PSNH

Public Service of New Hampshire

New Hampshire Yankee Division

George S. Thomas
Vice President-Nuclear Production

NYN-88007

January 22, 1988

United States Nuclear Regulatory Commission
Washington, DC 20555

Attention: Document Control Desk

Reference: (a) Facility Operating License NPF-56, Docket No. 50-443

(b) USNRC Letter, Dated February 3, 1987, "Inspection Report No. 50-443/86-54", E. C. Wenzinger to R. J. Harrison

(c) PSNH Letter (NYN-87013), Dated February 9, 1987, "Request for Additional Information", G. S. Thomas to the USNRC

(d) PSNH Letter (NYN-87024), Dated March 2, 1987, "Response to Inspection Report No. 50-443/86-54", G. S. Thomas to the USNRC

Subject: Proposed Modification to Control Building HVAC (CBA) System

Gentlemen:

In Reference (d), New Hampshire Yankee (NHY) committed to provide the details of modifications to the Control Building HVAC (CBA) System for NRC review prior to implementation. In accordance with that commitment, Enclosure 1 provides a description of the proposed design modifications to the CBA System. Also, the post-LOCA radiological doses to Control Room personnel have been reanalyzed by modeling the CBA System in the proposed configuration. The results of this analysis are provided as Enclosure 2. Based upon the present implementation schedule, it is requested that the NRC Staff provide comments and/or concurrence regarding the proposed modifications by February 29, 1988.

Should you have any questions concerning this submittal, please contact Mr. Warren J. Hall at (603) 474-9574, extension 4046.

Very truly yours,

George S. Thomas

Enclosure

cc: Mr. William T. Russell
Regional Administrator
Region 1
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

Mr. Victor Nerses, Project Manager
Project Directorate I-3
Division of Reactor Projects
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. A. C. Cerne
NRC Senior Resident Inspector
Seabrook Station
Seabrook, NH 03874

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ENCLOSURE 1 TO NYN-88007

CONTROL ROOM HABITABILITY SYSTEM DESCRIPTION

REFERENCES

1. 10CFR50, Appendix A. General Design Criterion 19

2. NUREG-0800, Standard Review Plan

   (a) Section 6.4
   (b) Section 6.5.1

3. PSNH Letter (NYN-87013)

4. PSNH Letter (NYN-87024)

5. PSNH Letter (NYN-87051)

INTRODUCTION

One of the specific functions of the Control Building HVAC (CBA) System is to maintain the radiological exposure to Station operators within allowable limits for a 30-day mitigation period following a Design Basis Accident (DBA). These limits are specified in References 1 and 2(a). The subsystems of the CBA System which limit radiation exposure will collectively be referred to herein as the Control Room Habitability System. References 3 and 5 provided a description of those subsystems, as currently designed, which perform this function. Figure 1 shows the existing system configuration.

Modifications to the CBA System are proposed to be implemented prior to operation above 5% of rated power (References 3 & 4). The configuration of the modified Control Room Habitability System is shown in Figure 2 and consists of the following subsystems:

- Control Room Normal Makeup Air Subsystem
- Control Room Emergency Makeup Air and Filtration Subsystem
- Control Room Exhaust and Static Pressure Control Subsystem

These subsystems function to maintain post-accident Control Room doses within allowable limits.

DESIGN BASES

The Control Room Habitability System is designed to provide filtered air for continuous occupancy of the Control Room complex by Station personnel during postulated emergency conditions.

The subsystems discussed above are specifically designed to satisfy the following design bases:

- Maintain a pressure of at least (+) 1/8" W.G. in the Control Room complex with respect to adjacent areas at all times to preclude the infiltration of hazardous contaminants.

CONTROL ROOM HABITABILITY SYSTEM DESCRIPTION

- Provide for adequate air changeout to preclude excessive buildup of carbon dioxide and other noxious odors within the Control Room complex.

- Filter all Control Room makeup air and a portion of recirculated air during emergency/radiological conditions to prevent the buildup of airborne particulates and radioactive iodines within the Control Room complex.

- Satisfy the post-accident Control Room dose and habitability criteria specified in References 1 and 2(a).

SYSTEM DESIGN

During normal plant operation, the Control Room Normal Makeup Air Subsystem is aligned to deliver approximately 1000 cfm of outside air from remotely located intakes (500 cfm per intake). With one normal makeup air fan (CBA-FN-27A or 27B) operating, valves 1-CBA-V9 and 2-CBA-V9 will be positioned to allow equal amounts of air to be drawn from the east and west intakes. The makeup air discharges into a plenum immediately upstream of the CBA-F-38 filter components. This plenum is integral to the housing of CBA-F-38 and is made common to CBA-F-8038 by connecting ductwork. Approximately 500 cfm flows through the prefilter and electric heater for CBA-F-38, and discharges into the Control Room HVAC Equipment Room, bypassing the remainder of the filtration system. The remaining air (approximately 500 cfm) flows through the filter crosstie to CBA-F-8038 where it flows through a prefilter and electric heater and discharges into the Control Room HVAC Equipment Room, bypassing the remainder of the filtration system. Manual isolation dampers are provided immediately downstream of the prefilter for CBA-F-38 and on the crosstie duct to CBA-F-8038. The dampers allow for train isolation. The air heater in each filter operates continuously to maintain the relative humidity within the carbon adsorber section equal to or less than 70%. The Control Room Exhaust and Static Pressure Control Subsystem functions with exhaust fan (CBA-FN-15) operating and its discharge control damper (CBA-DP-28) modulating to maintain the Control Room complex at a pressure of at least (+) 1/8" W.G. with respect to adjacent areas. The redundant exhaust isolation damper (CBA-DP-1058) remains fully open during normal plant operation.

During emergency plant conditions, when high radiation is detected in either remote intake or upon generation of a safety injection ("S") signal, the Control Room Normal Makeup Air Subsystem (CBA-FN-27A and 27B, CBA-DP-53A and 53B) and the Control Room Exhaust and Static Pressure Control Subsystem (CBA-FN-15, CBA-DP-28, and CBA-DP-1058) are automatically isolated. In addition, both redundant Control Room Emergency Makeup Air and Filtration Subsystem fans (CBA-FN-16A and 16B) and discharge dampers (CBA-DP-27A and 27B) are automatically actuated.

CONTROL ROOM HABITABILITY SYSTEM DESCRIPTION

Either filter unit (CBA-F-38 or CBA-F-8038) and its associated fan are designed to draw a total of 600 cfm makeup air from both remote intakes (300 cfm per intake) and 500 cfm recirculation air from the Control Room HVAC Equipment Room, resulting in a flow rate of 1100 cfm per filter.

The system air flow rates specified above are for single train operation (i.e., one emergency makeup air fan operating and its associated discharge damper fully open). The emergency makeup air fans and associated system configuration have been designed to ensure fan stability during dual train operation. The increased air flow rates for dual train operation will not impact the system's ability to satisfy its intended design bases. Conservatively high system flow rates projected for dual train operation have been assumed in calculating post-LOCA Control Room radiological doses (Reference Enclosure 2 to this submittal).

The emergency makeup air is drawn from the intakes via piping and backdraft dampers (CBA-DP-1061A, 1061B) which bypass the normal makeup air fans and discharge dampers. This makeup air enters a suction plenum immediately upstream of CBA-F-38 which is made common to CBA-F-8038 by connecting ductwork. The makeup air is drawn through either or both filter units. Each unit is designed with a prefilter, an electric heater for humidity control, and a HEPA-carbon-HEPA filter configuration. Each filter housing is also designed with an orifice, immediately downstream of the heater, for recirculation airflow. The mixture of makeup air and recirculation air is drawn through the HEPA-carbon-HEPA configuration and discharged into the Control Room HVAC Equipment Room. The filtered air is then distributed throughout the Control Room complex via the Control Room Air Conditioning System.

The 600 cfm makeup air flow rate and one filter unit are more than adequate to maintain the Control Room complex pressurized and provide required air changeout. The Control Room complex outleakage with the Control Room Exhaust and Static Pressure Control Subsystem fully isolated is calculated to be 165 cfm at a pressure of (+) 1/8" W.G. Preoperational testing has determined this postulated leakage value to be conservatively high. The minimum required ventilation rate for occupancy/breathing purposes is 175 cfm.

The total flow rate of 1100 cfm per filter train provides an average air flow velocity of 22 fpm for the CBA-F-38 carbon adsorber and 53 fpm for the CBA-F-8038 carbon adsorber. These velocities satisfy Regulatory Guide 1.52 minimum carbon residence time criterion of 0.25 seconds for the respective filter units.

A 4-inch diameter pipe with a manual isolation valve is provided to cross-connect the two filter units at a point downstream of the carbon adsorber sections. The isolation valve will be throttled to a preset normally open position. During single train operation, this alignment will provide approximately 50 cfm of air flow through the carbon

adsorber section of the inactive train. This air flow will remove decay heat satisfying fire protection concerns. The isolation valve will be closed for train isolation in the event a fire is detected in one of the filter units.

INSTRUMENTATION AND CONTROL

The Control Room Normal Makeup Air Subsystem fans and discharge dampers are controlled from the Main Control Board (MCB). Opening of a discharge damper (CBA-DP-53A or 53B) satisfies a permissive to start its corresponding fan (CBA-FN-27A or 27B). During normal plant operation, one damper is open and its associated fan is running. Detection of high radiation at either remote intake will automatically close the damper and shut down the fan. The control scheme of the normal makeup air fans and dampers is "cross-trained" to ensure isolation regardless of any single active failure. That is, detection of high radiation by either Train A monitor (RM-6507A for west intake or RM-6506A for east intake) will close CBA-DP-53B and trip CBA-FN-27A. Detection of radiation by either Train B monitor (RM-6507B for west intake or RM-6506B for east intake) will close CBA-DP-53A and trip CBA-FN-27B. Failure of a vital bus will also isolate the system.

Redundant radiation monitoring instruments are provided for each remote intake. Details of the radiation monitoring instrumentation are provided in Section 12.3.4 of the FSAR. Status lights are provided on the MCB for the normal makeup air fans and dampers. Status indication is also provided on the MCB for the intake isolation valves (1-CBA-V9 and 2-CBA-V9). Isolation of the Control Room Normal Makeup Air Subsystem generates an alarm at the MCB. Smoke detection alarms are provided for each intake.

The Control Room Emergency Makeup Air and Filtration Subsystem fans and discharge dampers are also controlled from the MCB. In the auto mode, CBA-DP-27A and 27B will open upon receipt of a high radiation signal or a safety injection ("S") signal. Opening of these dampers will automatically start associated fan CBA-FN-16A or 16B. A high radiation signal or starting fans 16A and 16B will trip CBA-FN-27A and 27B and isolate dampers CBA-DP-53A, 53B, 28, and 1058. Each filter air heater operates continuously. High and high-high temperature heater trips are provided. The high-high temperature trip requires local/manual reset. Status lights are provided on the MCB for the fans and discharge dampers. Status lamps are also provided for the fans in the Accident Monitoring Instrumentation arrays.

Differential pressure indication across each filter component is provided locally. High differential pressure across each filter unit generates an alarm at the MCB. The temperature for each filter unit is indicated locally. High temperature generates an alarm at the MCB.

CONTROL ROOM HABITABILITY SYSTEM DESCRIPTION

Relative humidity for each filter unit is monitored by the Main Plant Computer, with high relative humidity generating an alarm at the MCB. Air flow for each filter train is monitored by the Main Plant Computer. Two carbon monoxide detectors per filter unit (one each at the inlet and outlet of the carbon adsorber banks) provide for early fire detection. These devices monitor the filtration systems and generate an alarm in the Control Room.

The Control Room Exhaust and Static Pressure Control Subsystem fan (CBA-FN-15) and discharge control damper (CBA-DP-28) are controlled from the MCB. During normal plant operation, the fan is running and the discharge damper modulates to maintain Control Room pressure at $\geq$ (+) 1/8" W.G. This modulating feature is controlled by a differential pressure control loop. This control loop senses pressure in the Control Room HVAC Equipment Room, Cable Spreading Room, and the outside atmosphere. The damper is modulated automatically to maintain the Control Room HVAC Equipment Room at $\geq$ 1/8" W.G. positive pressure with respect to atmosphere and the Cable Spreading Room. The redundant exhaust isolation damper (CBA-DP-1058) is fully open during normal plant operation. Loss of normal makeup air and/or loss of Control Room pressurization will close CBA-DP-28 and trip CBA-FN-15. Interlocks are provided so that isolation dampers CBA-DP-28, 1058 and exhaust fan CBA-FN-15 are isolated whenever a high radiation signal is present or fan 16A or 16B is running. Status indication for CBA-FN-15, CBA-DP-28 and 1058 is provided on the MCB. Indication of differential pressure between the Control Room HVAC Equipment Room and outside atmosphere is provided in the HVAC Room. This differential pressure, as well as the differential pressure between the Cable Spreading Room and the HVAC Room, is monitored by the station computer.

SAFETY EVALUATION

The Control Room Habitability System is being modified to ensure compliance with 10CFR50, Appendix A, GDC 19, and Section 6.4 of the Standard Review Plan.

All active components in the Control Room Normal Makeup Air Subsystem, Control Room Emergency Makeup Air and Filtration Subsystem, and Control Room Exhaust and Static Pressure Control Subsystem, except exhaust fan CBA-FN-15, are designed to meet ANS Safety Class 3 and Seismic Category I requirements. The exhaust fan is designed NNS.

Filtration systems CBA-F-38 and 8038, including associated fans and dampers, are designed as Engineered Safety Features (ESF) in accordance with Regulatory Guide 1.52 and Section 6.5.1 of the Standard Review Plan. The filter trains are fully redundant.

CONTROL ROOM HABITABILITY SYSTEM DESCRIPTION

All redundant active components are powered by separate and independent trains of emergency power from the diesel generators. Pneumatically actuated system dampers are designed to fail in the safe position as follows:

CBA-DP-53A	Fail Closed
CBA-DP-53B	Fail Closed
CBA-DP-28	Fail Closed
CBA-DP-1058	Fail Closed
CBA-DP-27A	Fail Open
CBA-DP-27B	Fail Open

In addition, the piping which bypasses the normal makeup air fans and dampers is provided with redundant parallel backdraft dampers (CBA-DP-1061A and 1061B). This design ensures that an emergency makeup air flow path is available in the event one of the backdraft dampers fails to open with flow initiated upon actuation of CBA-FN-16A or 16B.

The redundant and fail-safe damper design ensures that the system will perform its safety-related function regardless of any single active failure.

The motors for CBA-FN-16A and 16B, CBA-FN-27A and 27B are designed Class 1E. The electric air heaters associated with each filter are also Class 1E. All electrical, instrumentation and control systems which perform vital control functions are designed Class 1E in accordance with IEEE Standard 279-1971, and otherwise satisfy existing commitments in Chapters 7 and 8 of the FSAR.

The makeup air duct upstream of CBA-F-38 and 8038 and external to the Control Room complex envelope is heavy-wall carbon steel pipe designed to remain intact and functional following a seismic event. The filter housings, discharge ductwork, and all other passive system components are also designed to remain intact and functional following a seismic event. All portions of the makeup air system external to the Control Room complex envelope are designed to minimize inleakage.

All active and passive components of the system are contained in missile-protected buildings or are underground. No internally-generated missiles which could impair the system's ability to perform its safety-related functions are credible.

The proposed modifications do not increase the probability of occurrence or consequences of an accident or malfunction of equipment important to safety nor create the possibility for an accident or malfunction of a type other than currently evaluated in the FSAR. The proposed modifications do not reduce the margin of safety as currently defined in the bases for any Technical Specifications.

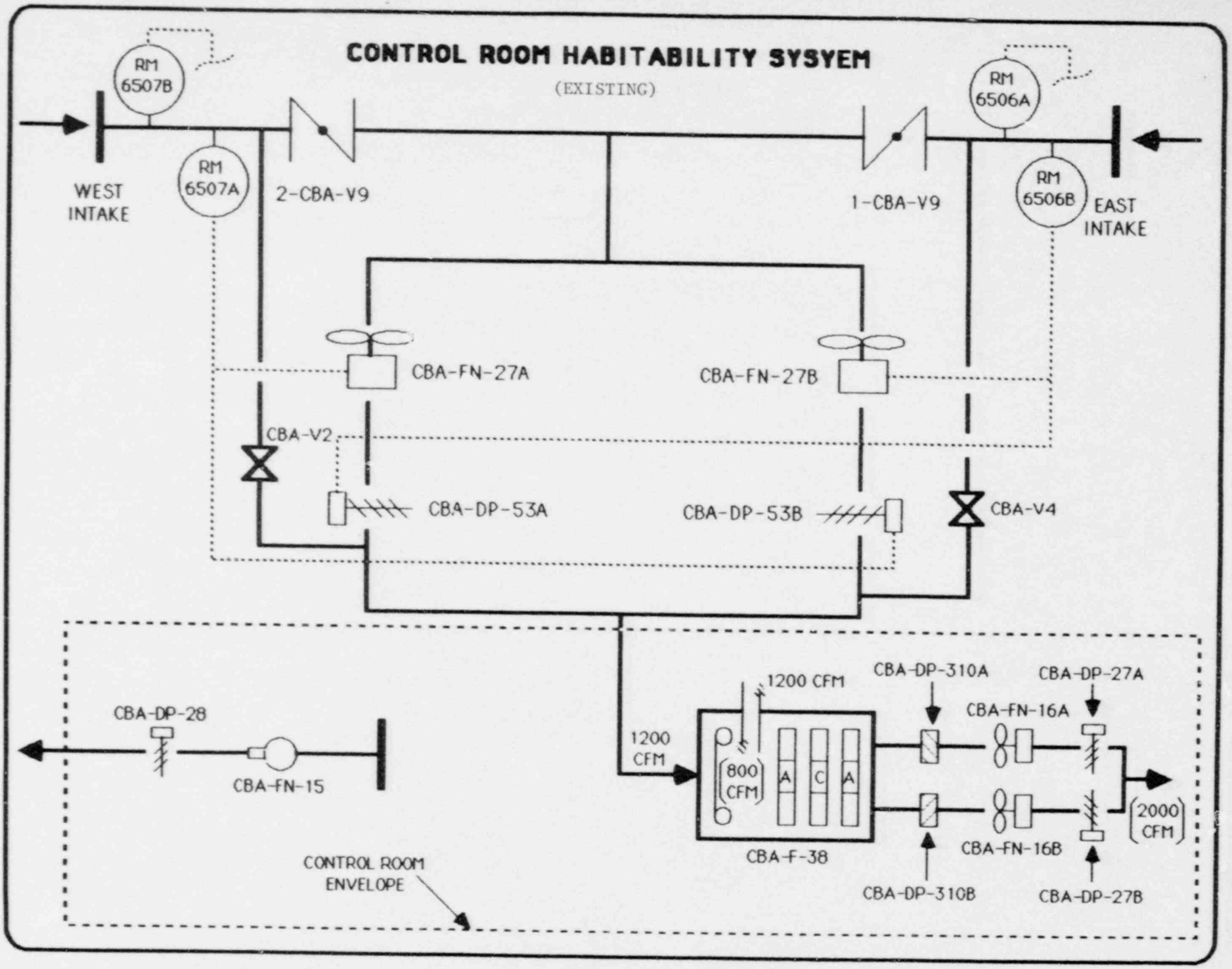
CONTROL ROOM HABITABILITY SYSYEM
(EXISTING)
RM 6507B
RM 6507A
RM 6506A
RM 6506B
WEST INTAKE
EAST INTAKE
2-CBA-V9
1-CBA-V9
CBA-FN-27A
CBA-FN-27B
CBA-V2
CBA-V4
CBA-DP-53A
CBA-DP-53B
CBA-DP-28
CBA-FN-15
1200 CFM
1200 CFM
CBA-DP-310A
CBA-DP-27A
CBA-FN-16A
800 CFM
A
C
A
CBA-F-38
CBA-FN-16B
2000 CFM
CBA-DP-310B
CBA-DP-27B
CONTROL ROOM ENVELOPE

FIGURE 1

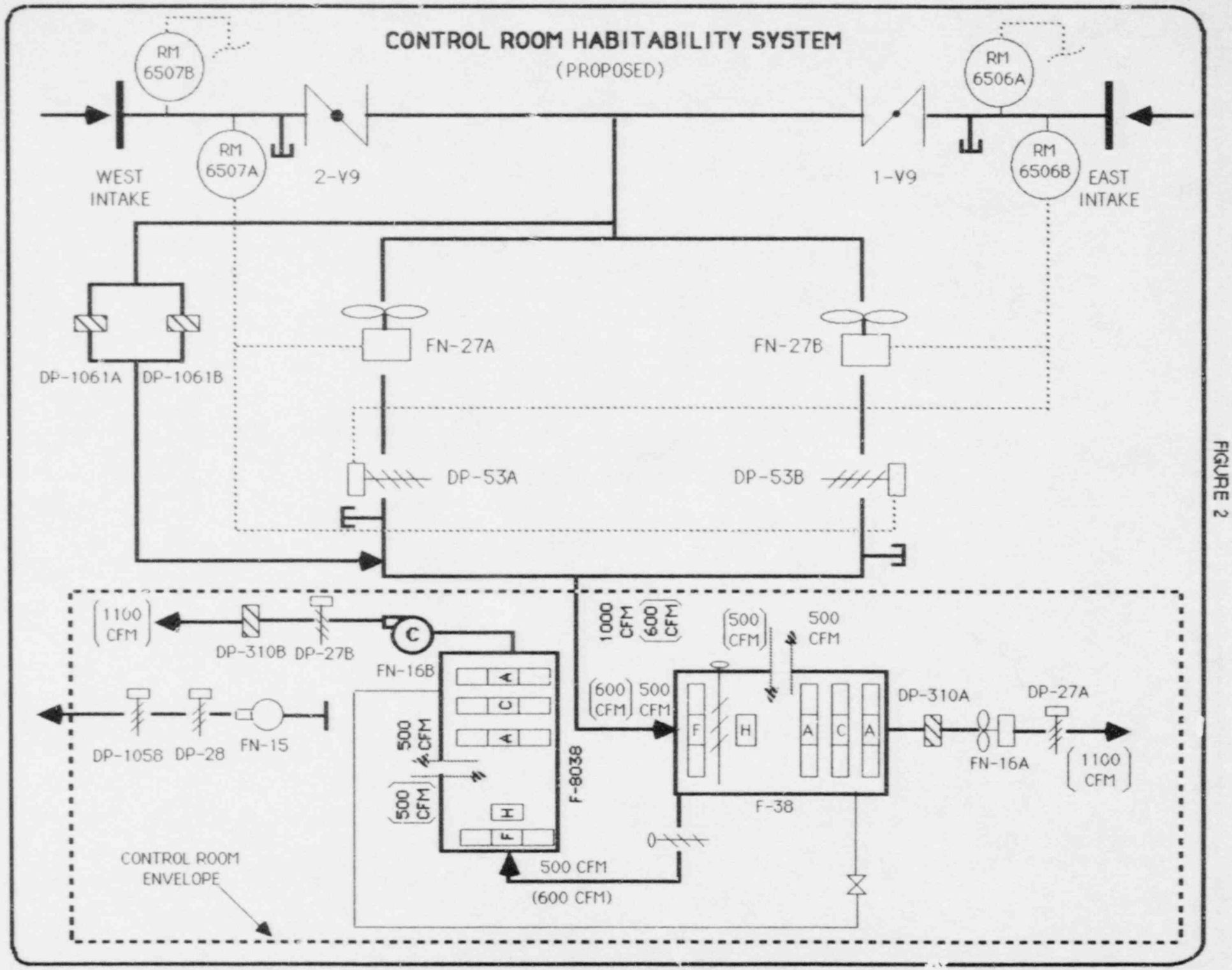
CONTROL ROOM HABITABILITY SYSTEM
(PROPOSED)
RM 6507B
RM 6507A
WEST INTAKE
2-V9
1-V9
RM 6506A
RM 6506B
EAST INTAKE
DP-1061A
DP-1061B
FN-27A
FN-27B
DP-53A
DP-53B
1100 CFM
DP-310B
DP-27B
FN-16B
1000 CFM
600 CFM
500 CFM
500 CFM
600 CFM
500 CFM
DP-310A
DP-27A
DP-1058
DP-28
FN-15
500 CFM
500 CFM
F-8038
FN-16A
1100 CFM
F-38
CONTROL ROOM ENVELOPE
500 CFM
(600 CFM)

FIGURE 2

ENCLOSURE 2 TO NYN-88007

CONTROL ROOM POST-LOCA RADIOLOGICAL DOSES

The Control Room doses for the DBA-LOCA have been reanalyzed modeling the Control Room Habitability System in accordance with the proposed modifications. The analysis is based on the following assumptions or inputs.

- o Source Term: Radiological releases based on current DBA-LOCA assumptions specified in FSAR Section 15.6.5 as follows.
  - Containment Leakage (La) = 0.15% Containment Mass/Day
  - Secondary Containment Bypass Leakage = 0.60 La
  - Secondary Containment Evacuation Time = 8 Minutes
- o Control Room Complex Volume: 246,000 ft^3 as specified in FSAR Section 6.4.
- o Control Room Emergency Filters: Redundant systems are located within the Control Room complex boundary filtering all outside makeup air and a percentage of recirculation air with the following efficiencies:

  95% Elemental Iodine
  95% Organic Iodine
  99% Particulate Iodine

- o Control Room Emergency Makeup Air and Filtration Subsystem Flow Rates: A total subsystem flow rate of 2000 cfm is the projected maximum for dual train operation. 1200 cfm make up air and 800 cfm recirculation air is assumed. The higher than projected makeup air to recirculation air flow rate proportion is conservative as doses increase with increasing makeup air. No credit is taken for manual isolation of a contaminated remote intake (i.e., both intakes remain open for the 30-day release period).
- o Unfiltered Infiltration: 1200 cfm is assumed for two seconds during automatic system alignment (i.e., switchover from Control Room Normal Makeup Air Subsystem to Control Room Emergency Makeup Air and Filtration Subsystem). The actual normal makeup air flow rate is approximately 1000 cfm. This assumption is therefore conservative. Following the system realignment, unfiltered infiltration is assumed to be 0 cfm for the primary ingress/egress boundary (double door configuration) and 1 cfm for the single door emergency fire exit (based on low anticipated usage).

CONTROL ROOM POST-LOCA RADIOLOGICAL DOSES

o Atmospheric Dispersion Factors X/Q (Sec/M^3)

Time Period (hr)	Control Room	West Intake	East Intake
0-1	4.08E-03	1.13E-03	1.42E-03
1-2	3.18E-03	7.06E-04	1.14E-03
2-8	2.04E-03	3.55E-04	6.95E-04
8-24	1.44E-03	1.45E-04	4.67E-04
24-96	9.78E-04	8.58E-05	3.05E-04
96-720	7.51E-04	5.71E-05	2.00E-04

Dose results are based on X/Q values for worst intake (east) divided by two for dilution since equal amounts of makeup air will be drawn from each intake for the 30-day release duration.

The resultant 30-day Control Room doses for the DBA-LOCA are as follows:

Thyroid Dose	25.0 rem
Whole Body Gamma Dose	4.1 rem
Skin Dose	6.5 rem