

SOUTH CAROLINA ELECTRIC & GAS COMPANY

POST OFFICE BOX 764

COLUMBIA, S. C. 29218

June 3, 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Virginia C. Summer Nuclear Station
Docket No. 50/395
Control Room Ventilation System

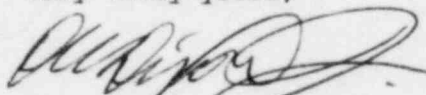
Dear Mr. Denton:

To ensure maintenance of 1/8" water gage positive pressure in the control room, South Carolina Electric and Gas Company has made two changes. One, we have modified the HVAC system to relocate the intake for the control room ventilation system. Two, we have used site specific meteorological data in determining control room dose (Chapter 15.4 of the FSAR).

The resulting FSAR pages are provided to indicate appropriate changes. These will be incorporated in the next FSAR Amendment. Drawing D-912-140 is FSAR Figure 9.4.1.

If you have any questions, please let us know.

Very truly yours,



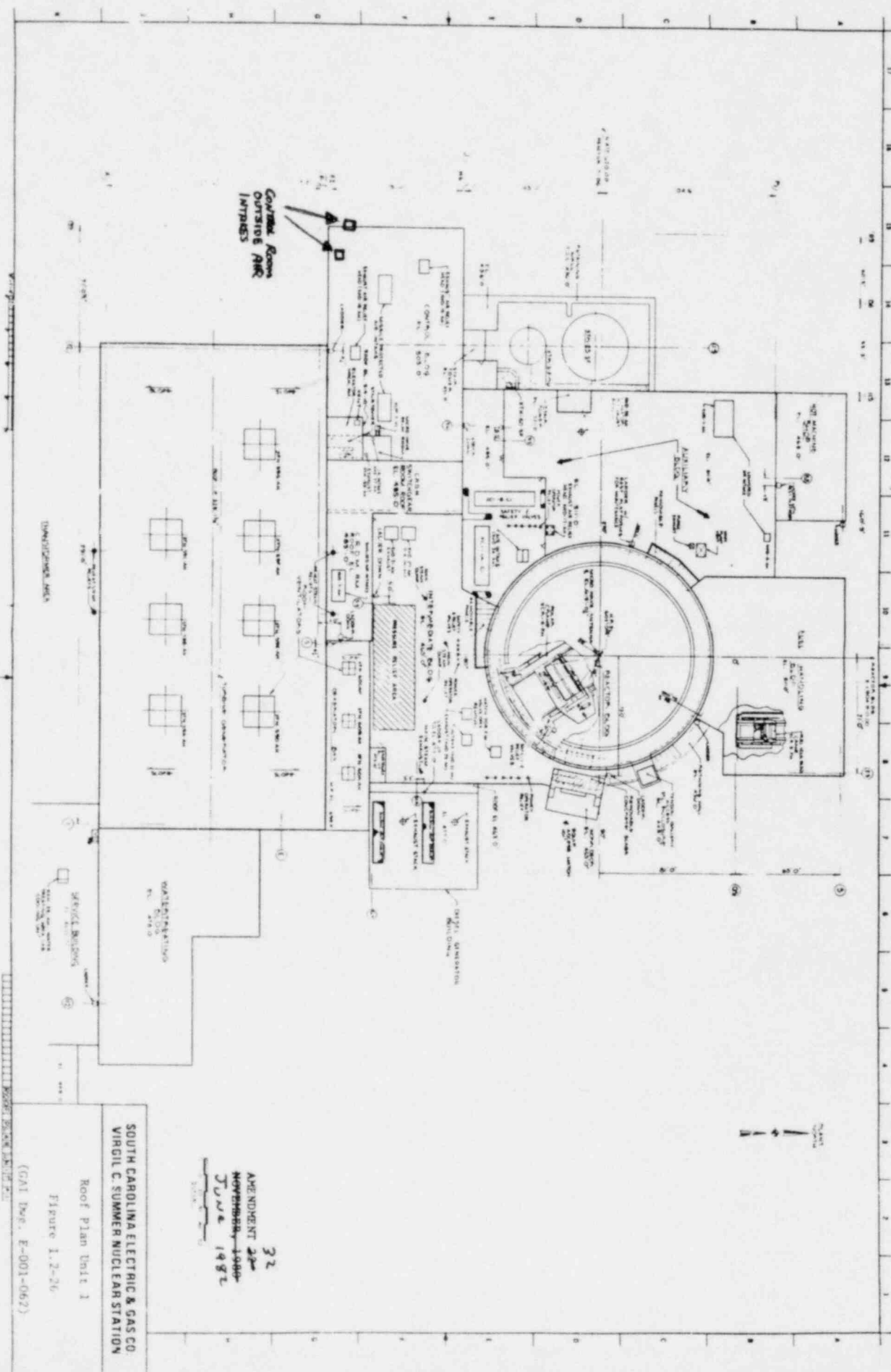
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SOUTH CAROLINA ELECTRIC & GAS CO
 VIRGIL C. SUMMER NUCLEAR STATION

Roof Plan Unit 1
 Figure 1.2-26
 (GAI Ref. E-001-062)

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The equipment to which the control room operator could require access during an emergency is listed in Table 6.4-1.

6.4.1.2.2 Ventilation System Design

Normal and emergency ventilation of the control room are discussed in Section 9.4.1.2.1. The system diagram, Figure 9.4-1, indicates major components, ducts, dampers, instrumentation and normal and emergency air flows.

System isolation dampers are pneumatically operated, spring opposed. Damper leakage does not exceed 20 cfm/ft^2 of damper area against a static pressure of 4 inches, water gage. Damper closing times do not exceed 4 seconds. Table 6.4-2 provides a summary of system isolation damper data.

↓
Outside air inlet valves are 14 inch butterfly valves with closure times which do not exceed 10 seconds and which have negligible leakage

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Components, essential instrumentation, ducting and outside air intake and relief vents of the control building ventilation system are designed in accordance with Seismic Category I requirements.

The components are not subject to the effects of floods, catastrophic weather, internal or external missiles, pipe whip or jet impingement.

Figures 1.2-15 and 1.2-16 present layout drawings of the control room indicating doors, corridors, stairwells, shielded walls, ventilation equipment and the location of outside air intakes.

The location of potential radioactive gas releases and their effect upon control room operation and the monitoring instrumentation and controls located therein are discussed in Chapter 15.

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A description of the emergency filter system and a discussion of Regulatory Guide 1.52 is presented in Section 6.5.1 and Appendix 3A.

6.4.1.2.3 Leak Tightness

The control room system is designed so that, when operating in a normal or an emergency mode (admitting outside air), positive differential pressure is maintained between the control room and adjacent spaces. In the emergency mode, outside air is filtered by the emergency filter system and is used to pressurize the control room.

The potential paths of air leakage into the control room include: outside air dampers in the non-operating redundant system and relief air dampers; openings around supply and return ducts in the control room walls and in duct chase floors; openings for electrical conduit and cables in the control room and chase walls and floors; doors; and piping. A review of these paths, as summarized below, indicates that air leakage through these paths during the emergency mode is minimal:

1. In the non-operating redundant system, the outside air is sealed from the control room by two ¹⁴ inch ^{butterfly valves} ~~by 42 inch dampers~~ in series. Both ^{valves} ~~dampers~~ are ^{the low leakage type} ~~gasketed~~ and arranged to close in the emergency mode and to fail closed upon loss of control air or power. The maximum leakage through a single ^{closed 14} inch ^{butterfly valve} ~~closed outside air damper~~ in the recirculation mode, ^{is negligible.} ~~at an estimated pressure differential across the damper of 0.7 inches of water, is 45 cfm. Maximum leakage through two closed dampers in series is approximately 30 cfm.~~
2. The relief dampers are two 36 inch by 36 inch ~~dampers~~ dampers, one in each train. Both dampers are gasketed and blanked closed, except during control room purge, to ensure negligible air leakage.
3. The purge dampers are two 42 inch by 42 inch dampers in series. The inlet plenum to these dampers is blanked closed, except during control room purge to ensure negligible air leakage. These dampers are fixed in the full open position.

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32 | 2. ~~The relief dampers are similar in arrangement and the potential air leakage quantity is similar to that discussed in item 1, above.~~

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32 | 48. Openings around supply and return ducts in the walls and floors of the control room and chases are sealed with air tight expanded silicone foam with a fire resistance rating of three hours. These openings are air tight.

32 | 54. Openings for electrical conduit and cables in the walls and floors of the control room and chases are sealed in the same manner as the openings noted in item 4, above.

32 | 68. Doors from the control room to the chase area are three hour fire rated doors with closures. The maximum anticipated total air gap around each door is 0.21 ft². The doors leading from the turbine building to the control room are gasketed, pressure tight doors.

32 | 76. Piping to plumbing fixtures, drains and potable water leaving the control room are sealed in the manner noted in item 4, above.

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None of the control room doors lead directly to the outside. Doors lead to closed chase spaces, stairwells, or corridor spaces. Thus, neither outside wind conditions or other ventilation system cause infiltration or leakage into the control room.

6.4.1.2.4 Interaction With Other Zones and Pressure Containing Equipment

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The control room ventilation system is not interconnected with other building areas where potential for radioactivity exists. The system interconnects with cable spreading areas which are flooded with

6.4.1.3.2 Toxic Gas Protection

The primary hazardous chemical onsite in sufficient quantities which may under accidental release approach toxicity limits in the control room is anticipated to be bottled chlorine.

In accordance with the recommendations of Item C2 of Regulatory Guide 1.95 chlorine is stored onsite in containers having a single container inventory of 150 pounds or less. It is stored in the chlorine shed adjacent to the water treatment building and is greater than ~~100~~ 150 meters from the control room intake. Indication of a chlorine leak is provided by a chlorine leak detector located in the chlorine shed which annunciates an alarm locally and in the control room. Capability for manual isolation of the control room ventilation system is described in Section 9.4.1. For discussion of postulated offsite hazardous chemical releases see Section 2.2.

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6.4.1.3.3 Control Room Filtering System

The general arrangement and control of the control room filtering systems are as described in Section 9.4.1. Detailed information concerning the emergency filter is presented in Section 6.5.1.2. The systems are shielded, housed in a Seismic Category I structure, separated, redundant and powered from the Class 1E electric system. They are equipped with filters designed in accordance with the requirements of Regulatory Guide 1.52 (see Section 6.5.1 and Appendix 3A). No single failure results in loss of system function.

Implementation of scheduled field testing, inspection, and maintenance programs ensure that each filtering system performs in accordance with design requirements.

6.4.1.3.4 Control of the Control Room Thermal Environment

The control room air handling system operates during normal and emergency periods to maintain an environment suitable for personnel and equipment. The conditions maintained and general system description

TABLE 6.4-2

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CONTROL ROOM VENTILATION SYSTEM
 ISOLATION DAMPER^{Valve} SUMMARY

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<u>Damper Function</u>	<u>Size (in)</u>	<u>Identification</u>	<u>Failure Position</u>
<i>Purge</i> Outside Air Inlets	42 by 42	XDP-18A, 19A-AH	Open *
<i>Purge</i> Outside Air Inlets	42 by 42	XDP-18B, 19B-AH	Open *
System Relief Air	36 by 36	XDP-21A, 21B-AH	Closed **
System Return Air	42 by 42	XDP-22A, 22B-AH	Closed
Equipment Room Relief Air	72 by 48	XDP-133A, 133B-AH	Closed
Equipment Room Relief Air	72 by 48	XDP-234A, 234B-AH	Closed
Emergency Filter Inlet Damper	42 by 42	XDP-23A, 23B-AH	Open
Emergency Filter Fan Discharge Damper	42 by 42	XDP-24A, 24B-AH	Open
Outside Air Inlets	14 (in) Butterfly Valve	XVB-3A, 4A-AH	closed
Outside Air Inlets	14 (in) Butterfly Valve	XVB-3B, 4B-AH	closed

* Inlet plenum blanked to ensure no air ingress
 ** Outlet plenum blanked to ensure no air leakage

TABLE 6.4-3

INFORMATION REQUIRED FOR
CONTROL ROOM HABITABILITY EVALUATION

Reference: NUREG-0737, Section III.D.3.4, Attachment 1

<u>Subject</u>	<u>FSAR Source</u>	<u>Response</u>
(1) Control room mode of operation	15.4.1.4.3 9.4.1.2.1 26.4.1.2.4	Zone isolation with filtered air recirculation and positive zone air pressurization
(2) Control room characteristics:		
(a) Control room volume	Table 15.4-17	226,040 ft ³ (free volume)
(b) Control room emergency zone	6.4.1.1 6.4.1.2.1	Most areas located on elevation 463'0" of the Control Building
(c) Control room ventilation system schematic		FSAR Figure 9.4-1 FSAR Table 6.4-2
(d) Infiltration leakage rate	Table 15.4-17	2760 410 cfm (Total) 32
(e) Filter efficiencies	9.4.1.2.1	
1. Charcoal filters		95% for all species of iodine
2. HEPA filters		99.97% on 0.3 micron particles
(f) Closest distance between containment and air intake	15.4.1.4.3	Approximately 200 feet 131 feet (minimum)
(g) Layout drawing	1.2	FSAR Figures 1.2-1 and 1.2-26

TABLE 6.4-3 (Continued)

INFORMATION REQUIRED FOR
CONTROL ROOM HABITABILITY EVALUATION

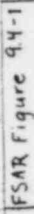
<u>Subject</u>	<u>FSAR Source</u>	<u>Response</u>
(h) Control room shielding	15.4.1.4.3 6.4.1.1	2 ft. concrete
(i) Automatic isolation capability		
1. Damper ^{Valve} closing time	6.4.1.2.2	< ¹⁰ seconds
2. Damper ^{Valve} leakage	Table 6.4-2	< 20 cfm/ft² ² of negligible damper area 32
3. Damper ^{Valve} area		113 1764 in ²
(j) Chlorine detectors or tube gas (local or remote)	6.4.1.3.2	Detector in chlorine shed with annunciation both local and in control room.
(k) Self-contained breathing apparatus availability	6.4.1.1 Table 12.3-4	1 unit/control room operator
(l) Bottled air supply	Appendix 3A RG 1.78	3.5 hours (30 min/person)
(m) Emergency food and potable water supply	6.4.1.1 6.4.1.3.6	7 persons for 7 days Resupply considered for periods longer than 7 days
(n) Control room personnel capacity (normal and emergency)	6.4.1.1 7.7.3	Normal = 6 person (control room) Emergency = 7 persons (control room) and \geq 25 persons (technical support center)

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TABLE 6.4-3 (Continued)

INFORMATION REQUIRED FOR
CONTROL ROOM HABITABILITY EVALUATION

<u>Subject</u>	<u>FSAR Source</u>	<u>Response</u>
(o) Potassium iodide drug supply		Will be available
(3) Onsite storage of chlorine and other hazardous chemicals		
(a) Total amount and size of containers	2.2.3.1.1 6.4.1.3.2	2 containers - with 150 lb chlorine/container
(b) Closest distance from control room intake	2.2.3.1.1 6.4.1.3.2	Approximately ⁵⁰⁷ 300 feet ³² southeast of control building
(4) Offsite manufacturing, storage, or transportation facilities of hazardous materials		
(a) Identify facilities within a 5 mile radius	2.2 Table 2.2-1	1. Nyline Corporation 2. Farm Milling Service 3. Interstate Materials Inc., Div. of Clement Bros. Co. 4. Winsboro Granite Corp.
(b) Distance from control room	Table 2.2-1	1. 2.6 miles southeast 2. 3.6 miles northeast 3. 3.0 miles northeast 4. 4.8 miles northeast

[illegible]

PRELIMINARY PRINT

6. System design capacity is 2500 CFM (Based on hardware). Cooler design capacity is 3000 CFM.

4. The direct dose to operators in the control room from the containment was calculated using a point source model and containment accident source strengths generated with the INHEC computer code.^[22] Credit was taken for a minimum of 6.75 feet of concrete shielding provided by the following:

- a. Reactor building, 4 feet.
- b. Control building, 2 feet.
- c. Control room ceiling, 0.75 feet.

32 | In addition, credit was taken for dose reduction due to a distance approximately 200 of ~~191~~ feet, the minimum distance between the reactor building and the ~~control building~~ nearest control room ventilation system air intake.

5. Atmospheric diffusion factors for the control room are as follows and are based upon methods presented in Reference [23] for a diffuse source-point receptor model *as used in conjunction with the site specific meteorological data contained in Section 2.3 of the FSAR*

<u>Time After Accident</u>	<u>X/Q (sec/m³)</u>
0-8 hours	9.35 4.42 x 10 ⁻⁸⁴
8-24 hours	6.63 2.72 x 10 ⁻⁸⁴
1-4 days	2.37 8.63 x 10 ⁻⁴
4-30 days	9.80 1.65 x 10 ⁻⁴

- 23 | 32 |
- 21 | 32 | 6. ^{and leak tightness} Design of the control room ventilation system is described in Section 9.4.1 ^{and 9.4.1.2 respectively.} By operation of either one of two supply air systems and the control of the appropriate dampers, controlled amounts of outside air are admitted to the control room.

During the normal and emergency modes of operation, the amount of outside air admitted to the control room to maintain a positive control room air pressure is limited to a maximum flow of ¹⁰⁰⁰~~400~~ cfm by ^{positioning one}~~a~~ manual damper located downstream of the isolation ^{valves in each train.}~~dampers~~. During the normal mode of operation, the control room recirculation air flow will be bypassed around the Control Room Emergency Filter Plenum. For the emergency mode of operation, the control room recirculation air flow will be routed through the Control Room Emergency Filter Plenum.

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In the purge mode of operation, the system will supply 100 percent outside air to the control room. The ^{purge air inlet cover plate will be}~~manual dampers downstream of the~~ removed from the outside air intake plenum and the system relief dampers isolation dampers will be manually positioned to the full open position to allow an outside air flow of 20,000 cfm into the control room. The recirculation flow will be terminated for the duration of the purge mode.

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Each control room air intake is provided with two isolation ^{Valves}~~dampers~~ in series. ^{one of the two valves}~~and a manual damper that~~ restricts the outside air flow to a maximum of ¹⁰⁰⁰~~400~~ cfm flow for both normal and emergency modes. Upon receipt of an engineered safety features actuation signal, the control room ventilation system switches to the emergency mode.

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For the purpose of this analysis, the maximum allowable air intake value was determined for the limiting total integrated dose to control room personnel. The results are presented in Table 15.4-18. The maximum allowable air intake value was determined to be 2760 CFM. The system operating flow of 1000 CFM provides adequate margin for the protection of control room personnel as specified under General Design Criterion 19 of 10 CFR 50, Appendix A.

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~~The integrated doses to operators in the control room for a LOCA, based upon these assumptions, are summarized in Table 15.4-18. These doses are less than the dose guidelines specified under General Design Criterion 19 of 10 CFR 50, Appendix A.~~

15.4.1.4.4 Radiological Consequences of Reactor Building Purge to Control Hydrogen after a Loss of Coolant Accident

In the extremely unlikely event that the concentration of hydrogen gas in containment following a postulated loss of coolant accident cannot be controlled by the redundant hydrogen recombiners, provisions have been incorporated into the design to purge the containment. This subsection analyzes the offsite dose due to such a purge.

The INHEC computer code^[22] is used to calculate offsite doses for this event. A schematic depicting the code modeling of activity flow paths for containment purge to control hydrogen is shown in Figure 15.4-56a. Two analyses of environmental consequences of purging are performed: a conservative analysis; and an analysis based on Regulatory Guide 1.7. The parameters used for each of the analyses are listed in Table 15.4-19. A description of the post accident combustible gas control system and hydrogen generation rates is presented in Section 6.2.5.

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The integrated thyroid and whole body doses at the low population zone as a result of purging to control hydrogen concentration in containment are listed in Table 15.4-20. These analyses show that purging the containment to control hydrogen will not result in doses which exceed the dose limitations of 10 CFR 100.

TABLE 15.4-17

PARAMETERS USED IN ANALYSIS OF CONTROL ROOM DOSE
FOLLOWING A LOSS OF COOLANT ACCIDENT

		Parameters	
Control Room Free Volume		226,040 ft ³	19
Filtered Recirculation Flow		20,000 ^{21,270} cfm	32
Recirculation Filter Efficiencies	95% for all species of iodine		
MAXIMUM Control Room Filtered Air Infiltration Rate		400 ²⁷⁵⁰ cfm	29 ³²
Control Room Unfiltered Air Infiltration Rate		10 cfm	21
MAXIMUM Control Room Outleakage	Equal to total inleakage (410 ²⁷⁶⁰ cfm)		29 ³²
Meteorology			
	0-8 hrs:	4.42 ^{9.35} x 10 ⁻⁸ sec/m ³	
	8-24 hrs:	2.72 ^{6.63} x 10 ⁻⁸ sec/m ³	
	1-4 days:	8.63 ^{2.37} x 10 ⁻⁴ sec/m ³	29 ³²
	4-30 days:	1.65 ^{9.80} x 10 ⁻⁴ sec/m ³	
Percent of Time Operator Is in Control Room Following Accident		0 - 24 hrs 100% 1 - 4 days 60% 4 - 30 days 40%	21
Duration of Accident		30 days	
Breathing Rate of Operators in Control Room		3.47 x 10 ⁻⁴ m ³ /sec	
Activity Release Assumptions		Table 15.4-15	
Method of Dose Calculation		Appendix 15A	

TABLE 15.4-18

CONTROL ROOM DOSES FOLLOWING A LOCA

	<u>Doses (Rem)</u>		
	<u>Thyroid</u>	<u>Gamma</u>	<u>Beta Skin</u>
Realistic Analysis	$\frac{1.85}{1.62} \times 10^1$	$\frac{1.25}{3.99} \times 10^{-1}$	$\frac{1.62}{1.65} \times 10^{-2}$
Conservative Analysis	$\frac{1.87}{1.64} \times 10^1$	$\frac{1.33}{4.57} \times 10^{-1}$	$\frac{6.23}{1.47} \times 10^{-2}$
Ultra-Conservative Analysis	$\frac{2.99}{2.66} \times 10^1$	$\frac{2.10}{4.87} \times 10^0$	$\frac{2.60}{2.16} \times 10^1$

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