an indication of pertinent system pressure drops and flow rates, is displayed in the control room during both normal and accident operation.

Table 6.5-2 addresses the extent to which the recommendations of NRC Regulatory Guide 1.52 are followed with respect to instrumentation.

All instrumentation is qualified to Seismic Category I requirements.

Redundancy and separation of the instrumentation is maintained, and it follows the redundancy and separation of the equipment.

The following conditions are annunciated in the control room:

a) Train failure

b) Heater failure (low temperature rise across the heater)

c) High or low pressure drop across the upstream HEPA – DIRTY HEPA, LOW FLOW

d) High pressure drop (DIFF PRESS) across any filter (a group alarm)

e) Pre-ignition charcoal temperature - Hi

f) Ignition charcoal temperature: Hi-Hi

g) Charcoal temperature detection system (HT DET SYS) failure (include the deluge valve solenoid circuit discontinuity)

h) Low pressure differential, referenced to the outdoor ambient pressure, in the reactor building ventilation zones being isolated – RB RECIRC ZONE(S) LO DIFF PRESS

i) High positive pressure or low negative pressure in the SGTS header – SGTS IN HDR LO DIFF PRESS, SGTS HDR HI PRESS

j) Outside makeup air damper failed open

k) Outside charcoal cooling air damper failed open

l) Instrument power failure

6.5.1.1.6 Materials

The materials of construction used in or on the filter systems are given in Tables 6.1-1a, 6.1-1b, and 6.5-5. Each of the materials is compatible with the normal and accident environmental conditions.

FSAR Dwg. C-1815, Sh. 3 shows the location of the SGTS filter trains is classified as harsh environment. The electrical components of the SGTS filter trains are environmentally qualified.

6.5.1.2 Control Structure Emergency Outside Air Supply System (OV-101) (CSEOASS) or (CREOASS)

6.5.1.2.1 Design Bases

The control structure emergency outside air supply system (CSEOASS) or (CREOASS) is designed to accomplish the following objectives:

a) Filter particulate matter which may be radioactive and remove gaseous iodine.

b) Recirculate and clean up room air.

c) Maintain ventilation air supply for the control structure envelope when radiation is detected in the outside air.

d) Maintain a positive pressure of 0.125 in. w.g. above atmospheric to inhibit outside air infiltration into the control structure during radiation filtration.

e) Operate during and after design basis accident without loss of function. The DBA initiation signal for this system is Reactor Building HVAC system isolation or secondary containment isolation.

f) Provide radiation monitoring of outside air supply.

The bases employed for sizing the filters, fans, heater, and associated ductwork are as follows:

a) System capacity (flow rate) to be based on required air changes for the control structure, and the air exhausted from the battery storage area. The required air change is calculated based on cfm required to slightly pressurize the control structure.

b) The system capacity to be maintained with all particulate filters fully loaded (dirty).

c) HEPA filters, maximum face velocity not to exceed 300 fpm with maximum airflow resistance of 1 in. w.g. when clean and 3 in. w.g. when dirty for upstream and 1.2 in. w.g. for downstream when dirty. A minimum efficiency to be 99.97 percent by DOP test method.

d) Prefilters, maximum face velocity not to exceed 300 fpm, with maximum airflow resistance 0.3 in. w.g. when clean and 0.9 in. w.g. when dirty.

e) Initial ductwork design including sizing of the ductwork was performed using equal friction method.

f) Charcoal adsorber is rated for 99 percent trapping of radioactive iodine as elemental iodine (I_3), and 99 percent trapping of radioactive iodine as methyl iodide (CH_3I) when passing through charcoal at 70 percent relative humidity.

g) Maximum relative humidity for air entering the charcoal adsorber to be limited to 70 percent by appropriate air heating.

h) The CSEOASS or CREOASS filter trains are designed to meet single failure criteria.

i) The CSEOASS or CREOASS is designed to Seismic Category I requirements, so that it remains operable during and after a Safe Shutdown Earthquake (SSE).

j) The power supply is designed to meet IEEE 308 criteria and ensure uninterrupted operation in the event of loss of normal AC power. The controls meet IEEE-279.

<u>6.5.1.2.2 System Design</u>

Each of the two redundant CSEOASS or CREOASS filter trains consists of an electric heater, a bank of prefilters, two banks of HEPA filters, one upstream and one downstream of the charcoal adsorber, and a vertical 4 in. deep charcoal adsorber bed with fire detector temperature sensors, associated dampers, instruments, controls, and water flooding system for fire protection. The CSEOASS or CREOASS is shown on Dwg. M-178, Sh. 1. The instrument and controls are shown on Dwg. VC-178, Sh. 1. The system design parameters are shown in Table 6.5-1.

The work, equipment and materials conform to the applicable requirements and recommendations of the guides, codes, and standards listed in Section 3.2.

The system design is consistent with recommendations of NRC Regulatory Guide 1.52, as described in Section 3.13, and shown in Table 6.5-2.

Each CSEOASS or CREOASS filter train contains the following components listed in the direction of airflow:

a) A 30 KW electric heater to maintain relative humidity of the entering air below 70 percent. The heater is energized at the same time as the fan and provides approximately 15°F temperature rise across the coil, ensuring that entering outside air ranging from -5°F to 92°F will enter the filters with a relative humidity of less than 70 percent.

b) A charcoal adsorber designed with six gasketless welded 4 inch vertical beds, containing a total of 2336 lb. of impregnated, activated carbon, assuming a density of 30 lb/ft^3. Eight canisters are provided for each adsorber. The canisters contain the same depth of identical charcoal as the adsorber. The canisters are mounted, so that a parallel flow path is created between each canister and the adsorber. Periodically one of the canisters is removed and laboratory tested to verify the adsorbent efficiency.

c) The housing is constructed of carbon steel welded construction in accordance with Ref. 6.5-1. Stainless steel is used for filter support brackets. The housing is designed for -20 in. w.g. and a +5 psig. Each housing is provided with five 20x50 in. access doors for servicing the heater and filter banks.

The access doors are provided with transparent portholes to allow inspection of components without violating the trains' integrity.

Filter housings, including water drains, are in accordance with recommendations of Section 4.5 of Ref. 6.5-1.

Interior lights with external light switches and outside access for bulb replacement are provided to facilitate inspection, testing, and replacement of components.

d) A centrifugal fan designed for a flow rate of 6,000 cfm (note that the fan is operated at an air flow rate of 5810 cfm ±10%). The fan performance and motor selection is based on the maximum air density and the maximum system pressure drop.

e) Ductwork is designed in accordance with recommendations of Section 2.8 of Ref. 6.5-1, except for sheet metal gauges that are slightly less and round duct reinforcement. The ductwork, however, has been seismically qualified by analysis and testing of duct specimens.

A fire protection system, designed to extinguish a fire within the charcoal bed by flooding the housing, is provided. The fire protection system is designed to spray 36 gpm of water at 15 psi on the charcoal. A deluge valve and a backup valve are installed in series in the fire protection water connection adjacent to the housing. The back-up valve is installed downstream of the deluge valve to prevent charcoal flooding in the event of a malfunction of the deluge valve. One pre-ignition (190°F setting) and one ignition (450°F setting) temperature switch are located in the discharge duct connection. Six pre-ignition and six ignition switches are evenly spaced across the downstream face of the charcoal adsorber. A 190°F or greater leaving air temperature will trip any of the seven temperature switches, and alarm in the control room. A 450°F or greater leaving air temperature will trip any of the seven temperature switches, alarm in the control room, stop the fan, and energize the deluge valve and the back-up valve. An overflow is provided in the housing to allow water to drain once the housing is full. The water must be shut off manually. The housing is drained by opening five manual drain valves.

See Subsection 9.4.1.2.4 for additional details of the CSEOASS or CREOASS operation.

The CSEOASS or CREOASS is designed to Seismic Category I requirements.

The power supply meets the IEEE-308 criteria and ensures uninterruptible operation in the event of loss of normal, onsite, AC power.

6.5.1.2.3 Design Evaluation

The CSEOASS or CREOASS work in conjunction with the control structure HVAC systems to maintain habitability in the control structure. The design evaluation is given in Subsection 9.4.1 including failure mode and effect analysis presented in Table 9.4-19.

6.5.1.2.4 Tests and Inspections

With the exception of Items 5, 6, 7, 15, and 16, all tests and inspections described in Table 9.4-1 apply to the CSEOASS or CREOASS.

6.5.1.2.5 Instrumentation Requirements

The CSEOASS or CREOASS can be actuated manually from the control room. Each CSEOASS is designed to function automatically upon receipt of a radiation detection signal from detector elements located in the outside air intake plenum. In addition to starting the CSEOASS or CREOASS, high radiation is annunciated in the control room.

The CSEOASS or CREOASS can be started manually in the recirculation mode to clean up the air within the control room.

The reactor building HVAC system isolation signal (DBA initiation signal) will cause the CSEOASS or CREOASS to operate in exactly the same manner as a high radiation signal from the outside air intake.

The status of system equipment, indication of pertinent system pressure drops, and flow rates are displayed in the control room.

Table 6.5-2 addresses the extent to which the recommendations of NRC Regulatory Guide 1.52 are followed with respect to instrumentation.

All instrumentation is qualified to Seismic Category I requirements. Redundancy and separation of the instrumentation is maintained and follows the redundancy and separation of the equipment.

The following alarms are annunciated in the control room:

a) Fan failure

b) Heater failure (low temperature differential across the heater)

c) High pressure drop across the upstream HEPA

d) High charcoal temperature

e) High-high charcoal temperature.

6.5.1.2.6 Materials

The materials of construction used in or on the filter systems are given in Tables 6.1-1b, and 6.5-6. Each of the materials is compatible with the normal and accident environments postulated in the control structure where CSEOASS or CREOASS equipment is located.

FSAR Dwg. C-1815, Sh. 3, shows that EQ Zone CS8, which is CSEOASS or CREOASS filter trains, is classified as a harsh environment. The electrical components of the CSEOASS or CREOASS filter trains are environmentally qualified.

6.5.2 CONTAINMENT SPRAY SYSTEMS

The containment spray system is described in Subsection 6.2.2. The containment spray system is not required for fission product removal.

6.5.3 FISSION PRODUCT CONTROL SYSTEM

6.5.3.1 Primary Containment

The standby gas treatment system (SGTS) is used to control the release of fission products to the environment when purging the containment. This is described in detail in Subsection 6.5.1.1.

The Primary Containment is charged with nitrogen during plant start-up in accordance with the Technical Specifications. Gaseous nitrogen is used to reduce the concentration of oxygen, as discussed in Subsection 6.2.5.2. The containment is purged of nitrogen during reactor shutdown in accordance with the Technical Specifications with air from the Reactor Building Ventilation Supply Air System. The purge piping and valves are shown on Dwg. M-157, Sh. 1. The 24" diameter and 18" diameter piping can be used for purging during reactor power operation (as mentioned above), start-up and hot standby; otherwise, the purge supply and exhaust valves HV-15704, HV-15714, HV-15721, HV-15722, HV-15723, HV-15724 and HV-15725 remain closed. These valves cannot be manually overridden to open following containment isolation.

The 2" vent by-pass valves, HV-15711 and HV-15705, and the inner isolation valves, HV-15703 and HV-15713, on the purge exhaust lines will be used to relieve containment pressure increases caused by thermal expansion during normal operations. Keylock handswitches are provided to override the containment isolation signal on valves HV-15703, HV-15705, HV-15711 and HV-15713 to allow emergency venting of the containment. The containment make-up line valves SV-15737, SV-15738, SV-15767 and SV-15789 are not used in the operating procedures following containment isolation. SV-15776A and SV-15736A are isolated for a period of 10 minutes. After the isolation period has elapsed, these valves may be opened remote manually under administrative control for control of hydrogen, as discussed in Subsection 6.2.5.2.

Layout drawings of the primary containment are listed in Section 1.2.

Hydrogen recombiners and the hydrogen purge system are discussed in Subsection 6.2.5.

The primary containment leak rates are discussed in Section 6.2.

6.5.3.2 Secondary Containment

The following are provided to control fission products within the secondary containment following a design basis accident:

a) A secondary containment that completely surrounds each of the two primary containments.

b) The Standby Gas Treatment System (SGTS) discussed in Subsection 6.5.1.1.

c) A recirculation system.

The secondary containment consists of a reinforced concrete structure up to the refueling floor (El. 818 ft. 1 in.) and of a metal sided superstructure above el. 818 ft. 1 in., both discussed in Subsection 3.8.4.

The secondary containment isolation is discussed in Subsection 9.4.2.1. This section also defines three ventilation zones (I, II, and III).

The SGTS is used to maintain the affected zone(s) of the secondary containment at a negative pressure for the events and purposes described in Subsection 6.5.1.1.1.

A common recirculation system is provided for Units 1 and 2 to perform the following functions:

a) Mix the atmosphere in the reactor building to obtain a lesser and more uniform concentration of radioactivity following a design basis LOCA and refueling accident.

b) Prevent the spread of radioactivity by the heating-ventilating-cooling systems between Zone III and Zones I or II during and after a refueling accident.

c) Provide mixing of the atmosphere within the reactor building. This may involve mixing the atmosphere of all three zones; of Zone I or Zone II and the refueling area (Zone III); or of Zone III alone, particularly in case of the refueling accident described in b), above. See Subsection 9.4.2.1.3 for the secondary containment isolation modes. Also see Subsection 6.2.3 for the secondary containment analysis.

The recirculation system is shown on the Standby Gas Treatment System flow diagram, Dwg. M-175, Sh. 2. The instruments and controls are shown on Dwg. VC-175, Sh. 1.

Estimated respective zone(s) recirculation flow rates and their volumes are listed in Table 6.5-7.

The recirculation system consists of two 100 percent redundant, vane-axial fans connected to the emergency power supply, associated ductwork, dampers, and controls.

The recirculation air is distributed to all areas and rooms through the existing normal ventilation ductwork.

Both fans, ductwork used in the recirculation mode, supports, and instruments and controls meet the Seismic Category I requirements.

The recirculation system starts automatically on receiving the secondary containment isolation signal, which is defined in Subsection 9.4.2.1.3.

For the recirculation system failure mode and effect analysis see Table 6.5-4.

The tests and inspection described in items 1, 2, 3, 13 and 14 of Table 9.4-1 are applicable to the recirculation system.

6.5.4 ICE CONDENSER AS A FISSION PRODUCT CLEANUP SYSTEM

Not applicable.

6.5.5 REFERENCES

6.5-1 ORNL-NSIC-65

ENGINEERED SAFETY FEATURE FILTER SYSTEM DESIGN PARAMETERS

ITEM	SGTS	CSEOASS
Type	Built-up unit	Built-up unit
Number of units	2	2
Flow rate, each cfm	3,000 min to 10,500 max	6,000 (design) 5,810 (operation)
Fan		
Type	Centrifugal	Centrifugal
Drive	belt	belt
No. of fans per unit	1	1
No. of running fans	1	1
Total pressure, in wg	17 at max. flow; 1.5 at min. flow	10
Motor, hp, each	50	20
Mist Eliminator		
Quantity and size, in.	9-24x24x8	N/A
Eliminator media	304SS/Fiberglass Mash	N/A
Efficiency (1) gal 1000 cfm	1	N/A
Pressure drop, in. wg		
Initial	1	N/A
Maximum	2	N/A
Air Heater		
No of coils per unit	1	2
Heating capacity per unit, Btu/hr (kW)	307,000 (90)	102,000 (30)
Prefilters		
Quantity and size, in.	9-24x24x11-1/2	6-24x24x12
Pressure drop, in. wg		
Clean	0.5	0.3
Dirty	1.0	0.9
Efficiency (2), %	90	95
HEPA filter, upstream Quantity and size, in.	9-24x24x12	6-24x24x11-1/2
Pressure drop, in. wg		
Clean	1.0	1.0
Dirty	3.0	3.0
Efficiency (3), %	99.97	99.97

ITEM	SGTS	CSEOASS
Charcoal adsorber		
Type	Vertical bed	Vertical bed
Depth, in.	8	4
Filter media	Impregnated activated charcoal	Impregnated activated charcoal
Maximum Pressure drop, in. wg	4	2.2
Efficiency		
Removing inorganic iodine, %	99	99
Removing organic iodine, %	99	99
HEPA filter, downstream (4)		

(1) Prevent blinding of downstream HEPA filter when operated at 260°F with air-steam mixture containing 1 gal of water droplets (actively contained in the airstream) per 1000 cfm.

(2) Dust spot test on atmospheric dust.

(3) By MIL Standards 282 DOP test method on 0.3 micron particles.

(4) All design parameters same as HEPA, upstream except pressure drop dirty = 1.2 in wg. for downstream CSEOASS HEPA

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TABLE 6.5-2

ENGINEERED SAFETY FEATURE FILTER SYSTEMS
COMPLIANCE WITH RECOMMENDATIONS OF REGULATORY GUIDE 1.52

(See Section 3.13 For Further Information - Also See Note 1 At The End Of The Table)

REGULATORY POSITION	COMPLIED WITH Yes/No	DESCRIPTION OF REFERENCE		REMARKS
		SGTS	CSEOASS	
1. ENVIRONMENTAL DESIGN CRITERIA				
Position a	Yes	Dwg. C-1815, Sh. 3 SGTS Equipment Room Zone CS9	Dwg. C-1815, Sh. 3 SGTS Equipment Room Zone CS8	The ESF Filter Systems are designed for the max. environments, resulting from the postulated DBA, to which the systems will be exposed.
Position b	Yes	Dwg. C-1815, Sh. 3 SGTS Equipment Room Zone CS9	Dwg. C-1815, Sh. 3 CSEOASS Equipment Room Zone CS8	Source Assumptions are consistent with, TID 14844. Other ESF equipment and services are adequately shielded from the ESF filter systems
Position c	Yes	Dwg. C-1815, Sh. 3 SGTS Equipment Room Zone CS9	Dwg. C-1815, Sh. 3 CSEOASS Equipment Room Zone CS8	Assumptions are consistent with TID 14844.
Position d	Yes	See Remarks	See Remarks	The operation of the ESF filter systems is compatible with the operation of other ESF systems.
Position e	Yes	See Remarks	See Remarks	Components of ESF filter systems have been designed for temperatures in excess of the highest predicted outdoor temperature (92°F) and also suitable for use if exposed to the lowest predicted outdoor temperature (-5°F).
2. SYSTEM DESIGN CRITERIA				
Position a	Yes	Table 6.5-1 Dwg. M-175, Sh. 1 Dwg. M-175, Sh. 2	Table 6.5-1 Dwg. M-175, Sh. 1 Dwg. M-175, Sh. 2	Mist eliminators not provided on CSEOASS, no entrained water droplets in outdoor air entering the system
Position b	Yes	Drawing V-12-11	Drawing V-12-11	Missile protection walls separate the redundant units, from each other and from adjacent rotating equipment.
Position c	Yes	All components are Seismic Category 1	All components are Seismic Category 1	
Position d	N/A	N/A	N/A	Located outside both primary and secondary containment.
Position e	Yes	Tables 6.5-5 and 6.1-1	Tables 6.5-5 and 6.1-1	
Position f	Yes	10,500 cfm	6,000 cfm	Flow rates, each train.

TABLE 6.5-2

ENGINEERED SAFETY FEATURE FILTER SYSTEMS
COMPLIANCE WITH RECOMMENDATIONS OF REGULATORY GUIDE 1.52

(See Section 3.13 For Further Information - Also See Note 1 At The End Of The Table)

REGULATORY POSITION	COMPLIED WITH Yes/No	DESCRIPTION OF REFERENCE		REMARKS
		SGTS	CSEOASS	
Position g	Yes	Recorded: - System flow rate - PD across 1st HEPA filter Alarms: - See Subsection 6.5.1.1.5	Recorded: - System flow rate - PD across 1st HEPA filter Alarms: - See Subsection 6.5.1.2.5	
Position h	Yes	Section 7.3 and 6.5.1.2.5	Sections 7.3 and 6.5.1.1.5	
Position i	N/A	N/A	N/A	No permanent bypass arrangement installed.
Position j	Yes	Section 3.13, response to Regulatory Guide 1.52	Section 3.13, response to Regulatory Guide 1.52	
Position k	Yes	N/A	Subsection 6.5.1.2.2	
Position l	Yes	Subsection 6.5.1.1.4	Subsection 6.5.1.2.4	
Position m	N/A	-	-	
3. COMPONENT DESIGN CRITERIA AND QUALIFICATION TESTING				
Position a	Yes	Table 9.4-1 and Subsection 6.5.1.1.2	N/A	
Position b	Yes	Subsection 6.5.1.1.2	Subsection 6.5.1.2..2	Heater failure detected by loss of temperature differential across the heater will alarm in the control room. If this occurs during an engineered-safety feature actuation operator action will be necessary to shutdown the affected train. Total system effectiveness remains, since the SGTS filter trains are operated in Lead-Lead and CSEOASS filter trains are operated in Lead/Lag.
Position c	Yes Table 6.5-1	Table 9.4-1 Table 6.5-1	Table 9.4-1	

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TABLE 6.5-2

ENGINEERED SAFETY FEATURE FILTER SYSTEMS
COMPLIANCE WITH RECOMMENDATIONS OF REGULATORY GUIDE 1.52

(See Section 3.13 For Further Information - Also See Note 1 At The End Of The Table)

REGULATORY POSITION	COMPLIED WITH Yes/No	DESCRIPTION OF REFERENCE		REMARKS
		SGTS	CSEOASS	
Position d	Yes	Table 9.4-1	Table 9.4-1	
Position e	Yes	Subsection 6.5.1.1.2	Subsection 6.5.1.2..2	
Position f	Yes	Subsection 6.5.1.1.2	Subsection 6.5.1.2..2	
Position g	Yes	Subsection 6.5.1.1.2	Subsection 6.5.1.2..2	
Position h	N/A	N/A	N/A	Both systems are located on control structure.
Position i	Yes Table 6.5-1	Tables 9.4-1 and 6.5-1	Tables 9.4-1 and 6.5-1	Replace carbon meets qualification ans batch test results summarization Table 5-1 of ANSI N509-80 in place of Table 1 of Regulatory Guide 1.52, Revision 0.
Position j	Yes	Subsections 6.5.1.1.2	Subsection 6.5.1.2.2	
Position k	Yes	Subsections 6.5.1.1.2	Subsection 6.5.1.2.2	
Position l	Yes	Subsections 6.5.1.1.2	Subsection 6.5.1.2.2	
Position m	Yes	Subsections 6.5.1.1.2	Subsection 6.5.1.2.2	
Position n	Yes	See Remarks	See Remarks	Both systems are in compliance.
4. MAINTENANCE				
Position a	Yes	See Remarks	See Remarks	Charcoal will be removed by a carbon removal system which draws the charcoal out by a blower. Prefilter and HEPA filters can be easily unclamped.
Position b	Yes	Inside clear height approximately 8 ft. 0 in.	Inside clear height approximately 8 ft. 0 in.	
Position c	See Remarks	See Remarks	See Remarks	30 in. x 50 in. and 20 in. x 50 in. access doors provided with no vacuum breakers. Administrative controls will be used to preclude any work inside of the housing when the unit is in operation. Both systems are normally not used.

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TABLE 6.5-2

ENGINEERED SAFETY FEATURE FILTER SYSTEMS
COMPLIANCE WITH RECOMMENDATIONS OF REGULATORY GUIDE 1.52

(See Section 3.13 For Further Information - Also See Note 1 At The End Of The Table)

REGULATORY POSITION	COMPLIED WITH Yes/No	DESCRIPTION OF REFERENCE		REMARKS
		SGTS	CSEOASS	
Position d	See Remarks	See Remarks	See Remarks	The SGTS complies but CSEOASS is less than 5 ft. 0 in. frame to frame distance.
Position e	Yes	See Remarks	See Remarks	Both systems are in compliance.
Position f	Yes	See Remarks	See Remarks	Both systems are in compliance.
Position g	Yes	See Remarks	See Remarks	Both systems will be provided with appropriate material handling equipment for transfer of used filters to radwaste building for processing.
Position h	See Remarks	Table 9.4-1 and Section 3.13	Table 9.4-1 and Section 3.13	Section 3.13 takes exception to paragraph 4(h) of Regulatory Guide 1.52.
Position i	See Remarks	Section 3.13	Section 3.13	Section 3.13 takes exception to paragraph 3(i) of Regulatory Guide 1.52. A monthly schedule will provide for the unit to operate at least 15 minutes a month.
Position j	Yes	See Remarks	See Remarks	If construction needs filters prior to startup, they will purchase their own prefilters or glass pads.
Position k	Yes	See Remarks	See Remarks	Gas-tight light fixtures with exterior bulb replacement capabilities are provided.
Position l	Yes	See Remarks	See Remarks	Electrical, water, and compressed air services are provided in the areas of the filters.
Position m	Yes	See Remarks	See Remarks	No sharp corners or ledges exist in the housing construction.

Note 1: Positions identified in this table are per Revision 0, dated June 1973 of the Regulatory Guide 1.52. Conformance to positions of Revision 1, dated July 1976 and Revision 2, dated March 1978 are shown in Section 3.13.

TABLE 6.5-3

STANDBY GAS TREATMENT SYSTEM FAILURE MODE AND EFFECT ANALYSIS

PLANT OPERATING MODE	SYSTEM COMPONENT	COMPONENT FAILURE MODE	EFFECT OF FAILURE ON THE SYSTEM	FAILURE MODE DETECTION	EFFECT OF FAILURE ON PLANT OPERATION
Emergency	Power supply	Total loss of offsite power (Loop)	None. All units are powered from separate standby diesel generators.	Alarm in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Exhaust fans (OV109A&B)	Loss of one fan	The system is operated in the lead-lead mode, the alternate train is already in operation.	Alarm in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Electric heaters	Loss of electric heater	The system is operated in the lead-lead mode, the alternate train is already in operation.	Alarm in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Prefilters, mist eliminators, up-stream & down-stream HEPA filters	High differential pressure across any of these components	None. The fan inlet vanes and the outdoor makeup air damper will modulate in sequence to maintain air-flow. The filter trains are operated in LEAD-LEAD. Individual system low flow is detected and alarmed in the control room.	Alarm in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Charcoal adsorbers	High-high temperature (ignition temperature)	None. At ignition temperature the affected train exhaust fan is tripped, the whole train is isolated, the fire protection system is actuated. Since filter trains are operated in LEAD-LEAD, the tripping and isolation of one filter train will not prevent satisfactory operation.	Alarms in the control room at pre-ignition and ignition temperatures	No loss of safety function

TABLE 6.5-3

STANDBY GAS TREATMENT SYSTEM
FAILURE MODE AND EFFECT ANALYSIS

PLANT OPERATING MODE	SYSTEM COMPONENT	COMPONENT FAILURE MODE	EFFECT OF FAILURE ON THE SYSTEM	FAILURE MODE DETECTION	EFFECT OF FAILURE ON PLANT OPERATION
Emergency (LOCA or LOCA & LOOP)	Recirc system to SGTS transfer dampers (PDD-07554A&B)	Damper failed closed	None. The building required pressure may not be maintained, for a short period of time. Both filter trains are operated in LEAD. The failure of one damper will not prevent satisfactory operation.	Alarm in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Outside air cooling air inlet dampers (HD-07555A&B)	Damper failed closed	None. These dampers are designed to fail safe in the closed position.	Damper position indication in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Outside air makeup dampers (FD-07551A2&B2)	Damper failed closed	None. These dampers are designed to fail safe in the closed position. The fan variable inlet vanes will continue to maintain minimum airflow and the inlet header static pressure at the set point. Filter train fans are operated in LEAD-LEAD. Failure of one outside air makeup damper will have no adverse effect on total system operation. If an individual train flow falls below a given setpoint an alarm is sounded in the control room.	Damper position indication in the control room	No loss of safety function

TABLE 6.5-3

STANDBY GAS TREATMENT SYSTEM
FAILURE MODE AND EFFECT ANALYSIS

PLANT OPERATING MODE	SYSTEM COMPONENT	COMPONENT FAILURE MODE	EFFECT OF FAILURE ON THE SYSTEM	FAILURE MODE DETECTION	EFFECT OF FAILURE ON PLANT OPERATION
Emergency (LOCA or LOCA & LOOP)	Fans inlet dampers (FD-07552A&B)	Damper failed open	None. These dampers are normally open and are designed to fail safe in the open position.	Damper position indication in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Filter trains cross-tie dampers (TD-07560A&B)	Damper failed closed	None. These dampers are designed to fail safe in the closed position.	Damper position indication in the control room.	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Seismically analyzed fire protection backup deluge water valve (TV-07550A&B)	Valve failed closed	None. These valves are normally closed and are designed to fail safe in the closed position. These valves are backup to the regular nonseismic deluge valves	None. However, when the non-seismically qualified deluge valves open, an alarm sounds in the control room.	No loss of safety function
Emergency (LOCA or LOCA + LOOP)	Filter trains inlet dampers (HD-07553A&B)	Damper failed open	None. These dampers are normally open and are designed to fail safe in the open position.	Damper position indication in the control room	No loss of safety function

TABLE 6.5-3

STANDBY GAS TREATMENT SYSTEM
FAILURE MODE AND EFFECT ANALYSIS

PLANT OPERATING MODE	SYSTEM COMPONENT	COMPONENT FAILURE MODE	EFFECT OF FAILURE ON THE SYSTEM	FAILURE MODE DETECTION	EFFECT OF FAILURE ON PLANT OPERATION
Emergency (LOCA or LOCA + LOOP)	Fans variable inlet vanes (FD-07551A1& B1)	Dampers fail	None. These dampers are designed to fail open. If the damper fails open, this will increase a demand for more makeup air. As a result, the outside air makeup damper will open and stay in fully open position, unless the inlet header controller starts to modulate it, if the building exhaust air-flow increases. The reactor building pressure control loop is independent of the SGTS flow control loop; therefore, the building pressure is not affected by this failure.	None	No loss of safety function
Emergency (LOCA or LOCA + LOOP)	Charcoal adsorbers temperature detection units	Failure of the temp. detection unit	The system is operated in the lead-lead mode, at high-high charcoal adsorber temperature the affected train may not be tripped automatically but the other train will continue to operate. Any of the SGTS redundant trains can be manually started from the control room.	Temperature detection unit trouble alarm in the control room. Also, SGTS exhaust high and high-high radiation alarms in the control room.	No loss of safety function

Table 6.5-4

RECIRCULATION SYSTEM FAILURE MODE AND EFFECT ANALYSIS[(1)]

Plant operating Mode	System Component	Component Failure Mode	Effect of Failure on The System	Failure Mode Detection	Effect Of Failure on Plant Operation
Emergency	Power Supply	Total loss of offsite power (LOOP)	None, each of the redundant fans and associated dampers are powered from separate standby diesel generations	Alarm in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Recirculation fans OV201A&B	Loss of one fan	None, the standby fan automatically starts.	Alarm in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Dampers on duct from recirculation system to SGTS HD-07543A&B	One damper failed closed	None, the other damper, installed in parallel, will remain open	Damper position indication in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP)	Dampers on duct from Zone I equipment compartment exhaust system to supply plenum of recirculation system HD-17601A&B	One damper failed closed	None, the other damper, installed in parallel, will remain open.	Damper positon indication in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP in Unit 1))	Dampers on duct from Zone II equipment compartment exhaust system to supply plenum of recirculation system HD-27601A&B	One damper failed open [(2)]	Possibility of limited transfer of Zone I recirculation air to Zone II reactor building exhaust vent	Flow alarm and flow indicating backup light in the control room	Possibility of some radioactive releases through Unit 2 Reactor Building vent. All releases will be monitored, and a Zone II isolation initiated, if required.

Table 6.5-4

RECIRCULATION SYSTEM FAILURE MODE AND EFFECT ANALYSIS[(1)]

Plant operating Mode	System Component	Component Failure Mode	Effect of Failure on The System	Failure Mode Detection	Effect Of Failure on Plant Operation
Emergency (LOCA or LOCA & LOOP)	Dampers on duct from Zone I exhaust system to supply plenum of recirculation system HD-17602A&B	One damper failed closed	None, the other damper, installed in parallel will remain open.	Damper position indication in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP in Unit 1)	Dampers on duct from Zone II exhaust system to supply plenum of recirculation system HD-27602A&B	One damper failed open [(2)]	Possibility of limited transfer of Zone I recirculation air to Zone II, exhaust vent	Flow alarm and flow indicating backup light in the control room	Possibility of some radioactive releases through Unit 2 Reactor Building vent. All releases will be monitored, and a Zone II isolation initiated, if required.
Emergency (LOCA or LOCA & LOOP)	Dampers on duct from exhaust plenum of recirculation system to Zone I supply system (Sys. No. V202) HD-17657A&B	One damper failed closed	None, the other damper, installed in parallel, will remain open	Damper position indication in the control room	No loss of safety function
Emergency (LOCA or LOCA & LOOP in Unit 1)	Dampers on duct from exhaust plenum of recirculation system to Zone II supply system HD-27657A&B	One damper failed open [(2)]	Possibility of limited transfer of Zone I recirculation air to Zone II supply system	Flow alarm and flow indicating backup light in the control room	Possibility of some radioactive releases through Unit 2 Reactor Building vent. All releases will be monitored, and a Zone II isolation initiated, if required.

(1) This table describes effects of single failures concurrent with design basis events in Unit 1. Effects of similar failures concurrent with design basis events in Unit 2 are similar.

(2) These dampers are designed to fail safe, that is, in closed position; however, for the purpose of these analyses, it is assumed that they may fail open.

TABLE 6.5-5

LIST OF MATERIALS USED IN THE STANDBY GAS TREATMENT SYSTEM

COMPONENTS	MATERIAL	CHEMICAL COMP.
Housing Plate & Angle Access Panel Plate Access Door Plate & Compression Frame Chromalox Heater Support Angle	ASTM A36 (Or Engineer Approved Equal)	
HECA [(1)] Plate Eclipse Valve-Shaft	ASTM A53	
Housing Pipe HECA [(1)] Pipe		
Housing Couplings Access Door Couplings & Plug		
Test Canister Plate HECA [(1)] Sheet		
Filter Frame Tubing	ASTM 554	
Prefilter	Glass Fibers w/Synthetic Resin, Particle board, Aluminum Separators, Fire Retardant Polyurethane Foam & Rubber Base Adhesive	
HEPA Filter	F-700 Glass, Chromized Steel Frame & Rubber Base Adhesive	

TABLE 6.5-5

LIST OF MATERIALS USED IN THE STANDBY GAS TREATMENT SYSTEM

COMPONENTS	MATERIAL		CHEMICAL COMP.
Moisture Separator Eclipse Valve-O-Ring	304 SST Frame W/Wire Mesh – 304 SST/Fiber Glass		
Neoprene Gasket	ASTM D105b & ASTM D2000 BC 516		
Paint	Mobil Zinc #7 With Zinc Pigment		$(C_2H_3)_4\ Si_4$
	Ameron	Epoxy Primer	
		For Bare Metal	Amerlock 400
		For General Tie-Coat	Amercoat 149
		Waterborne Finish	
		Epoxy	Amerguard 335
		Acrylic	Amercoat 220
	Carboline	Epoxy Primer	
		For Bare Metal	No. 890
		For General Tie-Coat	Multi-Bond 120
		Waterborne Finish	
		Epoxy	Santile D250WB
		Acrylic	D3359
	Keeler & Long	Epoxy Primer	
		For Bare Metal	No. 1013
		For General Tie-Coat	No. 2001 Hydro-Poxy
		Waterborne Finish	
		Epoxy	H-1 Series

TABLE 6.5-5

LIST OF MATERIALS USED IN THE STANDBY GAS TREATMENT SYSTEM

COMPONENTS	MATERIAL	CHEMICAL COMP.
	Acrylic Wash Primer For Exterior Ductwork Only Acrylic Urethane Finish For Exterior Ductwork Only	W-1 Series KL9400 KLN-1 Series”
Glass	Holophane #540	Diffuser Lens $Si0_3$, $AL_2 0_3$, Ca0 & Na_20
Heaters	Model DH70 & Model #LU.H-15-21 W/#WUH-05	Chromalox Heater Elements – 80% Nickel Sheath, 20% Chromium Coiled Wire, Ceramic Coated Steel Flanges, Fins & Frame – A-36
Filter Frame Angle HECA[(1)]Clip, Angle, Spacer Rod	ASTM A276	
Weld Stud Nuts & Washers	ASTM A240	
Filter Frame Pipe & Elbow HECA [(1)] Pipe & Drain Nozzle	ASTM A312	

TABLE 6.5-5

LIST OF MATERIALS USED IN THE STANDBY GAS TREATMENT SYSTEM

COMPONENTS	MATERIAL	CHEMICAL COMP.
Best Canister Elbow	ASTM 403	
Alison Sensor 9090	ASTM 446	
Eclipse Valve-Body	Cast Iron	
Eclipse Valve Disc.	ASTM A569	
Test Canister Bar	ASTM A479-304	
Test Canister Tubing	ASTM A511-304	
Chromalox Heater Sheet	ASTM A569	
Test Canister Tubing	ASTM A213-304	
Nuts	Silicone Bronze	Manganese Copper Silicone
Bearings	Bronze	Manganese Copper
Alison 304 Junction Box	Model 2003-SS Junction Box	
Adsorbent	Impregnated, activated carbon	KI_3, or TEDA, or TEDA + KI - 5% by weight max. Carbon TEDA = Triethylenediamine

[1]High Efficiency Charcoal Adsorber (HECA) – Charcoal Adsorber

TABLE 6.5-6

LIST OF MATERIALS USED IN THE EMERGENCY
OUTSIDE AIR SUPPLY SYSTEM

COMPONENTS	MATERIAL	CHEMICAL COMP.
Structural Steel Base Channels	ASTM A36 (Or Engineer Approved Equal)	
Steel Plate Plenum Skin	ASTM A283	
SST Plate HEPA Filter Holding Cranes and Charcoal Bed Construction	ASTM A240	
Welded & Seamless Steel Pipe Water Drains	ASTM A53	
Seamless Steel Pipe Water Drains	ASTM A106	
Galvanized Pipe Water Spray System	ASTM A120	
Pipe Fittings Tank Flanges, ½ Couplings and Pipe Flanges	ASTM A234	
SST Welded Tubing Charcoal Bed Fittings (Test Canister Mounting Rings)	ASTM A269	
SST Bar & Shapes Structural Supports for Charcoal Bed	ASTM A276	
Welded Pipe Charcoal Bed Fittings	ASTM A312	
Cold Rolled Sheet Mounting Brackets for Electrical Components	ASTM A366	

TABLE 6.5-6

LIST OF MATERIALS USED IN THE EMERGENCY OUTSIDE AIR SUPPLY SYSTEM

COMPONENTS	MATERIAL	CHEMICAL COMP.
SST Bar & Shapes Structural Supports for Charcoal Bed	ASTM A479	
Structural Steel Tubing Rounds & Shapes Alternate for A-36 Rise Channels	ASTM A500	
Hot Formed Carbon Steel Stiffeners on Outside of Housing	ASTM A501	
SST Mechanical Tubing Test Canister Holding Plate	ASTM A511	
Galvanized Sheet Electrical Fittings Conduit, Junction Boxes	ASTM A526	
Miscellaneous Electrical Components Which are Part of the Electrical System, Such as Wire Covering, Relay Components, etc.		
	A Derivative of Phenol	Phenol C_6H_5OH
	Glass Polyester & Phenol Formaldehyde	HCHO and C_6H_5OH
	Bakelite & Formica (Same as Phenol)	

TABLE 6.5-6

LIST OF MATERIALS USED IN THE EMERGENCY OUTSIDE AIR SUPPLY SYSTEM

COMPONENTS	MATERIAL	CHEMICAL COMP.
	Acrylic Resin Lucite (nameplates)	$CH_2{:}C(CH_3)COOCH_3$
	Copper Wire with Polyethylene Cover	
	Copper wire with Asbestos Cover (high temp. appl.)	
Adsorbent	Impregnated, activated carbon	KI_3, or TEDA, or TEDA + KI – 5% by weight max. Carbon TEDA = triethylenediamine
HEPA Filters	Glass Fibers with Resin Binder & Plastic Edge Seals	
Prefilter FARR HP-200	Glass Fibers with Phenolic Resin Binder	
Paint	Ameron Epoxy Primer For Bare Metal For General Tie-Coat Waterborne Finish Epoxy Acrylic	 Amerlock 400 Amercoat 149 Amerguard 335 Amercoat 220

TABLE 6.5-6

LIST OF MATERIALS USED IN THE EMERGENCY
OUTSIDE AIR SUPPLY SYSTEM

COMPONENTS	MATERIAL		CHEMICAL COMP.
	Carboline	Epoxy Primer	
		For Bare Metal	No. 890
		For General Tie-Coat	Multi-Bond 120
		Waterborne Finish	
		Epoxy	Santile D250WB
		Acrylic	D3359
	Keeler & Long	Epoxy Primer	
		For Bare Metal	No. 1013
		For General Tie-Coat	No. 2001 Hydro-Poxy
		Waterborne Finish	
		Epoxy	H-1 Series
		Acrylic	W-1 Series
		Wash Primer	
		For Exterior Ductwork Only	KL9400
		Acrylic Urethane Finish	KLN-1 Series
		For Exterior Ductwork Only	

TABLE 6.5-7

ZONE VOLUMES AND THEIR ESTIMATED RECIRCULATION AIRFLOW RATES

VENT ZONE NO.(1)	ZONE VOLUME FT ^{3}	SUBSYSTEM FLOW PATH (ASSOCIATED FANS) (2)		ESTIMATED DESIGN AIR FLOW RATES (3)			
				MODE A (4)	MODE B (5)	MODE C (6)	MODE D (7)
I	1,488,600	Supply	(1V202)	27400	-	19140	-
		Return	(1V205,1V206)	29730	-	21470	-
II	1,598,600	Supply	(2V202)	-	28600	20560	-
		Return	(2V205,2V206)	-	31100	23060	-
III	2,668,400	Supply (8)		49110	47740	34310	78830
		Return	(1V217,2V217 1V213,2V213)	53280	51900	38480	83000

(1) Section 9.4.2.1 defines the boundaries of the ventilation system.

(2) Associated fans are listed to identify the zone supply and return subsystems but are assumed not to operate. Only a single OV201A or B recirculation fan plus a single OV109A or OV109B SGTS fan is assumed to operate in the recirculation modes.

(3) Differences between recirculation return air and supply air flows represent the maximum estimated design air flows exhausted through the SGTS system (OV109) in order to maintain negative pressure in the affected zone(s), assuming in leakage of 225% volume of the affected zone(s) per day.

(4) Isolation of Zone I and III

(5) Isolation of Zone II and III

(6) Isolation of Zone I, II and III

(7) Isolation of Zone III only

(8) Separate ducting is provided from the recirculation system (OV201) discharge plenum to the common refueling floor. It is not connected to the normal Zone III supply fan system (1V212 & 2V212).