ATTACHMENT B

PROPOSED CHANGES TO APPENDIX A,

TECHNICAL SPECIFICATIONS OF FACILITY

OPERATING LICENSES NPF-37, NPF-66, NPF-72 AND NPF-77

Byron Station		Braidwood Station	
Revised Pages	3/4 3-40 3/4 3-41 3/4 3-42	Revised Pages:	3/4 3-40 3/4 3-41 3/4 3-42

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TABLE 3.3-6

RADIATION MONITORING INSTRUMENTATION FOR PLANT OPERATIONS

FUNCTIONAL UNIT	CHANNELS TO TRIP/ALARM	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ALARM/TRIP SETPOINT	ACTION
1. Fuel Building Isolation-Radioactivity-High and Criticality (ORE-AR055/56)	1	2	*	≤5 mR/h	29
2. Containment Isolation-Containment Radioactivity-High					
a) Unit 1 (1RE-AR011/12)	1	2	All	**	26
b) Unit 2 (2RE-AR011/12)	1	2	All	**	26
3. Gaseous Radioactivity-RCS Leakage Detection					
a) Unit 1 (1RE-PR011B)	N.A.	1	1, 2, 3, 4	N.A.	28
b) Unit 2 (2RE-PR011B)	N.A.	1	1, 2, 3, 4	N.A.	28
4. Particulate Radioactivity-RCS Leakage Detection					
a) Unit 1 (1RE-PR011A)	N.A.	1	1, 2, 3, 4	N.A.	28
b) Unit 2 (2RE-PR011A)	N.A.	1	1, 2, 3, 4	N.A.	28
5. Main Control Room Isolation-Outside Air Intake-Gaseous Radioactivity-High					
~~(ORE-PR031B/32B and ORE-PR033B/34B)~~	~~1~~	~~2 per intake~~	~~All~~	~~≤ 2 mR/h~~	~~27~~
a) Train A (ORE-PR031B/32B)	1	2	All	≤ 2 mR/h	27
b) Train B (ORE-PR033B/34B)	1	2	All	≤ 2 mR/h	27

TABLE NOTATIONS

*With new fuel or irradiated fuel in the fuel storage areas or fuel building.

**Trip Setpoint is to be established such that the actual submersion dose rate would not exceed 10 mR/hr in the containment building. For containment purge or vent the Setpoint value may be increased up to twice the maximum concentration activity in the containment determined by the sample analysis performed prior to each release in accordance with Table 4.11-2 provided the value does not exceed 10% of the equivalent limits of Specification 3.11.2.1.a in accordance with the methodology and parameters in the ODCM.

ACTION STATEMENTS

ACTION 26 - With less than the Minimum Channels OPERABLE requirement, operation may continue provided the containment purge valves are maintained closed.

ACTION 27 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, within 1 hour isolate the Control Room Ventilation System and initiate operation of the Control Room Make-up System.

ACTION 28 - Must satisfy the ACTION requirement for Specification 3.4.6.1.

ACTION 29 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, ACTION a. of Specification 3.9.12# must be satisfied. With both channels inoperable, provide an appropriate portable continuous monitor with the same Alarm Setpoint in the fuel pool area with one Fuel Handling Building Exhaust filter plenum in operation. Otherwise satisfy ACTION b. of Specification 3.9.12.#

switch to the redundant train of Control Room Ventilation, provided the redundant train meets the Minimum Channels OPERABLE requirement or

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#Satisfaction of Specification 3.9.12 ACTIONS are not required prior to July 1, 1985 when there is no irradiated fuel in the storage pool.

TABLE 4.3-3

RADIATION MONITORING INSTRUMENTATION FOR PLANT OPERATIONS SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	DIGITAL CHANNEL OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. Fuel Building Isolation-Radioactivity-High and Criticality (ORE-AR055/56)	S	R	M	*
2. Containment Isolation-Containment Radioactivity-High				
a) Unit 1 (1RE-AR011/12)	S	R	M	All
b) Unit 2 (2RE-AR011/12)	S	R	M	All
3. Gaseous Radioactivity-RCS Leakage Detection				
a) Unit 1 (1RE-PR011B)	S	R	M	1, 2, 3, 4
b) Unit 2 (2RE-PR011B)	S	R	M	1, 2, 3, 4
4. Particulate Radioactivity-RCS Leakage Detection				
a) Unit 1 (1RE-PR011A)	S	R	M	1, 2, 3, 4
b) Unit 2 (2RE-PR011A)	S	R	M	1, 2, 3, 4
5. Main Control Room Isolation-Outside Air Intake-Gaseous Radioactivity-High ~~(ORE-PR031B/32B* and ORE-PR033B/34B)*~~	S	R	M	All
a) Train A (ORE-PR031B/32B)				
b) Train B (ORE-PR033B/34B)	S	R	M	All

*With new fuel or irradiated fuel in the fuel storage areas or fuel building.

TABLE 3.3-6

RADIATION MONITORING INSTRUMENTATION FOR PLANT OPERATIONS

FUNCTIONAL UNIT	CHANNELS TO TRIP/ALARM	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ALARM/TRIP SETPOINT	ACTION
1. Fuel Building Isolation-Radioactivity-High and Criticality (ORE-AR055/56)	1	2	*	≤5 mR/h	29
2. Containment Isolation-Containment Radioactivity-High					
a) Unit 1 (1RE-AR011/12)	1	2	All	**	26
b) Unit 2 (2RE-AR011/12)	1	2	All	**	26
3. Gaseous Radioactivity-RCS Leakage Detection					
a) Unit 1 (1RE-PR011B)	N.A.	1	1, 2, 3, 4	N.A.	28
b) Unit 2 (2RE-PR011B)	N.A.	1	1, 2, 3, 4	N.A.	28
4. Particulate Radioactivity-RCS Leakage Detection					
a) Unit 1 (1RE-PR011A)	N.A.	1	1, 2, 3, 4	N.A.	28
b) Unit 2 (2RE-PR011A)	N.A.	1	1, 2, 3, 4	N.A.	28
5. Main Control Room Isolation-Outside Air Intake-Gaseous Radioactivity-High					
~~(ORE-PR031B/32B and ORE-PR033B/34B)~~	~~1~~	~~2 per intake~~	~~All~~	~~≤ 2 mR/h~~	~~27~~
a) Train A (ORE-PR031B/32B)	1	2	All	≤ 2 mR/h	27
b) Train B (ORE-PR033B/34B)	1	2	All	≤ 2 mR/h	27

TABLE NOTATIONS

*With new fuel or irradiated fuel in the fuel storage areas or fuel building.

**Trip Setpoint is to be established such that the actual submersion dose rate would not exceed 10 mR/hr in the containment building. For containment purge or vent the Setpoint value may be increased up to twice the maximum concentration activity in the containment determined by the sample analysis performed prior to each release in accordance with Table 4.11-2 provided the value does not exceed 10% of the equivalent limits of Specification 3.11.2.1.a in accordance with the methodology and parameters in the ODCM.

ACTION STATEMENTS

ACTION 26 - With less than the Minimum Channels OPERABLE requirement, operation may continue provided the containment purge valves are maintained closed.

ACTION 27 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, within 1 hour isolate the Control Room Ventilation System and initiate operation of the Control Room Make-up System.

ACTION 28 - Must satisfy the ACTION requirement for Specification 3.4.6.1.

ACTION 29 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, ACTION a. of Specification 3.9.12# must be satisfied. With both channels inoperable, provide an appropriate portable continuous monitor with the same Alarm Setpoint in the fuel pool area with one Fuel Handling Building Exhaust filter plenum in operation. Otherwise satisfy ACTION b. of Specification 3.9.12.#

Switch to the redundant train of Control Room Ventilation, provided the redundant train meets the minimum Channels OPERABLE requirement, or

Satisfaction of Specification 3.9.12 ACTIONs a. and b. not required prior to initial operation at ≥ 5% Rated Thermal Power on Cycle 1.

TABLE 4.3-3

RADIATION MONITORING INSTRUMENTATION FOR PLANT OPERATIONS SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	DIGITAL CHANNEL OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. Fuel Building Isolation-Radioactivity-High and Criticality (ORE-AR055/56)	S	R	M	*
2. Containment Isolation-Containment Radioactivity-High				
a) Unit 1 (1RE-AR011/12)	S	R	M	All
b) Unit 2 (2RE-AR011/12)	S	R	M	All
3. Gaseous Radioactivity-RCS Leakage Detection				
a) Unit 1 (1RE-PR011B)	S	R	M	1, 2, 3, 4
b) Unit 2 (2RE-PR011B)	S	R	M	1, 2, 3, 4
4. Particulate Radioactivity-RCS Leakage Detection				
a) Unit 1 (1RE-PR011	S	R	M	1, 2, 3, 4
b) Unit 2 (2RE-PR011A,	S	R	M	1, 2, 3, 4
5. Main Control Room Isolation-Outside Air Intake-Gaseous Radioactivity-High ~~(ORE-PR031B/32B and ORE-PR033B/34B)~~	S	R	M	All
a) Train A (ORE-PR031B/32B)				
b) Train B (ORE-PR033B/34B)	S	R	M	All

*With new fuel or irradiated fuel in the fuel storage areas or fuel building.

ATTACHMENT C

EVALUATION OF SIGNIFICANT HAZARDS CONSIDERATION

Commonwealth Edison has evaluated this proposed amendment and determined that it involves no significant hazards considerations. According to 10 CFR 50.92(c), a proposed amendment to an operating license involves no significant hazards considerations if operation of the facility in accordance with the proposed amendment would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated; or

2. Create the possibility of a new or different kind of accident from any accident previously evaluated; or

3. Involve a significant reduction in a margin of safety.

The proposed change does not result in a significant increase in the probability or consequence of accidents previously evaluated. The radiation monitors are designed to provide a response to a radiological incident. The operability of these monitors does not factor into the sequence of events required for a radiological release to the atmosphere to occur. They serve to initiate action to prevent a release from unacceptably impacting the Control Room; they do not prevent a release from occurring.

The subject radiation monitors function to isolate the Control Room Ventilation System (VC) outside air intakes in the event of a high radiation condition. Each train of the VC system is provided with redundant radiation monitors. Only one train of VC is operated at a time. The proposed change would allow the operation of a train of VC with a full complement of radiation monitors in the normal configuration. Assuming a limiting scenario of the plant operating with degraded monitoring on the idle VC train with the occurrence of a radioactive release and subsequent failure of the running train, the idle train could be started. This train would still have a single radiation monitor available. If the initiating event resulted in a Safety Injection signal, the ventilation system would automatically align to the post-accident mode. This provides a diverse means of providing radiological protection for the Control Room. The proposed change does not alter the manner in which the actuation signal is provided, nor does it have an impact on the response of the VC system to a valid actuation signal.

The proposed change does not create the possibility for a new or different kind of accident from any accident previously evaluated. The proposed change does not introduce any new or different equipment, and it will not result in installed equipment being operated in a new or different manner. The change will allow the operation of a fully operable train of VC, rather than require that a train with degraded monitoring be operated in its post-accident configuration. The monitors are designed to fail in a safe condition, so required system configuration or operation are not precluded.

The proposed change does not involve a significant reduction in a margin of safety. The proposed change allows the operation of a VC train with full radiation monitoring capability. In the event there is one monitor per train inoperable, the change does not render the plant vulnerable to a single failure which would result in the overexposure of control room personnel. Additionally, the Control Room is equipped with Area Radiation Monitors which provide an alarm upon detection of a high radiation condition. As such, suffi[illegible]ns will remain available to ensure that the VC system is capable of being both au[illegible]lly and manually aligned to provide for the mitigation of radiological events.

ATTACHMENT D

ENVIRONMENTAL ASSESSMENT STATEMENT

Braidwood & Byron Stations have evaluated the proposed amendment against the criteria for an identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21. It has been determined that the proposed change meets the criteria for a categorical exclusion as provided for under 10 CFR 51.22(c)(9). This determination is based on the fact that this change is being proposed as an amendment to a license issued pursuant to 10 CFR 50, and the change affects a requirement with respect to the use of a facility component located within the restricted area, and the change involves no significant hazards considerations. There is no change in the amount or type of releases made offsite, and there is no significant increase in individual or cumulative occupational radiation exposure.

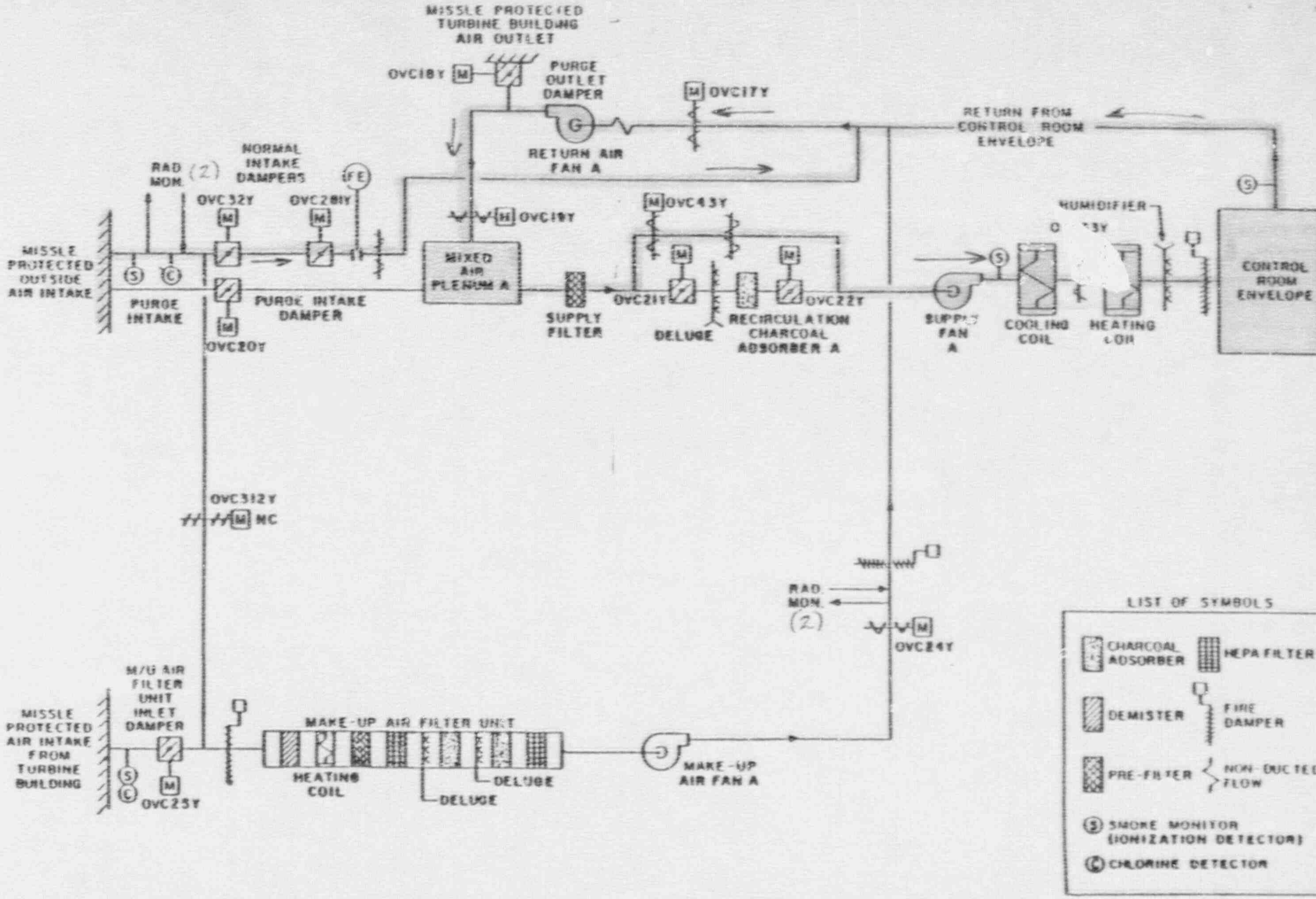

FIGURE 43b-1 CONTROL ROOM HVAC SUPPLY TRAIN A
(SUPPLY TRAIN B IDENTICAL) (REV. 1)

NORMAL OPERATION

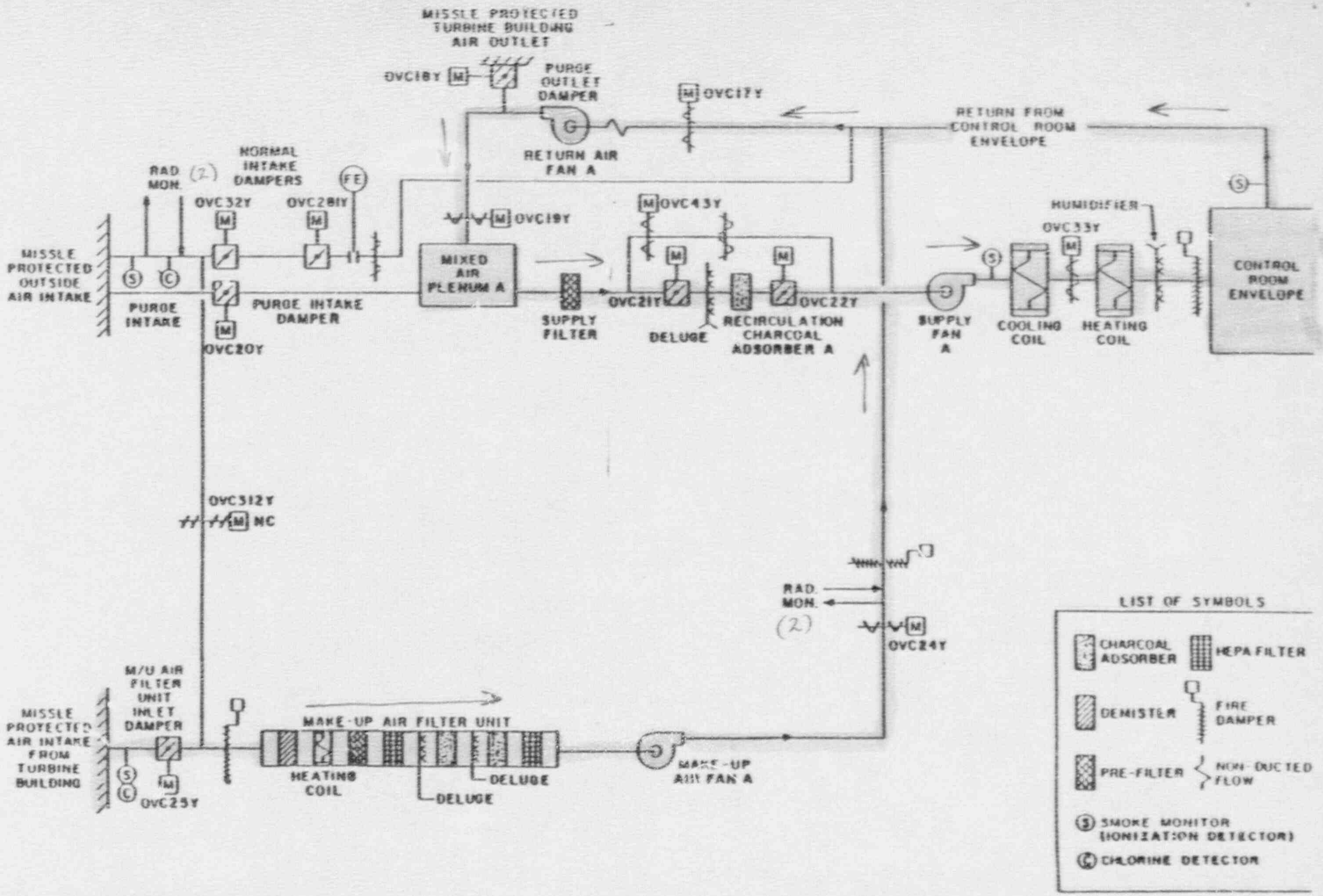

FIGURE 43b-1 CONTROL ROOM HVAC SUPPLY TRAIN A
(SUPPLY TRAIN B IDENTICAL) (REV. 1)

EMERGENCY OPERATION

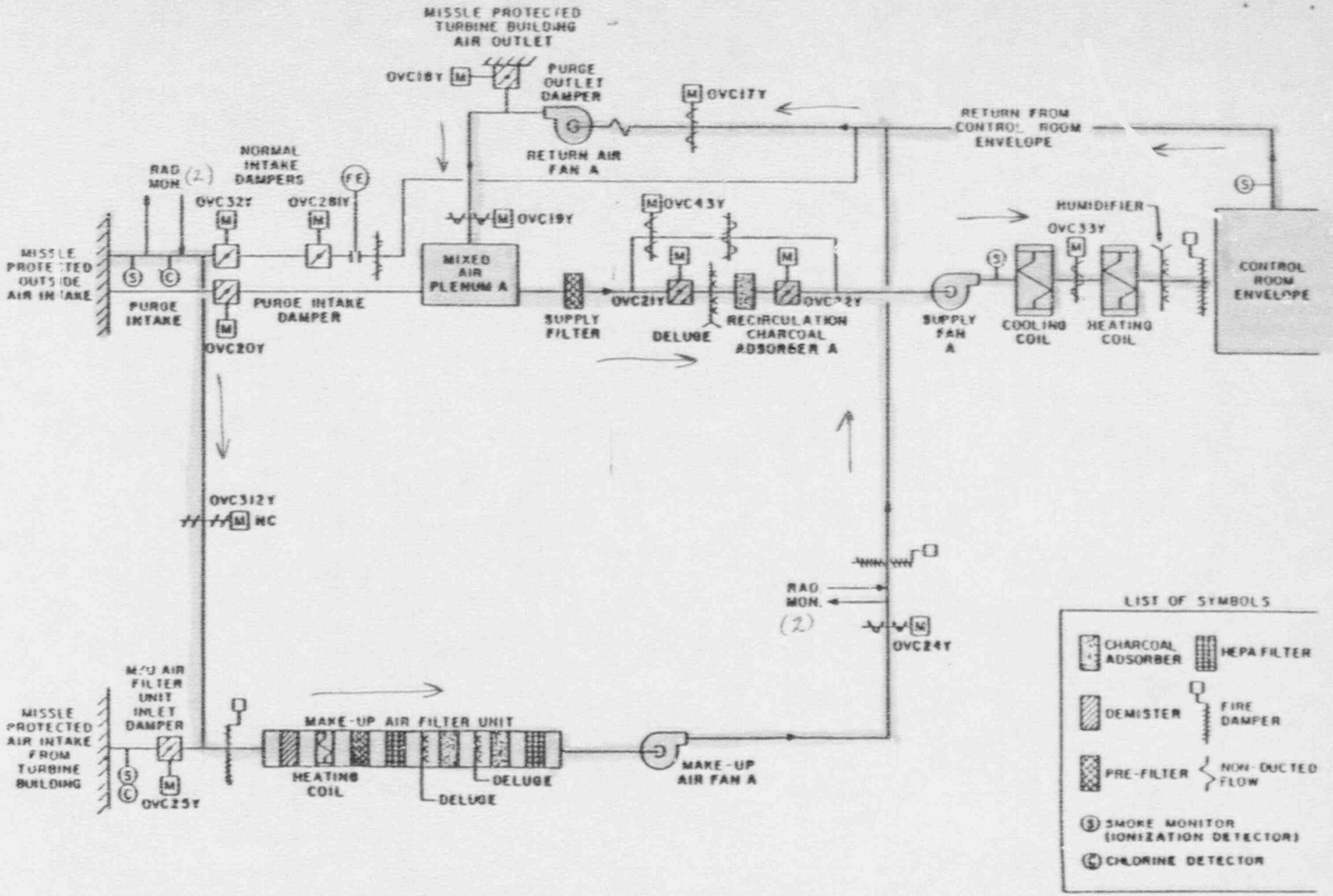

FIGURE 43b-1 CONTROL ROOM HVAC SUPPLY TRAIN A
(SUPPLY TRAIN B IDENTICAL) (REV. 1)

EMERGENCY OPERATION (ALTERNATE)

6.4 HABITABILITY SYSTEMS

Habitability systems are designed to ensure that control room operators can remain inside all spaces served by the control room HVAC system for both Units 1 and 2 during all normal and abnormal station conditions in compliance with Criterion 19 of 10 CFR 50, Appendix A. The habitability systems cover all the equipment, supplies, and procedures provided to ensure that control room operators are protected from postulated releases of radioactive materials, toxic gases, smoke, and steam. Adequate food, water storage, sanitary facilities, and medical supplies are provided to meet the requirements of operating personnel during and after an incident. In addition, the environments in all spaces served by the control room HVAC system (control room envelope) are controlled within specified limits which are conducive to prolonged service life of Safety Class 1 components during all station conditions.

6.4.1 Design Basis

The design bases of the habitability systems upon which the functional design is established are summarized as follows:

a. Redundant strings of HVAC equipment are provided to maintain habitable environmental conditions in the control room envelope.

b. The habitability systems are designed to support a maximum of seven people during normal and 30 days of abnormal station operating conditions. A minimum 8 hours of food supplies are provided for emergency control room staff, with additional food resupplied as needed. An unlimited water supply and onsite first aid is available.

c. Kitchen and sanitary facilities are provided for control room operating personnel.

d. The radiological effects on the control room envelope resulting from any incident described in Chapter 15.0 are considered in the design of the habitability system.

e. The design includes provisions to preclude the effects of toxic gases (carbon dioxide and smoke) from inside or outside the plant.

f. Adequate self-contained breathing apparatus is available inside the control room envelope. Face mask respirators and 6-hour bottled air supplies are provided for emergency staff.

g. The habitability systems are designed to operate effectively during and after a DBA such as a LOCA with the simultaneous loss of offsite power, safe shutdown earthquake, or failure of any one of the control room HVAC system equipment string components.

h. Radiation monitors and ionization detectors continuously monitor the control room HVAC System outside makeup air intakes. Also, ionization detectors continuously monitor the control room HVAC system turbine building makeup air intakes. Area radiation monitors are provided in the control room. Detection of high radiation or products of combustion is alarmed in the control room and related protection functions are simultaneously initiated. Pressure differential indicators are provided in the control room which monitor the pressure differential between control room envelope and surrounding areas. Low pressure differential is alarmed in the control room.

   Outdoor air and individual room temperature indicators in the control room are provided for the control room envelope.

6.4.2 System Design

6.4.2.1 Definition of Control Room Envelope

The control room envelope consists of control room (Units 1 and 2), auxiliary electric equipment rooms, upper control cable spreading rooms, HVAC equipment rooms, security control center, record room, locker room, toilets, kitchen, storage rooms, and instrument shop.

6.4.2.2 Ventilation System Design

Detailed control room HVAC system description is presented in Subsection 9.4.1. The control room makeup system is described in Subsection 6.5.1.

All the system equipment components are designed to perform their function during and after the safe shutdown earthquake except for the electric space heating, humidification equipment, the security computer A/C unit, and kitchen, toilet, locker room exhaust fans and filters, and storage room toilet recirculation filter unit which are supported to remain intact, but may not function.

All system components are protected from internally and externally generated missiles. A layout of the control room envelope, showing doors, corridors, stairways, shield walls and the equipment layout is given in Figure 6.4-1.

The description of controls, instruments, and ionization and radiation monitors for the control room HVAC system is included in Subsections 7.1.2.1 and 7.3.1.1. The locations of makeup air intakes and potential sources of radioactive and toxic gas releases are indicated in Figures 6.4-1, 6.4-2, 6.4-3, and 6.4-4.

6.4.2.3 Leaktightness

The entire control room envelope is designed as a low-leakage construction. All cable pans and duct penetrations are sealed. Approximately 6,000 cfm (0.6 air changes by volume per hour) of outside air is introduced in the control room envelope to maintain approximately 0.02 inches of water column positive pressure with respect to the surrounding areas for the upper cable spreading room, and approximately 0.125 inches of water column positive pressure with respect to the surrounding areas for the remaining rooms.

During emergency operation (radiation accident) of the control room ventilation system, the normally open minimum outside air makeup dampers are closed. Infiltration through damper and personnel ingress/egress is the only source of unfiltered air into the system.

6.4.2.4 Interaction With Other Zones and Pressure-Containing Equipment

The control room HVAC system serves only rooms in the control room envelope. Areas surrounding the control room envelope are served by various systems which are designated on Figure 6.4-1.

The control room offices HVAC system (a separate system, not a part of the control room envelope) and the laboratory HVAC system and the radwaste HVAC system are shut down by a high radiation signal detected in the control room HVAC system outside makeup air intakes. The auxiliary building areas adjacent to the control room envelope are at negative pressure with respect to ambient and control room pressures at all times. The naturally vented turbine building pressure is a function of elevation and will vary seasonally depending on outside air temperatures. The building pressure at the main floor is approximately atmospheric at all times.

All penetrations between the cable spreading rooms and the control room are sealed airtight. Any release of carbon dioxide within the cable spreading room would not enter the control room. Actuation of any of the carbon dioxide zone systems isolates that zone from airflow by simultaneously closing the airflow dampers surrounding the affected zone.

Normal access paths between plant areas and the control room envelope are double-door (two doors in series) vestibules to minimize system interaction. Single doors are not normally used and are under administrative control of the operator.

There are no high-energy lines in the proximity or within the control room envelope. Small fire extinguishers are provided in areas within the control room envelope.

The carbon dioxide fire protection system design is discussed in Subsection 2.3.3 and Appendix A5.4 of the Fire Protection Report.

6.4.2.5 Shielding Design

The design-basis accident for the control room area shielding is the loss-of-coolant accident (LOCA). The shielding is designed so that the doses to the control room personnel over the course of the accident are well below the limit specified in General Design Criteria 19 of 10 CFR 50, Appendix A.

The control room envelope is shown in Figure 6.4-1. An isometric view of the control room is shown in Figure 6.4-2.

The design of the control room envelope shielding is based on the sources given in Table 6.4-1. The distribution of the LOCA sources outside the control room are shown in Figures 6.4-3 and 6.4-4. All of the noble gases and 25% of the iodines are presumed to remain airborne and eventually escape into the plume. Radioactive decay in the plume is ignored.

Shielding thicknesses for the control room are shown in Figure 6.4-2 and enumerated in Table 6.4-1. The sources for the LOCA shielding model are shown in Figures 6.4-3 and 6.4-4.

6.4.3 System Operational Procedures

The control room is a common facility which serves both Units 1 and 2. The facility is served by two completely redundant HVAC equipment trains. The systems are shown in simplified schematic in Figures 6.4-5, 6.4-6, and 6.4-7. Note that only one of the redundant trains is detailed in the sketches; the other train contains equivalent equipment. The control room envelope is supplied with filtered, cooled and reheated (as necessary) air to maintain a suitable environment.

Under normal conditions the system operates as shown in Figure 6.4-5. The supply air consists of air that is recirculated from the control room envelope and outside air that is induced into the system to provide for control room envelope pressurization and to makeup for air that is exhausted. This mixture of recirculated and outside air is mixed and then passed through high-efficiency filters and then bypasses the charcoal adsorbers prior to being discharged into the control room.

Upon detection of high radiation in the minimum outside air intake, or upon a safety injection signal, the normally open outside air dampers close. The normally closed dampers of the turbine building emergency air intake are opened and the emergency makeup air filter unit is started. In addition, air that is normally bypassing the recirculation charcoal adsorber is routed through this charcoal adsorber. All of these actuations are automatic and the new system line-up is shown diagrammatically in Figure 6.4-6.

In addition, a radiation monitor located on each of the emergency makeup air filter trains monitors the radiological quality of the air delivered to the control room envelope.

Should high moisture due to a steam line break in the turbine building occur, a humidity sensor located in the turbine building emergency makeup air intake will annunciate this condition in the main control room. This will alert the operator of this condition. The operator may then draw the makeup air from the minimum outside air intake by opening the normally closed bypass damper and closing the turbine building emergency makeup air intake damper. This is shown diagrammatically in Figure 6.4-7.

To remove any toxic gases, odors, and smoke from the control room environs, a charcoal adsorber is provided with each control room HVAC equipment string. These adsorbers, located downstream of high-efficiency filters, are normally bypassed. At Braidwood, if the station is notified of a toxic gas release in the near vicinity, the control room HVAC system is manually isolated via a control switch on the local panel. Actuation of the control switch places the system in 100% recirculation mode and routes the air through the charcoal adsorbers.

On detection of ionization products in the return air duct or mixed air plenum, the mixed air (return air and makeup air) is automatically routed through the charcoal adsorber and annunciated on the main control board. The operator may continue to route the system supply air through the charcoal adsorber for smoke removal, or depending on the condition of the outside air, may manually bypass the charcoal adsorber and purge the entire system with outside air. On ionization detection in outdoor makeup air intake, annunciation in the control room alerts the operator to transfer operation to a redundant equipment string utilizing a remote intake.

In the event of high radiation detection in the makeup air intake of the control room HVAC system, the radiation monitoring system automatically shuts off normal outside makeup air supply to the system. The minimum outside air requirement is obtained from the turbine building makeup air intake and is routed through the makeup air filter train and fan (for removal of radioactive particulates and iodine) before being supplied to the system. The makeup air is then mixed with return air and is routed through the recirculation charcoal adsorber for the removal of radioactive iodine before being supplied to the vital areas of the control room envelope.

Two makeup air filter trains and fans are provided, each capable of handling minimum requirements of makeup air for the system. In the event of high radiation levels, each train is sized to process 6,000 cfm of makeup air. The makeup air filter units are described in detail in Subsection 6.5.1.

6.4.4 Design Evaluation

The control room HVAC system is designed to maintain a habitable environment compatible with prolonged service life of safety-related components in the control room under all the station operating conditions. The system is only provided with redundant equipment strings to meet the single-failure criterion. The equipment strings are powered from redundant Unit 1 ESF buses and are operable during loss of offsite power. All the control room HVAC system equipment except heating and humidification equipment is designed for Seismic Category I loads.

6.4.4.1 Radiological Protection

Two radiation monitors are provided in each control room HVAC system makeup air intake to detect high radiation. These monitors cause annunciation in the control room upon detection of high radiation or monitor failure conditions. Area radiation monitors are provided in the control room. The respective makeup air filter train connected to the operating equipment string (designed to remove radioactive particulates and adsorb radioactive iodine from the minimum quantity of makeup air) is automatically started upon high radiation signals in makeup air. The radiation monitors are described in detail in Subsections 11.5.2 and 12.3.4.

The makeup air filter trains, the recirculation charcoal adsorbers, and control room shielding are designed to limit the occupational dose below levels required by General Design Criterion 19 of 10 CFR 50 Appendix A. Doses are tabulated in Table 6.4-1.

The introduction of the minimum quantity of outside air to maintain the control room and other areas served by the control room HVAC system at a positive pressure with respect to surroundings, at all the station operating conditions (except at Braidwood, when the system is in recirculation mode) minimizes the possibility of infiltration of unfiltered air into the control room (see Subsection 6.4.2.3).

The physical location of makeup air intakes (see Figure 6.4-1) provides the option of drawing makeup air for the control room HVAC system from the less contaminated intake during and after a LOCA. It is possible one of the makeup intakes may not have any contaminants, while the other intake may have contaminants.

An assessment of the radiological dose to control room occupants has been made for the loss-of-coolant accident (LOCA) postulated in Subsection 15.6.5. This event is considered to be an upper bound of all accidents postulated to occur.

For the LOCA assessed here, 100% of the noble gases and 25% of the iodines present in the core are immediately available for release to the environment. Leakage from ESF equipment handling post-LOCA fluids is taken from Table 15.6-16. Credit for reduction of the amount of iodine available for release by engineered safety features (ESF) containment sprays is taken. Similarly credit is taken for the ESF control room makeup air filters (Subsection 6.5.1), the recirculation charcoal adsorbers, and ESF auxiliary building filters (Subsection 6.5.1).

The total dose as depicted in Figure 6.4-4 is comprised of four components, three of which are dependent on site meteorology. The effective atmospheric dispersion values, X/Q, used were calculated from the equations of Reference 1 and the site meteorology given in Section 2.3. Specific values used in this analysis are given in Table 6.4-1a.

Control room occupancy factors were taken from Table 1 of a paper by Murphy & Campe (1973).

Because of the control room design, as noted in Subsection 6.4.2.3, infiltration is considered and found to be a minor pathway for radionuclides entering the control room; all incoming air including makeup air passes through the recirculation charcoal adsorbers. In addition, the makeup and return air mixture is routed through the recirculation charcoal adsorbers (to adsorb radioactive iodine from the air mixture).

The resulting parametric factors and associated doses are given in Table 6.4-1. The doses are well below General Design Criterion 19 to 10 CFR 50, Appendix A guidelines.

6.4.4.2 Chlorine Gas Protection

The control room HVAC system is provided with control switches on the local control panels which can manually isolate the system upon notification of an accidental release of chlorine gas from sources external to the station. Upon isolation of the system from outdoor makeup air, the control room HVAC system operates in 100% recirculation mode, thus routing the recirculated air through recirculation filters.

6.4.5 Testing and Inspection

The control room HVAC system and its components are thoroughly tested in a program consisting of the following:

a. factory and component qualification tests,

b. onsite preoperational testing, and

c. onsite subsequent periodic testing.

Written test procedures establish minimum acceptable values for all tests. Test results are recorded as a matter of performance record, thus enabling early detection of faulty performance.

All equipment is factory inspected and tested in accordance with the applicable equipment specifications, codes, and quality assurance requirements. System ductwork and erection of equipment is inspected during various construction stages for quality assurance. Construction tests are performed on all mechanical components, and the system is balanced for the design airflows and system operating pressures. Controls, interlocks, and safety devices on each system are cold checked, adjusted, and tested to ensure the proper sequence of operation.

The equipment manufacturers' recommendations and station practices are considered in determining required maintenance.

6.4.6 Instrumentation Requirements

All the instruments and controls for the control room HVAC system are electric or electronic. Further details are provided in the following:

a. Each redundant control room HVAC system has a local control panel, and each is independently controlled. Important operating functions are controlled and monitored from the main control room. Local control panels containing the local control switches are located inside equipment rooms that are under the administrative control of operators.

b. Instrumentation is provided to monitor important variables associated with normal operation and to alarm abnormal conditions on the main control board.

c. A radiation detection system is provided to monitor the radiation levels at the system outside air intakes. A high radiation signal is alarmed on the main control board.

d. The ionization detection is provided both in rooms and in the return air path from main control boards. Ionization detection is annunciated in the main control room.

e. The control room HVAC system is designed for automatic environmental control with manual starting of fans.

f. A fire protection system water connection is provided to each charcoal adsorber bed.

g. The various instruments of the control system are described in detail in Chapter 7.0.

h. The standby makeup air filter unit upstream HEPA filter high differential pressure is annunciated and recorded in the main control room. The standby makeup air filter unit high and low airflow rates are annunciated in the main control room. This airflow rate is also indicated and the low airflow is annunciate ~n the local control panel.

i. The control room supply fan high and low differential pressures are annunciated in the main control room. Supply fan trip is also annunciated in the main control room. Supply fan differential pressure is indicated on the local control panel.

6.5 FISSION PRODUCT REMOVAL AND CONTROL SYSTEMS

6.5.1 Engineered Safety Feature (ESF) Filter Systems

The following filtration systems, which are required to perform the safety-related functions subsequent to a design-basis accident (DBA), are provided:

a. control room HVAC makeup air filter units: this system is utilized to clean the incoming air of gaseous iodine and particulates which are potentially present in incoming air following an accident.

b. auxiliary building exhaust system: this system can be utilized to reduce gaseous iodine and particulate concentrations in gases leaking from primary containment and which are potentially present in nonaccessible cubicles (see Subsection 9.4.5) following the accident.

c. fuel handling building exhaust system: this system is utilized to reduce gaseous iodine and particulate concentrations in the exhaust air from the fuel handling building which are potentially present following a fuel drop accident.

6.5.1.1 Design Bases

6.5.1.1.1 Control Room Makeup Air Filter Units

a. The makeup air filter units are designed to start automatically and provide outside air to the control room HVAC system in response to any one of the following signals:

   1. high radiation signal from the radiation monitors installed in outside air intake ductwork for control room HVAC system;

   2. manual activation from the main control room; and

   3. ESF signal.

b. The TID-14844 source model is used in conjunction with approved methods to calculate the quantity of activity released as a result of an accident and to determine inlet concentrations to the makeup air filter train.

c. The capacity of the makeup air filter units is based on the air quantity required to maintain the rooms served by the control room HVAC system at

0.125 in. of H_2O positive pressure with respect to adjacent areas.

d. Two full-capacity emergency makeup air filter units and associated dampers, ducts, and controls are provided.

e. Each makeup air filter unit utilizes air heaters, demister, and prefilters needed to assure the optimum air conditions entering the high-efficiency particulate air (HEPA) filters and charcoal adsorbers.

f. The emergency makeup air filter unit exhibits a removal efficiency of no less than 99% on radioactive and nonradioactive forms of iodine and no less than 99% on all particulate matter 0.3 micron and larger in size.

g. The makeup air filter unit is designed to meet the single-failure criterion.

h. The power supplies meet IEEE 308-1974 criteria and ensure uninterrupted operation in the event of loss of normal ac power. The controls meet IEEE 279-1971.

i. The makeup air filter units are designed to Safety Category 1 requirements.

j. The makeup air filter units are designed to permit periodic testing and inspection of principal system components as described in Subsection 6.5.1.4.

k. The electrical components are qualifie in accordance with IEEE 344-1971 and IEEE 323-1974.

6.5.1.1.2 Auxiliary Building Exhaust Systems

a. The auxiliary building exhaust system is designed to run continuously during all normal plant operations and exhaust auxiliary building air after filtering through prefilter and HEPA filter banks. Provisions are also made to route the effluents from nonaccessible cubicles in the auxiliary building (see Subsection 9.4.5) through charcoal adsorbers and HEPA filters on the following signals:

   1. Automatically on a safety injection signal from Unit 1 or 2.

   2. Manually through a control switch in the main control room.

9.4 AIR CONDITIONING, HEATING, COOLING, AND VENTILATION SYSTEMS

9.4.1 Control Room HVAC System

The control room HVAC system is common to both Units 1 and 2 and serves the control room (Units 1 and 2), auxiliary electric equipment rooms, upper cable spreading rooms, HVAC equipment room, security control center, record room and miscellaneous locker room, toilets, kitchen, and storage rooms.

9.4.1.1 Design Bases

The control room HVAC system, a Safety Category I system, is designed to provide environmental conditions conducive to habitability and long component life in the control room for both Units 1 and 2 under normal and abnormal station conditions.

9.4.1.1.1 Safety Design Bases

a. The system conforms to NRC General Design Criteria as discussed in Section 3.1.

b. The control room HVAC system is designed with redundancy to meet the single failure criteria.

c. The system monitors radioactive contamination in all makeup air intakes and limits the introduction of potential contaminants into the system by filtering the contaminated air on detection of high radiation. Area radiation monitors are provided in the control room.

d. Upon notification of an offsite chlorine accident at Braidwood, the control room outside air intakes are manually isolated and the HVAC system is operated in 100% recirculation mode, with all return air passing through the charcoal filter.

e. The system monitors products of combustion in makeup air intakes, return ducts from main control boards, and in equipment string mixed air. Ionization detector trips are alarmed in the control room. If ionization products are present in makeup air intakes, the makeup air can be switched to a redundant equipment string utilizing a remote intake. Provision is made to permit the operator to purge all spaces served by the control room HVAC system with 100% outside air unless radioactivity in excess of detector setpoints is present in intakes, or if an ESF signal is present.

f. The system is seismically designed with the exception of heating and humidification equipment, the security computer A/C unit, and the kitchen, toilet, and locker room exhaust fans, filters, and recirculation filter units which are seismically supported but may not function after SSE. This equipment is not needed to meet the habitability criteria or the equipment environmental criteria.

g. The Safety Category 1 equipment is powered from redundant ESF buses; the instrumentation and power supply to the system is described in Subsection 7.3.1.1.9 and Chapter 8.0.

h. The control room HVAC system is provided with 6000 cfm of makeup air except during the 100% outdoor air purge mode and (Braidwood only) chlorine isolation mode. This quantity of outside air is sufficient to maintain a nominal 0.02 inches water gauge positive pressure with respect to the surrounding areas for the upper cable spreading room, and a nominal 1/8 inch water gauge positive pressure relative to adjacent areas in other spaces served by the control room HVAC system. The positive pressure inside the control room precludes infiltration of potentially contaminated air from adjacent areas.

i. All the equipment, ducts, and accessories for the control room HVAC system are housed in a missile protected structure. The makeup air intake openings are also missile protected.

j. The control room HVAC system serves only essential areas in the habitability envelope and therefore, isolation devices to isolate nonessential areas of the system are not applicable and not provided.

9.4.1.1.2 Power Generation Design Bases

The control room HVAC system is designed to provide a controlled temperature of 75° ± 2° and a relative humidity of 20% to 60% in the control room, auxiliary electric equipment rooms, kitchen, record room, storage room, and security control center. The upper control cable spreading room ambients are expected to fluctuate between 65° and 90°, 20% relative humidity and 70% relative humidity depending on outside temperatures. Additional details on environmental conditions are contained in Section 3.11.

9.4.1.2 System Description

The design of the control room HVAC system is shown on the piping and instrumentation diagrams, Figure 9.4-1. Capacities of principal system components are listed in Table 9.4-1.

a. The control room HVAC system is comprised of two full capacity, redundant equipment trains, each located in separate HVAC equipment rooms. During normal operation the minimum outside air quantity is induced through an outside air intake to the return air ductwork where it is mixed with return air from all spaces. Particulates are removed from mixed air as it passes through high efficiency filters on its way to the operating supply fan inlet. The supply fan discharges air through the chilled water cooling coil cabinet into the main supply duct header. If required, heat is added to supply air in this header by a non-safety-related electric blast coil.

Tempered air is distributed in the Unit 1 and Unit 2 branch supply ducts via the main supply duct header which interconnects the Unit 1 and Unit 2 equipment trains with suitable isolation dampers. An electric heating coil and humidifier manifold is provided in each equipment string main supply duct to maintain controlled space temperatures and humidities. Local electric reheat coils are provided for certain ancillary rooms to enhance temperature control.

Return air is induced from the spaces through main control boards and return registers to a branch return duct network through a main return duct header (which also is interconnected to Unit 1 and Unit 2 equipment trains with suitable isolation dampers) to the suction of the operating return fan which discharges the return air to the mixed air plenum.

b. Each equipment train is connected to two missile protected makeup air intakes: an outside air intake and a turbine building air intake. Each outside air intake is the preferred makeup source and is sized to provide either normal minimum flow (6,000 cfm) or full supply flow (49,500 cfm) for purging purposes.

Each turbine building intake is an alternate intake for minimum flow only and is used during abnormal conditions if radiation in the outside air intake exceeds instrument setpoints. Each turbine building air intake is directly connected to an atmospheric cleanup system makeup filter unit which removes potentially radioactive particulates and inorganic and organic forms of iodine from the airstream.

Low leakage motor-operated butterfly isolation dampers are also provided for each turbine building intake. Makeup filter units are described in detail in Subsection 6.5.1.

Two radiation monitors, and two ionization detectors are located in each outdoor air intake plenum. The discharge of the makeup filter unit contains two radiation monitors.

Double isolation dampers (including one bubble-tight damper) are provided on minimum makeup air paths since these are open during normal operation. Maximum outdoor air paths (supply and exhaust) are closed except in the very unlikely event that there is a fire in the control room envelope. Bubble tight isolation dampers are provided on the maximum outside air paths. These are normally closed fail-closed dampers.

c. Each equipment train return fan discharge is connected to a missile protected relief opening to the turbine building. Whenever the operator chooses to purge the spaces served by the control room HVAC system with 100% outside air, the return air from these spaces is exhausted to the turbine building through this opening. The opening is provided with a bubble-tight motor-operated damper which is normally closed and will fail close on loss of power.

d. Upstream of the supply air fan, a charcoal adsorber is provided which is normally bypassed. The mixed air is automatically routed through this adsorber whenever radiation levels in the makeup air exceed detector setpoints and whenever the mixed air duct ionization detector is actuated.

e. The source of cooling for each control room HVAC system equipment train is a corresponding control room chilled water equipment string which is described in detail in Subsection 9.2.7.

f. A non-safety-related full capacity electric steam generator is provided for each equipment string and is connected to a main duct mounted humidifier manifold and control valve.

g. Electric and electronic controls and instrumentation are used for the control room HVAC system. Each equipment train has a local control panel and important operating functions are monitored in the main control room. Abnormal conditions, i.e., high radiation detection at makeup air intakes and ionization detection in return air ducts are annunciated on the main control board. Refer to Section 7.3 for a detailed description of the control and instrumentation of the control room HVAC system.

h. Water deluge valves connected to the station fire protection system are provided for the charcoal adsorber bed in the makeup air filter trains and normally bypassed charcoal adsorber in the supply air filter trains. These are described in Subsection 6.5.1.

i. All automatic isolation and control dampers are driven by spring loaded electric powered operators which fail safe on the loss of electric power or control signal.

9.4.1.3 Safety Evaluation

a. The control room HVAC system is designed to ensure control of space environment conditions within specified maximum and minimum limits (see Table 3.11-1) which are conducive to personnel habitability and prolonged service life of Safety Category I components under all normal and abnormal station operating conditions.

Redundant equipment is provided where needed to ensure system function. Power for the redundant equipment is supplied from separate ESF buses which are energized during all normal and abnormal conditions. All of the HVAC equipment and surrounding structures are seismically designed except heating and humidification equipment which are only seismically supported. A system failure analysis is presented in Table 9.4-2.

b. Flood protection for this system is not applicable.

c. A local fire in the control room should not cause the abandonment of the control room because early detection, filtration, and purging capabilities are provided in addition to local fire fighting apparatus.

d. Air distribution in the control room is designed to supply air into the occupied area and exhaust approximately half of the supply quantity through the main control boards. In the event of smoke or products of combustion in the control boards, the ionization detection system automatically alarms in the main control room.

Manual control is provided to direct the mixed air through the normally bypassed charcoal adsorber for smoke and odor removal. A manual override is provided for this function as well as the ability to introduce 100% outside air to purge the spaces served by the system.

e. Two radiation monitors are provided in each control room HVAC system outside air makeup air intake to detect high radiation. These monitors alarm in the control room as do area radiation monitors located in the control room. The intake monitors are described in detail in Subsection 11.5.2 and the area monitors are described in Subsection 12.3.4. The high radiation actuation signal causes automatic closure of the normal outside makeup air source to the system and opening of turbine building makeup air intake as well as startup of the makeup air filter train to clean up the makeup air. In addition, the makeup air and return air are routed through the normally bypassed charcoal adsorber.

f. The makeup air filter trains and control room shielding are designed to limit the control room operator dose below levels of 5 rem as required by Criterion 19 of 10 CFR 50, Appendix A.

g. The introduction of a minimum quantity of makeup air is ensured to maintain the control room and other spaces served by the control room HVAC system at a positive pressure with respect to surroundings, for all the plant operating conditions except at Braidwood when manual isolation for a chlorine incident is initiated.

h. (Braidwood only) Upon notification of an offsite chlorine accident, the control room outside air intakes are manually isolated and the HVAC system is operated in 100% recirculation mode, with all return air passing through the charcoal filter.

i. There are no high energy lines in close proximity to or within the control room envelope which will affect the habitability of the control room.

9.4.1.4 Testing and Inspection

All equipment is factory inspected and tested in accordance with the applicable equipment specification, quality assurance requirements, and applicable codes. System ductwork and erection of equipment are inspected during various construction stages for quality assurance. Construction tests are performed on all mechanical components and the system is balanced for the design airflows and system operating pressures. Controls, interlocks, and safety devices on each system are cold checked, adjusted, and tested to ensure the proper sequence of operation.

Provisions are made for periodic inservice testing of the equipment and filters, as discussed in Section 6.4. The equipment manufacturer's recommendations and station practices are considered in determining required maintenance.

The makeup filter trains are subjected to the factory, preoperational, and subsequent periodic tests described in Subsection 6.4.5. Technical specifications state limiting conditions for system operation and testing requirements.

9.4.2 Spent Fuel Pool Area Ventilation System

The spent fuel pool area ventilation system is part of the auxiliary building ventilation system and is described in Subsections 9.4.5 and 6.5.1.

9.4.3 Auxiliary and Radwaste Area Ventilation Systems

The auxiliary and radwaste area ventilation systems are comprised of the following four systems:

a. radwaste and remote shutdown control room HVAC system,

b. laboratory HVAC system,

c. radwaste building ventilation system, and

d. auxiliary building HVAC system.

9.4.3.1 Radwaste and Remote Shutdown Control Room HVAC System

The radwaste and remote shutdown control room HVAC system is common to both Units 1 and 2. The system serves the control room which contains the radwaste system control panels and the remote shutdown panels, and the associated HVAC equipment room located on elevation 383 feet 0 inch.

9.4.3.1.1 Design Bases

The system is designed to limit the temperature and relative humidity of the radwaste and remote shutdown control room in conformance with the equipment requirements.

9.4.3.1.1.1 Safety Design Basis

The radwaste and remote shutdown control room HVAC system is non-safety-related; therefore, there is no safety design basis.

11.5 PROCESS AND EFFLUENT RADIOLOGICAL MONITORING AND SAMPLING SYSTEMS

This section describes the systems that monitor and sample the process and effluent streams in order to control the release of radioactive materials generated as a result of normal operation, anticipated operational occurrences, and during postulated accidents.

11.5.1 Design Bases

11.5.1.1 Design Objectives

The process radiological monitoring and sampling system provides measurement, indication, and/or control of radioactivity in those streams which could conceivably be contaminated by radioactive substances.

The effluent radiological monitoring and sampling system provides measurement, indication, and control of radioactivity in those streams which discharge to the environs outside the plant boundaries.

The systems are subdivided into gaseous (airborne) systems, shown in Table 11.5-1, and liquid systems, shown in Table 11.5-2. Both continuous monitoring and sampling with associated laboratory analysis are used for all systems.

The process monitor systems provide operating personnel with radiological measurements within the plant process systems. The continuous monitors provide a continuous readout of the radiation levels, and they annunciate or generate automatic control of the process streams when a significant increase occurs. By sampling and laboratory analysis, the type of radioactive material and the specific radionuclide present can be determined qualitatively and/or quantitatively.

The effluent monitoring systems provide operating personnel with a continuous readout of the radioactivity levels present in the plant's air exhaust and liquid discharge streams.

The objective of the effluent radiological monitoring system is to sample and monitor each plant effluent discharge path for radioactivity prior to discharge. This is satisfied by the installation of sampling monitors on the following airborne effluent streams and liquid effluent streams:

a. Airborne effluent streams:

1. station vent stacks.

b. Liquid effluent streams:

1. station blowdown, and

2. liquid radwaste effluent.

The objective of the process radiation monitoring system is to monitor those sections of the plant process to control the release of radioactivity into the effluent streams. This is satisfied by the installation of process gaseous and airborne radiation monitors and liquid process monitors in the following locations:

a. Process gaseous airborne monitors for:

1. auxiliary building ventilation exhausts,

2. fuel handling building ventilation exhausts,

3. radwaste building ventilation exhaust,

4. laundry room ventilation exhaust,

5. lab fume hood exhaust,

6. miscellaneous tank filtered vent exhaust,

7. containment purge effluent,

8. steam jet air ejector/gland steam exhaust, and

9. gas decay tank effluent.

b. Process liquid monitors for:

1. station blowdown,

2. steam generator blowdown,

3. boron thermal regeneration chiller surge tank return,

4. component cooling heat exchanger water outlet,

5. reactor containment fan coolers essential service water outlet,

6. radwaste evaporators condensate return,

7. gross failed fuel monitors,

8. condensate cleanup area sumps discharge, and

9. turbine building fire and oil sump discharge.

This group of monitors is used for surveillance and control of radioactive substances in gaseous and liquid effluents during normal reactor operations, including anticipated operational occurrences. Accident monitors are discussed separately in the subsequent text, in Subsection 12.3.4 and Section E.30 of Appendix E.

The design and operation characteristics of the process and effluent radiological monitoring and sampling system is based on requirements and guidance in 10 CFR 20, 10 CFR 50, 10 CFR 70, 10 CFR 100, Regulatory Guides 1.21, 1.97, and 4.15, NUREG-0737, NUREG-0800, ANSI N13.1-1969, and ANSI N13.10-1974.

11.5.1.2 Design Criteria

The design of the process and effluent radiological monitoring and sampling system was based on the following:

a. The particulate airborne monitors are beta scintillators, the iodine airborne monitors are gamma scintillators and the noble gas monitors are beta scintillators.

b. Liquid monitors are gamma-responsive scintillation detectors to provide maximum sensitivity to a water medium.

c. Shielding is provided to reduce background and increase sensitivity.

d. Background compensation is provided on selected monitors to increase sensitivity.

e. The gaseous monitor range of detectability is based on actual experience at operating PWRs.

f. The monitors are designed to fail in the interlock mode in the event of loss of power, loss of signal, or operate failure. For OPR31J, OPR32J, OPR33J, and OPR34J, the associated ESF actuation will occur on a 2/2 per train coincidence.

g. All alarms annunciate in the main control room.

h. Monitors readout, alarm, and trend in the main control room.

i. Monitor pumps are initiated locally and in the main control room.

j. Monitor components are readily accessible for maintenance.

k. The monitoring systems are designed for operability within the environmental conditions anticipated. The plant environmental conditions are shown in Table 3.11-2. Instrument locations are shown in Tables 11.5-1 and 11.5-2.

l. Alarm setpoints are adjustable over the range of the instrument, excluding the upper (high) range detector setpoints ORE-PR031A, C; ORE-PR032A, C; ORE-PR033A, C and ORE-PR034A, C (these setpoints are above the range of the detector, thus eliminating each channel's interlock).

m. The following statements apply to the effluent monitors and samplers for airborne and gaseous radioactivity:

1. They continuously withdraw an isokinetic and representative sample as recommended by ANSI N13.1-1969.

2. The radioparticulates are concentrated on a high-efficiency filter and the radioiodines on an activated charcoal cartridge, which can be changed routinely for laboratory analysis.

3. The radionoble gases are continuously monitored for gross beta activity.

4. Grab sampling capability shall be provided to allow for periodic laboratory analysis.

n. Setpoints and ranges for effluent monitors are established to meet technical specification limits, which encompass 10 CFR 20 (including Table II of Appendix B) and 10 CFR 50 Appendix I objectives. Setpoints for process monitors are established to provide a warning of increased system activity and to initiate corrective action where appropriate. Also, see Subsection 12.3.4 and Section E.30 of Appendix E.

Two independently adjustable radiation setpoints are provided for most monitors. The lower setpoint normally activates only an alarm, while the upper (high) setpoint activates an alarm and initiates corrective action where appropriate. Setpoints are initially set to twice the background level. Alarms setpoints will be appropriately adjusted as operating experience is gained. Alarm and trip functions associated with the various monitors are listed in Tables 11.5-1 and 11.5-2. The setpoints are under the administrative control of the plant superintendent or his authorized delegate and can be changed if needed within technical specification limits.

o. All process and effluent monitors are annunciated in the main control room. The radiation monitoring equipment in the main control room will feature an integrated audible (horn) and visual (CRT display) alarm system. In addition, alarm conditions may be automatically logged on the system typer.

The audible alarm is actuated each time a new alarm message is received. The CRT display provides a color coded indication of low level (failure), alert-interlock, high, and multi-level diagnostic alarms. The alarm message typed will include the date, time, channel number, and alarm condition.

11.5.2 System Description

11.5.2.1 Instrumentation

The process and effluent radiological monitoring and sampling systems monitor radiation levels in various plant operating systems and effluent streams. This includes both liquid and gaseous radiation monitoring.

Continuous Monitoring

The system consists of a number of separate and distinct monitors and channels as listed in Tables 11.5-1 and 11.5-2. Each monitor consists of an isokinetic probe or a tap, detector(s) and associated electronics. The continuous sample is piped to a monitor where the sample is monitored for air particulate, gas, and iodine activity, as shown in Tables 11.5-1 and 11.5-2. Data and information from each channel is transmitted to the main control room.

The main control room contains a CRT display, an operator's keyboard, a magnetic tape recorder, a hard disk unit, a central processor and a typer for each unit. The disk maintains an hourly record of radiation levels which may be stored on the recorder for historical purposes. When the radiation level for a particular channel is exceeded, the service, setpoint, and intensity level are displayed on the CRT. In addition, the system alarms to indicate abnormal conditions.

The microprocessor for each monitor is provided with the following features:

a. monitor on-off switch and instrument available light,

b. high radiation level light, and

c. interlock alert radiation level light.

The operate failure alarm also annunciates in the main control room. This alarm will be initiated by loss of power, loss of signal, or operate failure. The operate failure will also initiate the interlock switching functions. For 0PR31J, 0PR32J, 0PR33J, and 0PR34J (Subsection 11.5.2.7.8) the associated ESF actuation will occur on a 2/2 per train coincidence. Reset action cannot be affected until the failure condition is corrected.

Sample probe locations are shown on HVAC drawings in Section 9.4. Monitor locations are shown on the drawings referenced in Tables 11.5-1 and 11.5-2 and are also shown and identified on the radiation shielding figures in Section 12.3 (Figures 12.3-5 through 12.3-24).

For the type of radiation detector and measurement made, see Tables 11.5-1 and 11.5-2.

For most channels which are interlocked with the safety-related systems, redundancy is maintained by using two separate and completely independent channels. In cases where these channels are non-1E, input to the safety-related systems is through non-1E interfacing circuitry located outside the radiation monitoring system cabinets. The redundant channels are designated in Tables 11.5-1 and 11.5-2 under "Remarks".

The range of radioactive concentrations to be monitored is listed in Tables 11.5-1 and 11.5-2 for each detector. The range selected was based on the expected level of radiation for each service.

For alarm and control interlock setpoint values, refer to the "Setpoint" column in Tables 11.5-1 and 11.5-2. Radiation monitors which interlock automatic control functions are designated as such in the remarks column of Tables 11.5-1 and 11.5-2. A reference to the explanatory text section is included.

The radiation monitoring channels employ radioactive check sources. Monitors automatically bypass the interlock function if one is provided upon initiation of the check source test switch.

11.5.2.2 <u>Airborne Process and Effluent Monitors</u>

11.5.2.2.1 <u>Auxiliary Building Vent Stack Effluent</u>

Detectors 1RE-PR028A, B, C, D, and E (air particulate, gas low range, iodine, gas high range and background subtraction channels, respectively) and 2RE-PR028A, B, C, D, and E (air particulate, gas low range, iodine, gas high range and background subtraction channels, respectively) monitor station stack effluent from the auxiliary building vent stacks (Units 1 and 2). Additional features associated with these monitors include:

a. automatic isokinetic sampling system,

b. automatic grab sampling system,

c. tritium sampling system,

d. low/high range gas channels, and

e. background subtraction channel.

11.5.2.2.2 <u>Auxiliary Building Plant Areas (For Auxiliary Building Vent Exhausts)</u>

Detectors 0RE-PR021A, B, C (air particulate, gas, and iodine channels respectively) and 0RE-PR022A, B, C monitor auxiliary building plant areas.

High radiation is annunciated in the main control room.

11.5.2.2.3 <u>Pipe Tunnel (For Auxiliary Building Vent Exhausts)</u>

Detectors 1RE-PR021A, B, C (air particulate, gas, and iodine channels respectively) and 2RE-PR021A, B, and C monitor the pipe tunnel.

High radiation is annunciated in the main control room.

Refer to Subsection 9.4.5.1 for description of fans and dampers.

11.5.2.2.4 <u>Fuel-Handling Building Exhaust</u>

Detectors 0RE-PR024A, B, C (air particulate, gas, and iodine channels respectively) monitor fuel handling exhaust.

High radiation is annunciated in the main control room.

11.5.2.2.5 Containment Purge Effluent

Detectors 1RE-PR001A, B, and C (air particulate, gas and iodine channels respectively) monitor containment effluent for Unit 1, while detectors 2RE-PR001A, B, and C monitor the same for Unit 2.
High radiation is annunciated in the main control room.

11.5.2.2.6 Fuel-Handling Incident in the Fuel Handling Building

Two area radiation detectors, ORE-AR055 and ORE-AR056, monitor for a postulated fuel-handling incident in the fuel handling building.

Area radiation monitor ORT-AR055 is interlocked with booster fan OVA04CA. Area radiation monitor ORT-AR056 is interlocked with booster fan OVA04CB. Upon exceeding the interlock setpoint or as a result of certain monitor failures, a booster fan will automatically start and its associated bypass damper will close with proper VA system alignment.

The channels used for monitoring a postulated fuel-handling incident in the fuel handling building are Class 1E.

Refer to Subsection 12.3.4 for further radiation monitor details.

11.5.2.2.7 Fuel-Handling Incident in the Containment Building

Two area radiation detectors, 1RE-AR011 and 1RE-AR012, monitor for postulated fuel-handling incidents in the containment building for Unit 1, while area detectors 2RE-AR011 and 2RE-AR012 monitor the same for Unit 2.

Area radiation monitor 1RT-AR011 is interlocked with Train A of the normal containment purge and minipurge isolation valves. Area radiation monitor 1RT-AR012 is interlocked with Train B of the normal containment purge and minipurge isolation valves.

Refer to Subsections 6.5.1.1 ", 9.4.8, and 9.4.9 for descriptions of the containment building HVAC system.

The channels used for monitoring a postulated fuel-handling incident in the containment building are Class 1E.

Refer to Subsection 12.3.4 for further radiation monitor details.

11.5.2.2.8 Main Control Room Outside Air Intakes A and B

Detectors ORE-PR031A, B, and C (air particulate, gas and iodine channels, respectively) and ORE-PR032A, B, and C monitor main control room outside air intake A. Detectors ORE-PR033A, B, and C and ORE-PR034A, B, and C monitor main control room outside air intake B.

Detectors ORE-PR031B and ORE-PR032B are interlocked with the makeup area unit fan OVC03CA and main control room outside air intake A dampers. Automatically on high radiation, the outside air intake A dampers close, and the fan starts and in turn opens the main control room turbine building air intake A dampers mentioned in Section 6.4 and Subsection 9.4.1.

Detectors ORE-PR033B and ORE-PR034B are interlocked with the makeup area unit fan OVC03CB and main control room outside air intake B dampers. Automatically on high radiation, the outside air intake B dampers close, and the fan starts and in turn opens the main control room turbine building air intake B dampers mentioned in Section 6.4 and Subsection 9.4.1.

11.5.2.2.9 Main Control Room Turbine Building Air Intakes A and B

Detectors ORE-PR035A, B, and C through ORE-PR038A, B, and C monitor air from the turbine building intakes after it has passed through the makeup air filters.

Detectors ORE-PR035A, B, and C (air particulate, gas and iodine channels, respectively) and ORE-PR036A, B, and C monitor the discharge air from the makeup air filter unit A entering the main control room. Detectors ORE-PR037A, B, and C and ORE-PR038A, B, and C monitor the discharge air from the makeup filter unit B entering the main control room.

High radiation in the makeup air filter unit (A or B) discharge is annunciated in the main control room.

11.5.2.2.10 Containment Atmosphere Monitoring

Detectors 1RE-PR011A, B, C, D, and E are used to monitor the Unit 1 containment atmosphere for airborne particulate, gaseous activity low range, iodine, gaseous activity high range and background subtraction, respectively. Identical detectors provide the same function for Unit 2.

Interlocks are provided from the monitor to actuate certain containment air sampling system valves on high radiation. These valves provide isolation for the monitor as well as other components in the containment air sampling system. Additionally, monitor purge valves are opened by the interlock to provide a timed purge of any contaminated air from the monitor. Upon timeout of the purge function, the valves close and the monitor trips.

The monitor wetted parts are required to maintain pressure boundary integrity during abnormal pressure conditions. The