Attachment 1 to JPN-95-010

Response to NUREG-0737, III.D.3.4 Control Room Habitability for the James A. FitzPatrick Nuclear Power Plant

New York Power Authority
February 1995

Executive Summary

This report updates a report originally submitted to the NRC on August 31, 1981 (Ref. 20) to reflect recent changes in the design and operation of the FitzPatrick Control Room Ventilation System. The Authority committed to prepare and submit this update in LER 93-019-02 (Ref. 8). This report supersedes and replaces the Authority's 1981 and 1994 reports which were submitted in response to TMI Action Plan (NUREG-0737) Item III.D.3.4, "Control Room Habitability."

In July of 1993, Authority engineers identified deviations from the UFSAR regarding how the system would operate to protect the operators in the event of an accident. The system was placed in the isolate mode as a compensatory measure until the concerns could be resolved. The Authority submitted an initial Licensee Event Report (LER) (LER-93-019-00) detailing the concerns. An LER update (LER 93-019-02) dated May 27, 1994, documented the resolution of these issues. Two 10 CFR 50.59 nuclear safety evaluations allowed the system to be returned to the normal mode prior to startup following the 1994 maintenance outage.

This report describes the mode of operation for radiological accident isolation and fifteen characteristics of the FitzPatrick Control Room requested as part of NUREG-0737. Technical Specifications for chlorine detection and air filtration systems are compared to the NRC's Standard Technical Specifications. Results of analyses of Control Room radiation exposures from airborne radioactive material and direct radiation resulting from design-basis accidents are summarized.

The Control Room Ventilation System compares favorably with the NRC staff guidance in Standard Review Plan 6.4, with the exceptions detailed in this report. The system is capable of assuring that plant operators are adequately protected against the effects of accidental releases of toxic and radioactive gases.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

List of Tables

List of Figures

List of Figures
(continued)

1.0 Introduction

Background

NUREG-0737 Item III.D.3.4

The first version of this report was submitted to the NRC by the Authority on August 31, 1981 (Ref. 20). The NRC reviewed the report and prepared a Safety Evaluation Report (SER, Ref. 21) documenting their conclusions. Two Technical Specification amendments were granted to reflect the guidance in the Standard Technical Specifications (Ref. 11).

LER 93-019-00

After a series of inspections and evaluations starting in July of 1993, FitzPatrick engineering determined that an unquantified amount of air could leak into the Control Room with the ventilation system in the isolate mode of operation with a single failure, specifically failure of a motor-operated-valve to shut. On July 9, 1993, the Control Room Ventilation System was placed in the isolate mode as an interim compensatory action until the concerns were resolved. In September 1993, LER 93-019-00 (Ref. 27) was issued to document these actions.

LER 93-019-01

In October 1993, engineering identified a second single failure concern in the routing of control and power cables for some of the ventilation system fans, dampers, and isolation valves. Interim LER 93-019-01 (Ref. 24) informed the NRC.

Reasonable Assurance of Safety

To justify startup from the Fall 1993 maintenance outage and plant operation with these and other deviations in the Control and Relay Room Ventilation Systems, the Authority prepared a Reasonable Assurance of Safety (Ref. 25). This engineering report assessed the effect on safety of all the deviations and concluded that the plant could be safely operated.

Nuclear Safety Evaluations

Two 10 CFR 50.59 Nuclear Safety Evaluations (Refs. 1 and 41) were prepared by the Authority to demonstrate that system modifications or deviations from the FSAR would not constitute an unreviewed safety question. The plant returned to power operation with the ventilation system in the normal mode after the spring 1994 maintenance outage.

Updated LER 93-019-02

An updated LER (Ref. 8) was prepared and submitted in May 1994, to reflect the resolution of these concerns. One of the corrective actions identified in this updated LER was the preparation and submittal of a revised NUREG-0737, Item III.D.3.4 Control Room Habitability report.

November 1994

An updated NUREG-0737, Item III.D.3.4 report was submitted to the NRC (Reference 57.) Analyses to determine the potential effects of accidental releases of hazardous materials (Section 8) were not completed in time for this report. The Authority committed to revise and submit a report with these analyses.

Purpose

This report updates the 1981 report (Ref. 20) to reflect changes in the design and operation of the FitzPatrick Control Room Ventilation System since that time. The Authority committed to prepare and submit this update in LER 93-019-02 (Ref. 8).

Report Format

The format of this report is similar to that of the report submitted to the NRC in 1981. The information included in Sections 3 through 7 is based on the NRC's list of "Information Required for Control Room Habitability Evaluation" included as Attachment 1 to NUREG-0737, Item III.D.3.4 (pages III.D.3.4-4 and III.D.3.4-5). Sections 8 and 9 summarize the analyses performed to determine the effects of potential toxic gas releases and design basis accidents on Control Room operators.

Section 2 describes significant changes in the system or supporting evaluations since the 1981 report was prepared.

Section 3 describes the mode of operation for radiological accident isolation.

Section 4 describes the fifteen characteristics of the FitzPatrick Control Room requested in Attachment 1 to NUREG-0737, Item III.D.3.4.

Section 5 addresses onsite storage of chlorine and other hazardous chemicals.

Section 6 describes offsite manufacturing, storage, or transportation facilities of hazardous chemicals.

Section 7 addresses the adequacy of Technical Specifications for chlorine detection and air filtration systems compared to the NRC's Standard Technical Specifications.

Section 8 presents the results of analyses of Control Room concentrations from postulated accidental releases of toxic gases.

Section 9 presents the results of analyses of Control Room operator radiation exposures from airborne radioactive material and direct radiation resulting from design-basis accidents.

2.0 Summary of Major Changes to Report

November 1994 Report

This report is similar to the original report submitted in 1981. The major differences are summarized below:

- The system operation description was corrected for minor discrepancies.
- The ventilation system flow rates described in the report are system test data after rebalancing the system rather than original design values.
- The discussions on breathing air supply, and emergency food and water were updated.
- The discussion of testing and maintenance requirements for the charcoal and HEPA filter was revised to reflect Technical Specification requirements.
- Updated report to reflect results of revised radiological analyses. Analyses make conservative assumptions about operator action times.
- Cable separation concerns addressed.
- Lists of onsite and offsite hazardous materials were updated.

February 1995 Revision

The changes in this revision are summarized as follows:

- Section 3.0 (Control Room Mode of Operation for Radiological Accident Isolation) was revised to include a discussion of the current status of open items identified as part of the Design Basis Document Development Program.
- Section 6.0 (Offsite Manufacturing, Storage, or Transportation of Hazardous Chemicals) was modified to include the screening analysis to determine which hazardous materials are analyzed in Section 8.0.
- Table 1 (Onsite Storage of Chlorine and Other Hazardous Chemicals), was revised to correct distances to the Control Room outside air intake. The table is now consistent with Figure 6.

- Table 2 (Offsite Storage of Hazardous Chemicals within Five Miles of the FitzPatrick Control Room Intake) was revised to remove data from Specialty Minerals Inc., which was outside the five mile radius. Data for the Sithe/Independence Cogeneration Station has been added to Table 2. The table was also revised to identify those chemicals not considered to constitute a potential Control Room habitability concern, and those chemicals for which a dispersion analysis was performed.

- Section 8.0 (Hazardous Materials Analysis) was completed and included.

3.0 Control Room Mode of Operation for Radiological Accident Isolation

Flow diagrams of the Control Room Ventilation System are presented in Figures 1, 2 and 3, for the normal, purge and isolate operating modes respectively including valve alignments. Damper positions for the normal operating mode are for Train A and assume that the outside air temperature is greater than 55°F. The flowrates shown on the figures are from tests conducted on Train B.

The FitzPatrick Control Room Ventilation System operation, during emergency conditions, uses isolation with filtered makeup air, supplied by the emergency ventilation system fans and filters. This maintains a 0.125" w.g. positive pressure in the Control Room volume (refer to Figure 7) relative to the atmosphere to prevent the entrance of potential airborne contaminants through infiltration. When the control switch is manually placed in the isolate position (refer to Figure 3), the mode utilized in the event of an accident, the system is in full recirculation. In addition, two 100% capacity booster fans (70FN-6A, B) and two filter trains (70F-11A and 70F-11B) are utilized as redundant units with the capability of providing 1,000 $\pm$ 10% cfm of filtered outside air from either of two outside emergency air intakes (refer to Section 4.f) for maintaining 0.125" w.g. positive pressure in the Control Room volume. Both trains consist of a prefilter, a HEPA filter, a pair of 2 inch charcoal filters in series, and a second HEPA filter.

The standby components of the ventilation system (70AHU-3A or 70AHU-3B and 70FN-4A or 70FN-4B) are controlled by installed instrumentation. On detection of low air flow at the operating fan discharge, an alarm will sound on the local panels (70HV-5A or 70HV-5B) and the ventilation panel (09-75) in the Control Room, and will start the redundant/standby fan (See Ref. 1). The control system is designed for fail-safe operation in the event of any instrument or equipment failure, causing the room exhaust temperature to rise above 98°F. Both air handling systems and both chillers will start automatically to provide maximum cooling. If the Control Room temperature exceeds 98°F, the standby components will start.

In the event that the filters on the operating train (70F-11A or 70F-11B) become clogged or the operating booster fan fails (70FN-6A or 70FN-6B), installed instrumentation senses a loss of pressure and automatically starts the standby filter train and annunciates an alarm in the Control Room.

When the control switch (70-43-1CRVN02) is manually moved from the normal position to the isolate position the following occurs:

- The atmospheric exhaust butterfly valve (70MOV-107) and the outside air supply butterfly valve (70MOV-108) close.

- The outside air supply damper (70MOD-105) and the atmospheric

exhaust damper (70MOD-109) close.

- The recirculation dampers (70MOD-110A and 70MOD-110B) open.

- The exhaust fan (70FN-1) for the toilet and kitchen stops and its discharge damper (70MOD-111) closes.

- Depending upon which emergency fan is lead (70FN-6A or 70FN-6B), the lead fan starts, and the associated emergency supply fan discharge damper (70MOD-112A or 70MOD-112B), opens.

In addition, the outside air supply bypass damper (70DMPR-105) will be manually closed. The outside air exhaust bypass damper (70DMPR-109) is maintained closed under administrative controls (Ref. 30). The emergency outside air intake damper (70MOD-113) and the recirculation damper (70MOD-114) are permanently positioned in their "failed" position.

The Control Room Ventilation System is comparable to the design described in Sections III.3.a.(1) and III.3.d.(1) of Standard Review Plan 6.4. Zone isolation is provided with incoming air filtered and a positive pressure maintained by the ventilation system fans.

The primary emergency air intake isolation valve (70CRV-01) and the secondary emergency air intake isolation valve (70CRV-02), for the emergency supply fans (70FN-6A and 70FN-6B) are manually operated. Valve 70CRV-01 is normally open, while valve 70CRV-02 is normally closed. These valves are operated manually to choose the most suitable intake during an emergency situation where air will flow through them to the special filter train. In the event that the secondary air intake is required to supply air, 70CRV-01 would be manually closed and 70CRV-02 would be manually opened. Both emergency air intakes are seismically qualified, but only the primary air intake is tornado missile protected. In the event that the secondary emergency air intake is in service and high winds or a tornado warning was to occur, the alignment could be switched from the secondary emergency air intake to the primary emergency air intake, until the threat of tornado passes.

In the event of an emergency, the system has the capability to isolate the Control Room Emergency Zone from the surrounding areas, recirculating and cooling the air within the zone, and at the same time pressurizing the Control Room Volume with filtered outside air by using the emergency supply fan in conjunction with the filter trains.

The system design ensures that pressurization can be maintained. It does not, however, meet the single active failure criterion presented in SRP 6.4. A single

failure analysis of the Control Room Emergency Ventilation System was performed (Ref. 10) which identified potential single failures that could significantly degrade the performance of the system. The identified single failures and resolutions are as follows:

- 70MOV-107 failure to close - This would provide for a potential leakage path through the exhaust bypass damper (70DMPR-109). The exhaust bypass damper is maintained closed under administrative controls. In addition, quarterly testing verifies that a positive pressure exists inboard of the MOD with the MOV failed open.

- 70MOV-108 failure to close - This would provide for a potential leakage path through the supply bypass damper (70DMPR-105). This damper is manually closed when the Control Room Ventilation System is placed in the isolate mode. In addition, quarterly testing verifies that a positive pressure exists inboard of the MOD with the MOV failed open.

- 70MOD-113 failing closed, 70MOD-114 failing open, or a failure of 70DPT-100. These failures could prevent the Control Room from maintaining a positive pressure. The dampers are in their "failed" positions by disconnecting the mechanical linkage for each damper.

- Failure of the mode selector switch (43-1CRNV02). The potential failure of the mode selector switch was reviewed in detail and determined not to be credible (Ref. 32).

A habitability analysis was performed to determine the potential effects of these single failures and it was determined that, with the worst case single failure, the radiation dose to Control Room operators was within acceptable limits (Ref. 9).

Power and controls cables to each component of the Control Room Ventilation System were investigated (Refs. 32 and 40). Cables sharing a common terminal point (associated) with major, safety-related components were evaluated to determine their single failure vulnerability. The failure of any cable, including instrumentation and annunciator cables, will not affect the intended safety function of any major component.

The components of the system are connected to safety-related power except for the kitchen and toilet exhaust fan (70FN-1), and motor operated dampers 70MOD-105, 109 and 111. It is not required to provide safety-related power to these components since they fail in their safe position upon loss of power, and they are seismically designed. Additional details concerning the current mode of operation during emergency conditions are outlined in Reference 1.

Design Basis Document Program Open Items

During the development of design basis documentation for the Control Room Ventilation System, the Authority could not identify a document that addressed the potential effects of the failure of one of two 50% capacity recirculation dampers (70MOD-110A and 70MOD-110B) in the Control Room Ventilation System. This open item is being tracked by DDOI-JAF-CREVASS-070-032 (Reference 43). The DDOI (Design Document Open Item) also identified a similar condition in the Relay Room Ventilation System. These concerns were classified as Priority II because the missing information does not have direct or immediate affect on the performance of a safety function.

The Authority has resolved this DDOI. The potential effects of the failure on system operation are negligible (Ref. 60). The sensitivity of the system flow rates to the single failure of one of the two fifty percent recirculation dampers is small and would not prevent the system from performing its safety function.

With the resolution of the DDOI described above, the Control Room Ventilation system satisfies the single failure criterion as described in Sections II.2.b and III.3.c of SRP 6.4.

As a result of work to quantifiy conditions similar to Control Room Ventilation issues, the Authority identified other design and licensing basis questions about the Relay Room Ventilation System. These were reported to the NRC in voluntary LER-94-008 (Reference 61.)

Temporary Conditions

1. Currently, both emergency filter trains will be manually started if a high radiation alarm in the Control Room intake duct work is received. This condition is temporary and will be returned to the original design mode after resolution of cable separation concerns regarding these filter trains (Ref. 8).

2. The emergency air intake is currently aligned with 70CRV-02 open and 70CRV-01 closed, due to potential CO_2 intrusion concerns. The normal alignment will be restored after changes to the Relay Room Ventilation System are completed.

Modifications to resolve these temporary conditions are being installed and will be operable prior to startup from the 1994/1995 Refueling Outage.

Figure 1
CONTROL ROOM VENTILATION SYSTEM
NORMAL OPERATING MODE

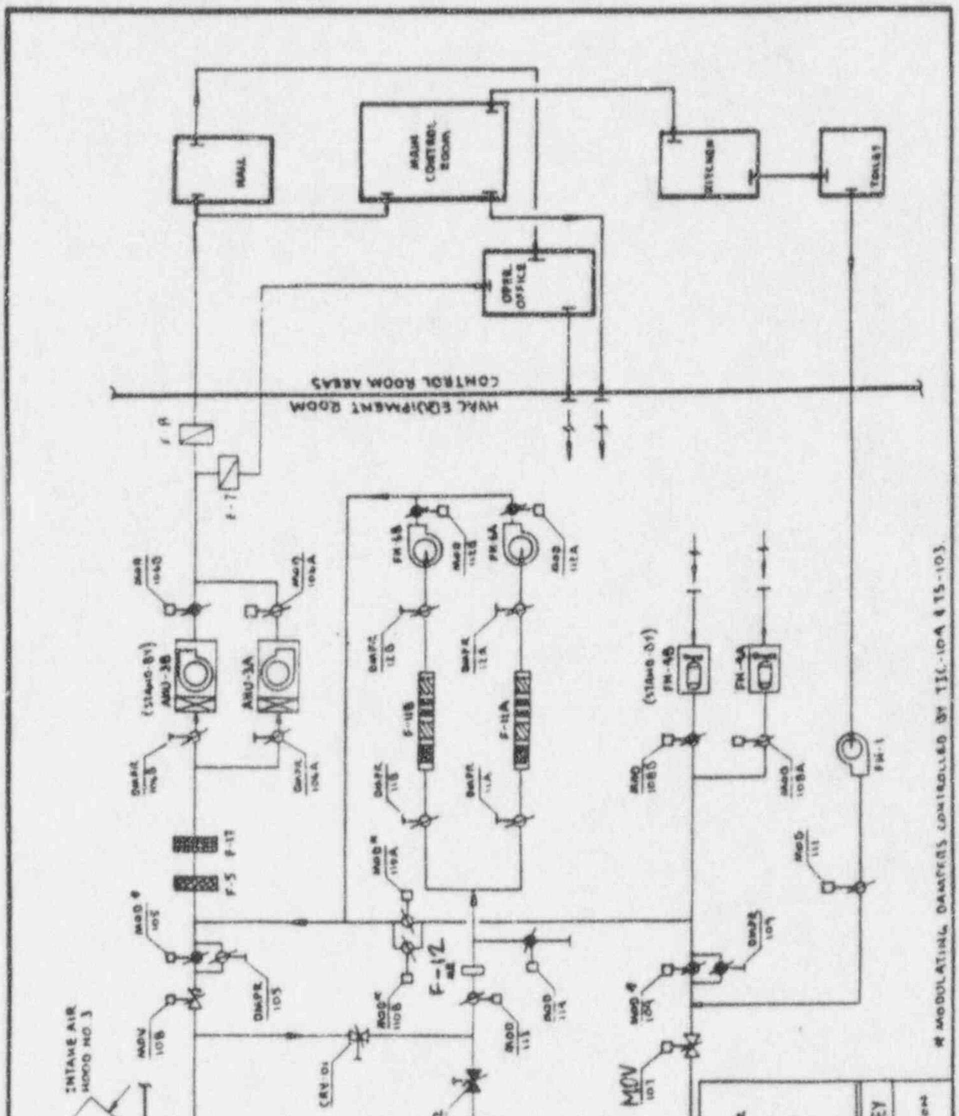


Figure 2
CONTROL ROOM VENTILATION SYSTEM
PURGE OPERATING MODE

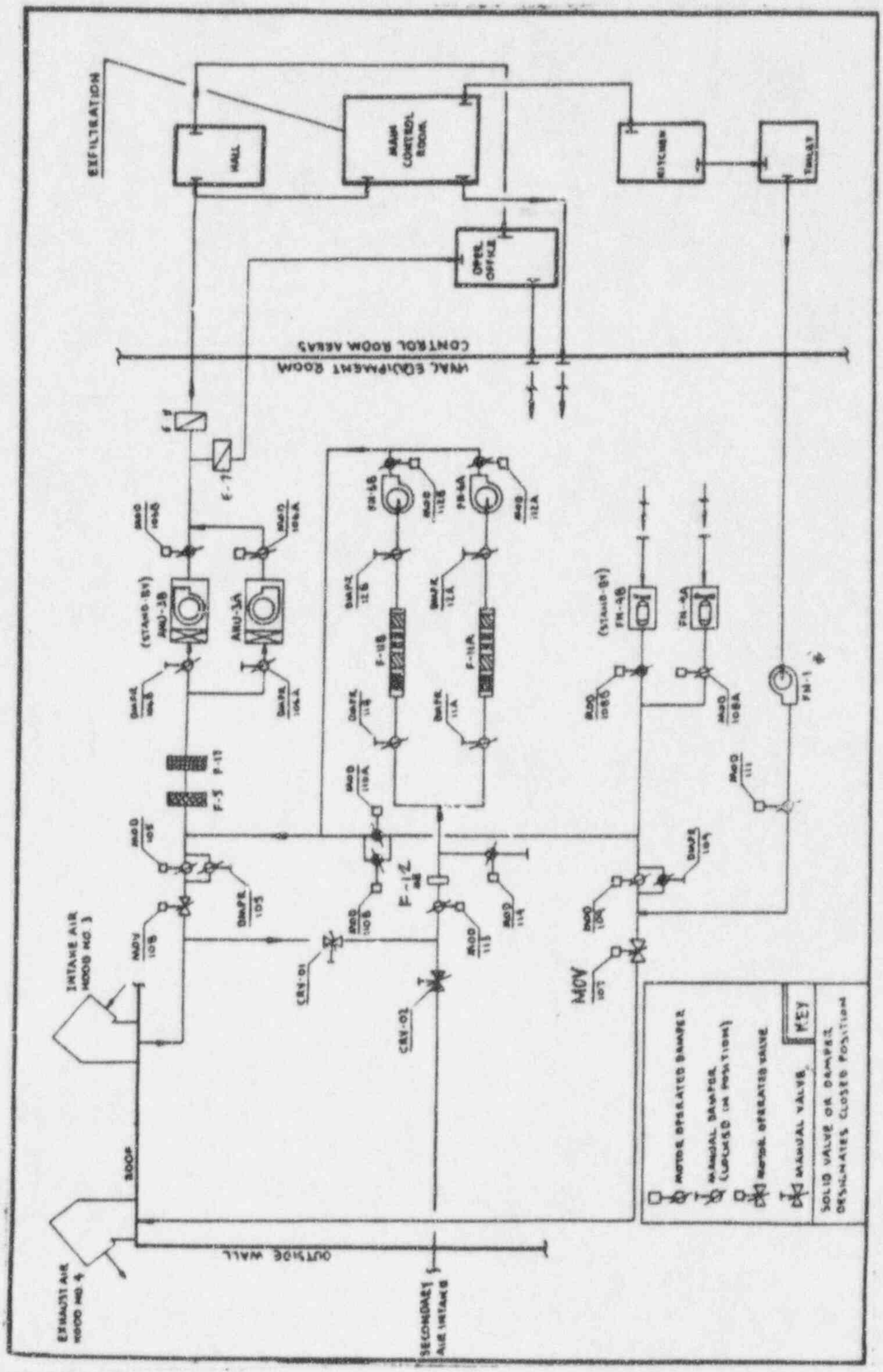
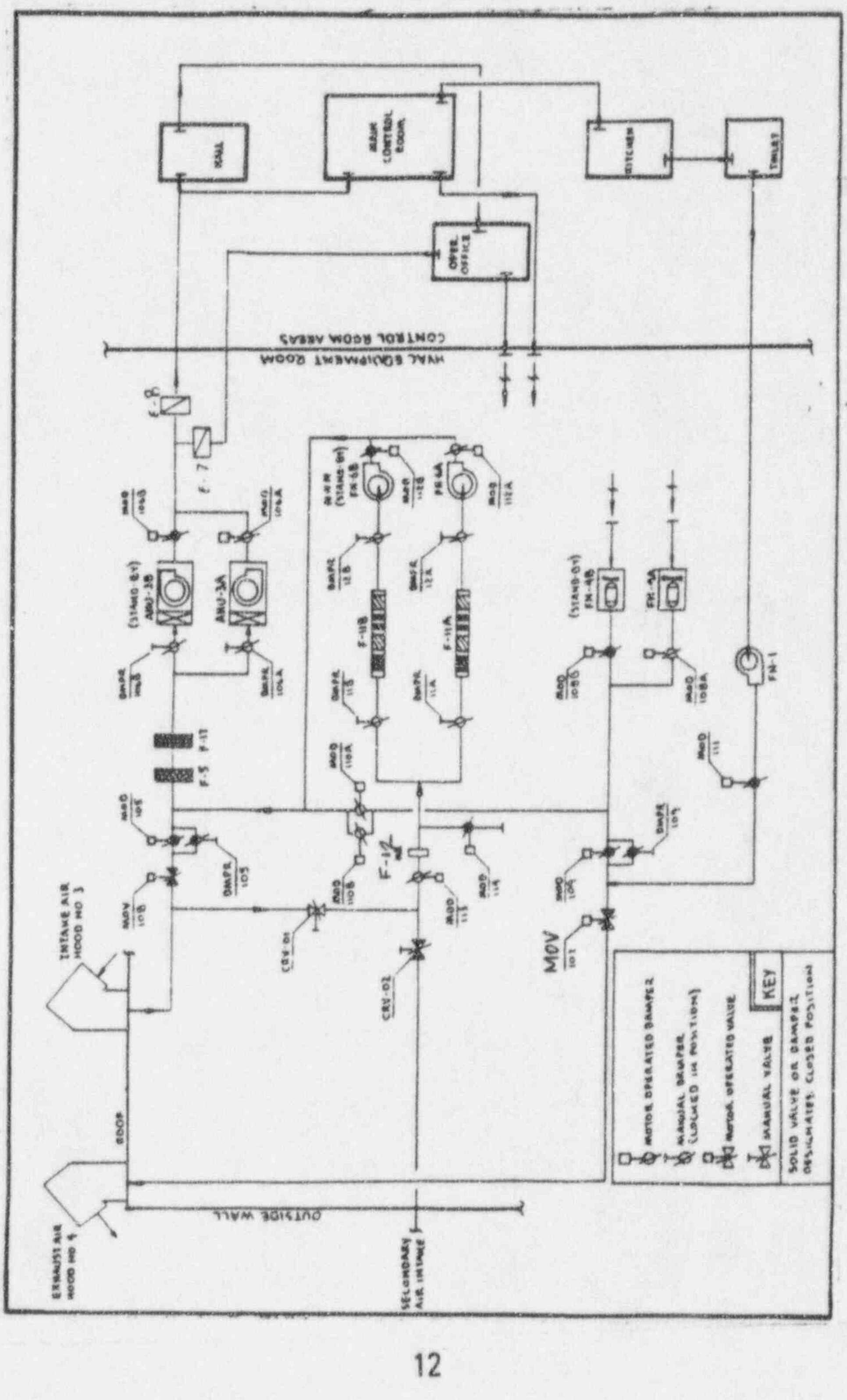


Figure 3
CONTROL ROOM VENTILATION SYSTEM
ISOLATE OPERATING MODE



4.0 Control Room Characteristics

(a) Control Room Air Volume

The Control Room Emergency Zone volume (Figure 7) is calculated as the volume between columns "9" and "12" and "Z" and "G", plus the additional volume of the HVAC equipment room between columns "9" and "10" and "Z" and "T".

This volume includes the Shift Supervisor's Office, Operations Department Office, Toilet/Kitchen Areas and HVAC Equipment Room.

Control Room Volume Z-G/9-12 (less wall thickness):

(Z-G) = 87'-8"   (9-12) = 75'-2"   Ave. Height = 19'-0" (*)

Vol. Z-G/9-12 = (87.67)(75.17)(19.0) = 125,200 cu.ft.

HVAC Equipment Room Volume Z-T/9-10:

(Z-T) = 47'-4"   (9-10) = 26'-0"   Ave. Height = 19'-0" (*)

Vol. Z-T/9-10 = (47.33)(26.0)(19.0) = 23,400 cu.ft.

Total Volume = 125,200 + 23,400 = 148,600 cu.ft.

(*)Due to the slope of the roof, an average height was used.

This represents the gross volume, based on centerline dimensions of column lines, and does not account for the volume of walls and equipment contained within the boundaries described above.

Conclusion

Since the existing Control Room Emergency Zone gross volume is 148,600 cu.ft., CO_2 buildup due to exhalation by occupants would not constitute a problem for six people occupying the area for five days. SRP 6.4, Section III.2, states that sufficient air is available in a 100,000 cu.ft. (isolated) volume to support five persons for at least six days. This would be applicable for six persons for five days and allows for up to 33% of the gross volume to be reduced for the volume of the miscellaneous walls and equipment and still satisfy the 100,000 cu.ft. net volume criteria.

Additionally, the ventilation system has the capability of providing 1,000 $\pm$ 10% cfm of fresh (filtered) makeup air to the Control Room Emergency Zone during

isolate mode operations. This further reduces CO_2 buildup during isolate mode operations.

Based on the Control Room zone volume and the emergency make-up air flow rate, the pressurization rate is approximately 0.4 volume changes per hour.

Testing is performed every eighteen months to assure that the make-up rate capability is within 10% of the design value of 1000 cfm. After modifications to the Control Room that could significantly affect the ventilation system's ability to maintain a positive pressure are installed, tests would be performed to demonstrate that the system is capable of maintaining a pressure of at least 0.125 inch w. g. relative to atmosphere. This satisfies the guidance of Section II.3.b of SRP 6.4.

<u>(b) Control Room Emergency Zone</u>

The Control Room Emergency Zone, shown in Figures 7, 8 and 9, contains the following sub-zones:

Operations Department Office
HVAC Equipment Room
Control Room Volume (which includes):
- Shift Supervisor's Office
- Hall Areas
- Kitchen
- Toilet/Wash Room

These areas are located on the same floor level (el. 300'-0") and are contiguous. During emergency conditions, air is recirculated from all spaces, except the kitchen and toilet, and filtered outside air is provided to maintain a 0.125" w.g. positive Control Room volume pressure.

In the normal mode, air is exhausted from the toilet and kitchen areas to the atmosphere. In the isolate mode, the exhaust fan for these areas is shut off. This decreases the possibility of infiltration into the emergency zone.

The Emergency Plant Information Computer (EPIC) is not located in the Control Room Emergency Zone, but direct access to the computers is not necessary since EPIC display terminals are located in the Control Room. Although information about the condition of the plant should be available to operators on EPIC terminals in the Control Room, their use is not an integral part of the emergency response plan. The EPIC computers themselves are located within the Technical Support Center (TSC) ventilation boundary.

Conclusion

The Control Room Emergency Zone satisfies the criteria of SRP 6.4, Sections II.1 and III.1. The ventilation system for these areas is a dedicated system which is exclusive to the Control Room Emergency Zone.

(c) Control Room Ventilation System Schematics with Normal and Emergency Air Flow Rates

The Control Room Ventilation System schematics are presented in Figures 4 and 5 for normal and isolate modes. System flows are indicated for both modes of operation based on system balancing test results (Ref. 26) .

For normal operation, original design rates with 70DMPR-109 open (Ref. 7), makeup air through 70DMPR-105 was provided at a rate of 1,920 cfm, and the exfiltration leakage rate from the Control Room is 800 cfm, to create a positive pressure within the Control Room boundary. 70DMPR-109 is normally closed and the actual flow rates are shown on Figure 4. Original design rates for emergency operation (Refs. 5 and 7) provided adequate makeup air to maintain the Control Room volume at a positive pressure at least 0.125" w.g. above potentially contaminated surrounding areas. Refer to Section 4(d) for details.

During normal operation of the Control Room Ventilation System, air is recirculated from Control Room Emergency Zone spaces, except from the kitchen and toilet areas, where the air is exhausted directly to the atmosphere (See Figure 4). Makeup air is provided from Intake Air Hood 3 through valve 70MOV-108, and dampers 70MOD-105 and 70DMPR-105.

When outside air temperature is 55°F or less, the normal mode of the Control Room Ventilation System uses outside air to control temperature. During this mode of operation,the outside air intake can be as high as approximately 13,500 cfm.

During an emergency condition, after receipt of a high radiation alarm in the intake duct or general area, the Control Room Ventilation System is manually switched to the isolate mode. The system will operate as discussed in Section 3.

Figure 4
CONTROL ROOM VENTILATION SYSTEM AIR FLOW RATES
NORMAL OPERATING MODE

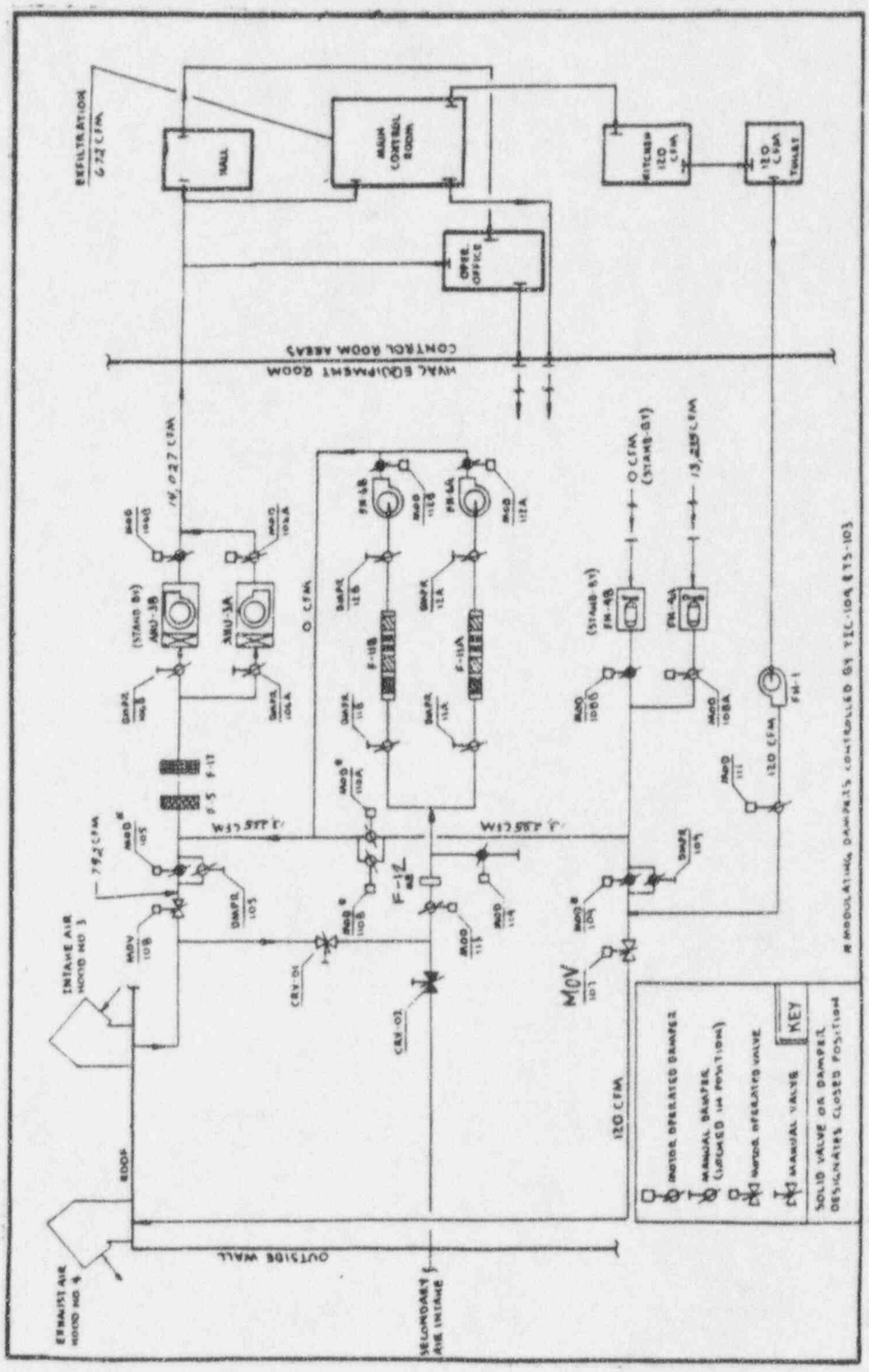
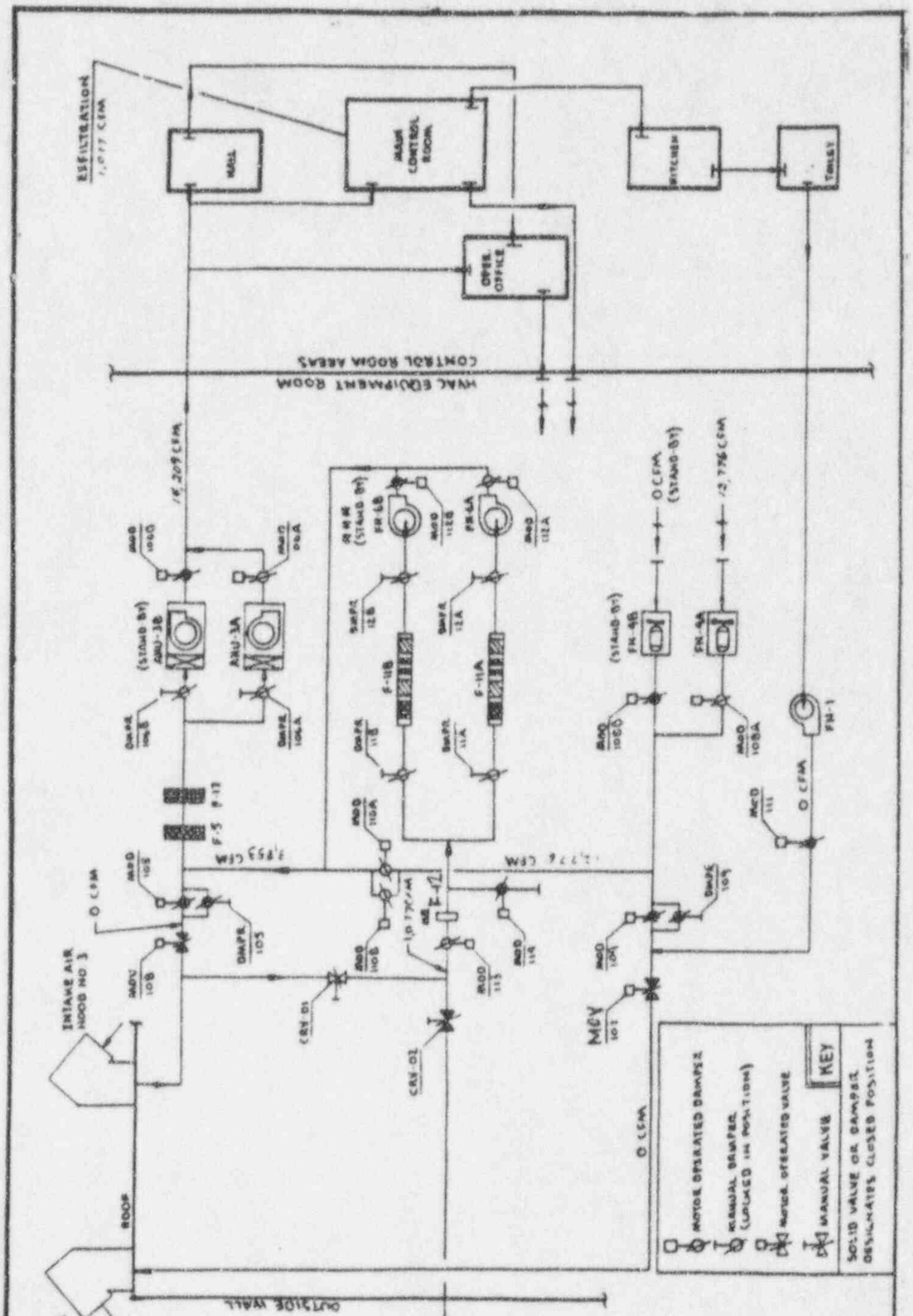


Figure 5
CONTROL ROOM VENTILATION SYSTEM AIR FLOW RATES
ISOLATE OPERATING MODE



(d) Infiltration Leakage Rate

The Control Room Emergency Ventilation System is designed to isolate the Control Room, provide recirculation and cooling, and maintain a positive pressure differential above the surrounding potentially contaminated volumes, using filtered makeup air.

The makeup flow rate to the Control Room is 1,000 $\pm$ 10% cfm in the isolate mode (Ref. 5). In accordance with the guidance of SRP 6.4, Section III.3.d.(3), the makeup flow rate has adequate margin to maintain a positive Control Room pressure with respect to atmosphere. System test data (Ref. 18) verifies the capability of the makeup flow to maintain the pressure above the requirements of SRP 6.4.

NUREG-1433, Section 3.7.4 (Ref. 11), discusses Control Room positive pressure requirements in terms of measurements with respect to "potentially contaminated adjacent areas."

A 0.125" w.g. positive pressure will be maintained with respect to the outside atmosphere and the Turbine Building, since these are the only adjacent areas to the Control Room that could be directly contaminated by a design basis accident. Since the Turbine Building is normally maintained at a slightly negative pressure, Control Room positive pressure is maintained (and measured) with respect to the outside atmosphere. This ensures that Control Room pressure is maintained above adjacent areas.

A single failure analysis of the Control Room Ventilation System was performed (Ref. 10). The worst case single failure was determined to be a postulated failure of the intake air isolation valve (70MOV-108) in the open position (Ref. 8).

For normal operation, original design rates with 70DMPR-109 open (Ref. 7), makeup air through 70DMPR-105 was provided at a rate of 1,920 cfm, and the exfiltration leakage rate from the Control Room is 800 cfm, to create a positive pressure within the Control Room volume. In the isolate mode, the normal makeup path is secured by closing both isolation valve 70MOV-108 and modulating damper 70MOD-105. A normally open bypass damper (70DMPR-105), is provided adjacent to the modulating damper. This damper is manually closed on a high radiation alarm in the Control Room.

Considering the worst case single failure, the potential exists for an unfiltered infiltration leakage rate of 1,920 cfm (the normal system flow, through the bypass damper, Ref. 9) through the manual portion of the damper, if it were not closed. Additionally, infiltration leakage is also anticipated through the closed modulating damper at a rate of 180 cfm (Ref. 9). The leakage through the doors due to

access and egress (10 cfm per SRP 6.4) is negligible in comparison to the leakage through these dampers. This yields a conservative, worst case scenario of 2,100 cfm for unfiltered infiltration leakage.

In addition, recent test data (Ref. 17), taken with the 70MOV-108 valve failed open, showed that based on system balancing, the pressure differential across dampers 70DMPR-105 and 70MOD-105 was such that there was no infiltration, and a Control Room pressure of 0.125" w.g. pressure relative to atmosphere was maintained.

Conclusion

In the isolate mode, the worst case scenario for infiltration leakage rate is based on the single failure of Control Room Ventilation System inlet isolation valve, 70MOV-108, to close. This potentially allows infiltration through the bypass line, which contains a normally open damper, 70DMPR-105. This damper will be manually closed when the system is placed in the isolate mode. Additional infiltration leakage may occur, based on design leakage rate, through the modulating damper, 70MOD-105, which will also be closed in the isolate mode.

The worst case potential unfiltered infiltration rate into the Control Room Emergency Zone was determined to be 2,100 cfm after isolation. This is conservative, since it accounts for a single failure of 70MOV-108 to close and a failure to manually close 70DMPR-105.

(e) High Efficiency Particulate Air (HEPA) and Charcoal Adsorber Efficiencies

HEPA Filters

The HEPA filters are temperature resistant to 250 °F (Ref. 19). Filter efficiency is greater than 99.9% based on DOP test method with 0.3 micron smoke when handling air from 98 to 100% relative humidity (Ref. 19). Cells are 24 x 24 inches by approximately 12 inches thick with an initial clean filter air resistance of not more than 1.0 inch (W.G.) at 275 fpm face velocity (Ref. 19).

Charcoal Adsorber

The carbon bed in each train has the capability to remove a minimum of 99.9% of iodine with 5% in the form of methyl iodide (CH_3I) under entering conditions of 70% relative humidity and 150°F. The carbon bed has a retention time of 0.25 seconds. The initial flow resistance of the carbon bed does not exceed 1 inch w.g. The filter bed is 4 inches thick and consists of a pair of 2 inch filters (Ref. 19).

The radiation dose analysis, presented in Section 9, conservatively assumed a

carbon bed filter efficiency of 90%, based on a 4 inch thick bed and a relative humidity greater than 70% (Ref. 12), since the system does not reduce relative humidity.

Conclusion

The charcoal efficiency will be greater than or equal to 90%. Therefore, 90% can be conservatively used in the radiation dose calculations consistent with NRC Regulatory Guide 1.52 (Ref. 12) guidance. The filters are effective in protecting against iodine releases during a LOCA or other design basis accidents. This satisfies the guidance in Sections II.4 and III.4 of SRP 6.4.

<u>(f) Layout of Control Room, Air Intakes, Containment Building, and Onsite Chemical Storage Facilities</u>

The FitzPatrick Control Room Ventilation System has dual emergency air inlets. A secondary air intake is provided as an alternate source of emergency air to minimize the introduction of contaminated air into the Control Room. The inlets are located on the Administration Building separated by a horizontal distance of approximately 65 feet and are separated by a vertical distance of approximately 14 feet. The primary intake is located at a horizontal distance of approximately 53 feet north of the edge of the Reactor Building (Secondary Containment). The secondary intake is located at a horizontal distance of approximately 58 feet north of the edge of the Reactor Building. This arrangement, and the location of onsite chemical storage facilities, is shown in Figure 6.

Conclusion

FitzPatrick does not take credit for dual emergency air inlets in the post-DBA radiation exposure analysis, since the secondary air intake is not tornado missile protected. Dual air inlets are not required per the 13th AEC Air Cleaning Conference (Ref. 36) for systems that utilize a once through charcoal filter system. Therefore, the air intake design is adequate and the guidance in Section II.5.a of SRP 6.4 is satisfied.

Section 5.0 of this report describes chlorine and other hazardous chemicals stored onsite.

Based on toxic gas analyses described in Section 8, there is no threat to Control Room habitability due to toxic gases. The guidance of Section II.5.b of SRP 6.4 is satisfied.

Figure 6
LAYOUT OF CONTROL ROOM, AIR INTAKES, CONTAINMENT BUILDING AND ONSITE CHEMICAL STORAGE FACILITIES

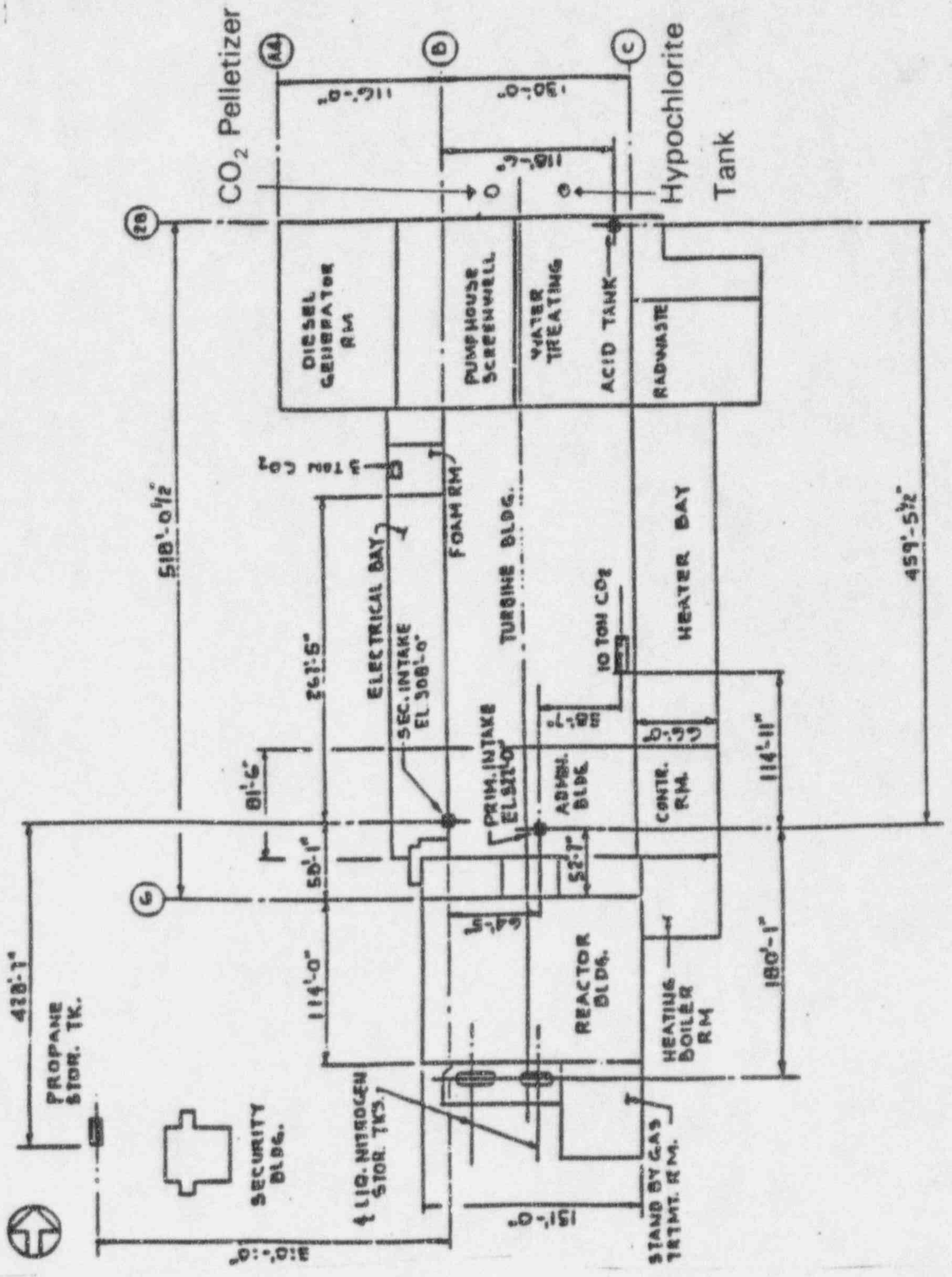


Figure 7
CONTROL ROOM EMERGENCY ZONE BOUNDARY
PLAN EL. 300'-0"

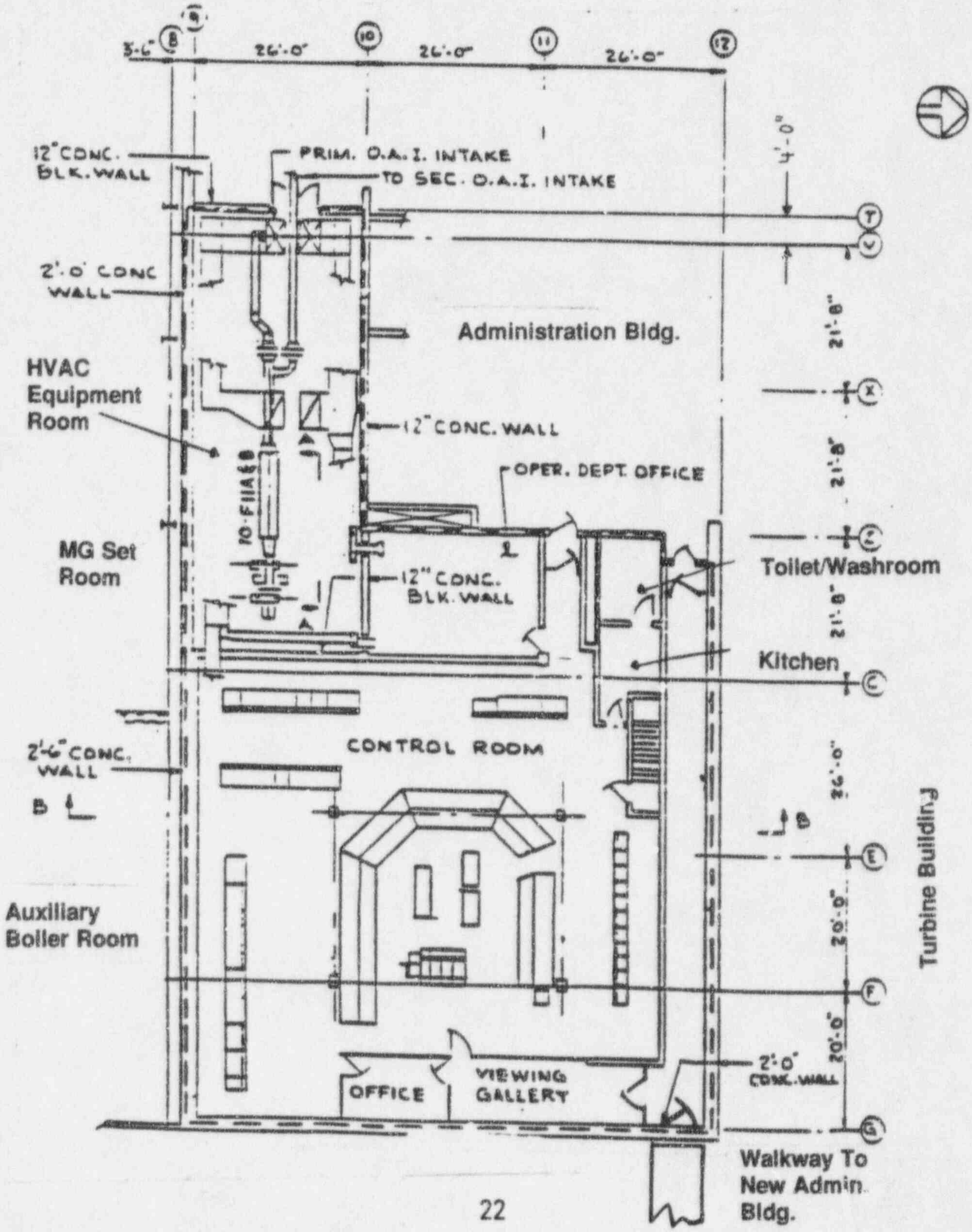


Figure 8
CONTROL ROOM EMERGENCY ZONE - SECTION A-A

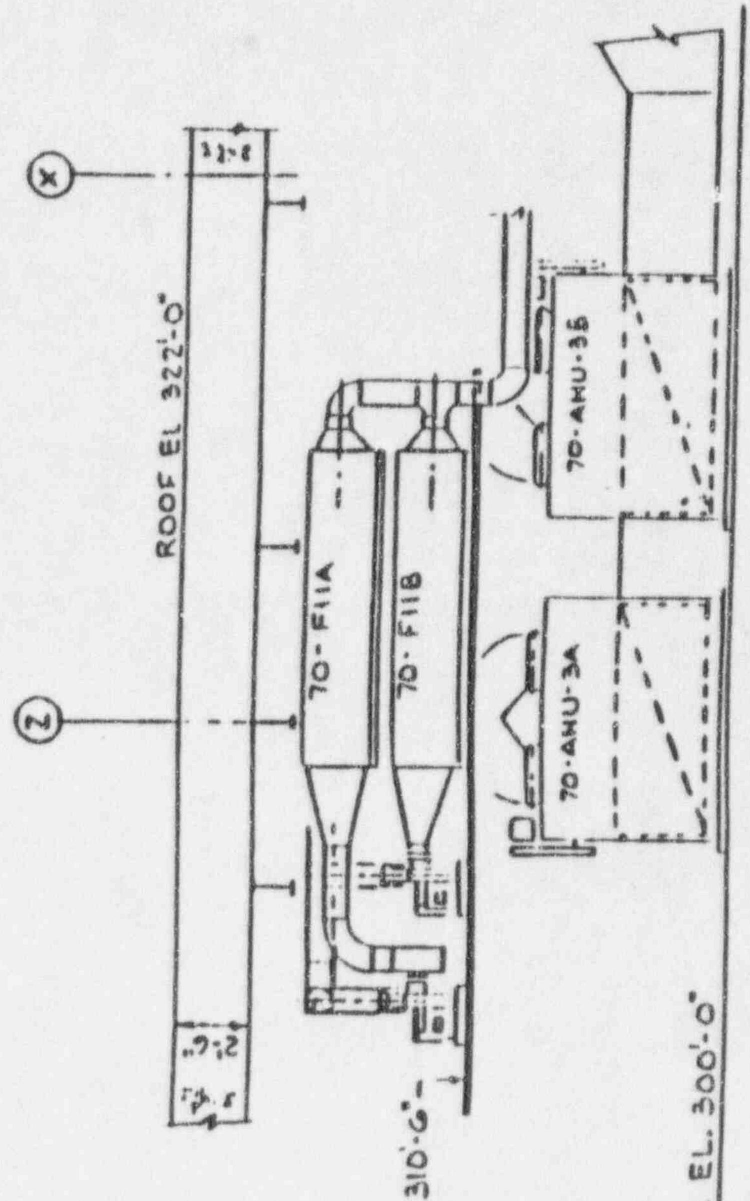
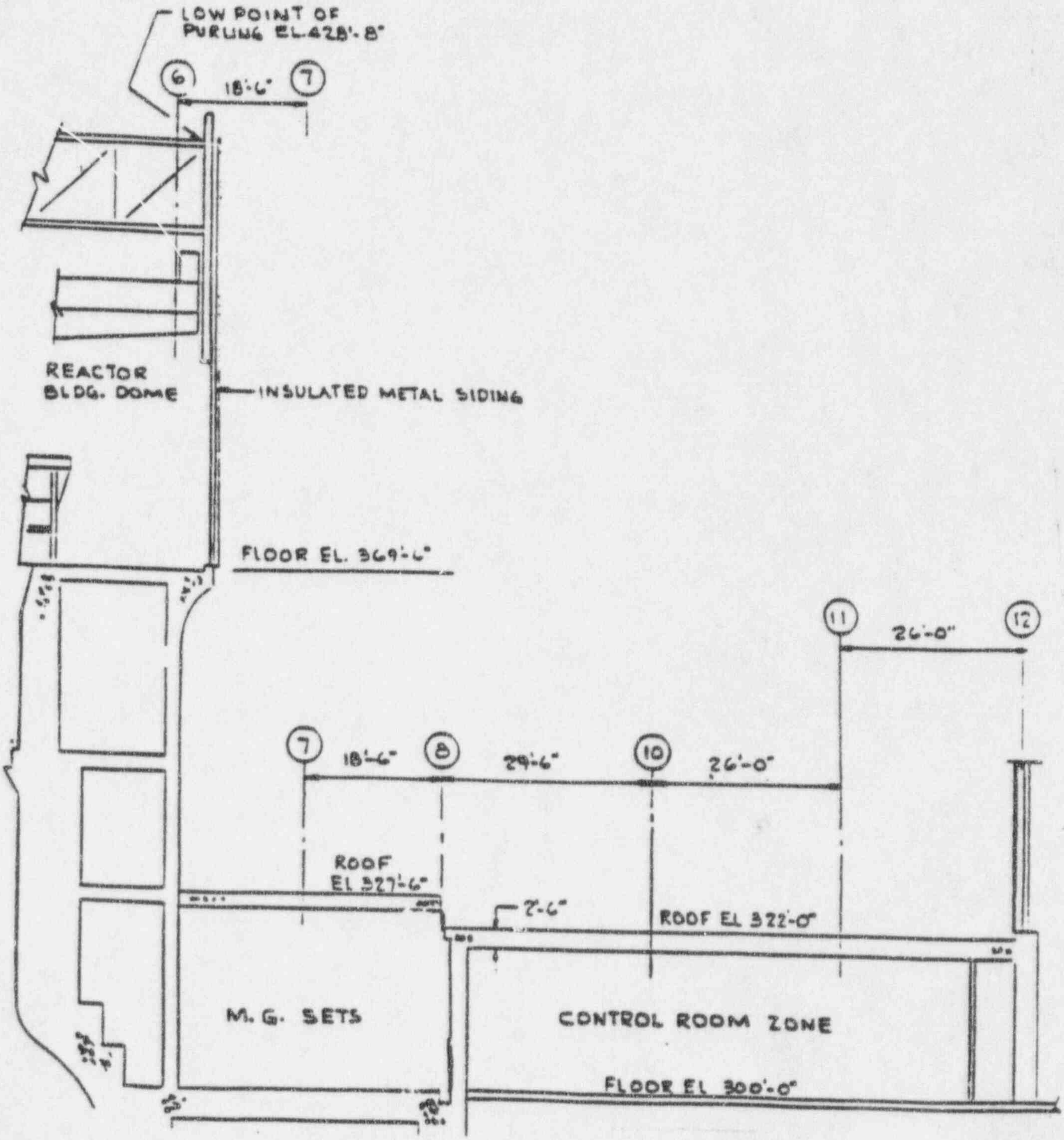


Figure 9
CONTROL ROOM EMERGENCY ZONE - SECTION B-B



Relay Room

(g) Control Room Radiation Shielding

The layout of the Control Room showing the concrete shielding walls, roof slab, location of ducts, wall penetrations and openings is shown in Figures 7, 8 and 9. The dashed line (---) in Figure 7 denotes the pressure boundary.

The South wall of the Control Room is 2.5 feet thick. The South wall of the adjoining HVAC Equipment Room is 2.0 feet thick. The roof over the pressure boundary zone is 2.5 feet thick.

Calculations (Refs. 9 and 31) were performed modelling the Control Room geometry and the effects of dose from surrounding areas was determined. The calculation determined that no significant doses from surrounding areas occurs during a design basis event.

Conclusion

The Control Room shielding is adequate to prevent against any significant doses from the surrounding areas. This satisfies the guidance of Section III.6 of SRP 6.4.

(h) Automatic Isolation Capability and Damper Closing Time

There is no automatic isolation capability for the Control Room emergency ventilation system. The isolate mode of operation requires manual initiation by the operator placing the mode selector switch (43-1CRNV02) in the isolate position, after receipt of a high radiation alarm, from the radiation monitor installed in either the general area or the inlet duct.

Two motor operated valves (intake and exhaust, 70MOV-108 and 70MOV-107, respectively) close to isolate the Control Room Emergency Zone from outside air. The isolation dampers on the primary and secondary emergency outside air intakes (70CRV-01 and 70CRV-02) are manual valves; one is normally open to allow flow to the emergency makeup filters. The other is normally closed. These dampers provide the operator with the ability to select a source of outside air.

Inlet isolation bypass damper 70DMPR-105, which is normally open, will be manually closed. Outlet isolation bypass damper 70DMPR-109 is maintained closed under administrative controls.

The radiation dose calculations assume 30 minute operator action to initiate the isolate mode to close these valves. Damper closing time was not considered in the calculations because the time required to close the dampers is short compared to the operator action time and would not significantly affect the results of the calculation. A worst case single failure of 70MOV-108 in the open position, and

no operator action to manually close 70DMPR-105 was also assumed in the analysis (Ref. 9).

The Control Room Intake Radiation Monitor is not safety-related since it does not provide a safety-related function as defined in 10 CFR 50.49 (b)(1) since the Control Room is not automatically isolated (Reference 42). The radiation monitor provides the control room operator with radiation level indication of supply air coming into the control room; operators manually isolate the Control Room Ventilation System. Other indicators, such as area radiation monitors, are available to alert operators of a release of radiation.

Valve Leakage

The intake dampers (70MOD-105 and 70DMPR-105) have a combined design leak rate of approximately 225 cfm. The exhaust dampers (70MOD-109 and 70DMPR-109) have a combined design leak rate of approximately 132 cfm. These leak rates are based on pre-installation tests conducted by the vendor at a pressure of 4 inch w.g.

Credit is not taken for these dampers to prevent inleakage. The system has been balanced so that a positive pressure exists inboard of the MODs, with either the supply or exhaust MOVs failed in the open position. This satisfies the guidance of Section II.2.a of SRP 6.4.

Leakage past 70MOV-107 was 0.21 cfm, and 70MOV-108 was 0.81 cfm. Recent tests were performed on the motor operated valves after extensive maintenance.

Conclusion

When the mode selector switch is placed in the isolate mode, inlet and outlet dampers 70MOD-105 and 70MOD-109 respectively, close. However, bypass damper 70DMPR-105 remains open. At design conditions when open, 70DMPR-105 passes 1,920 cfm and 70DMPR-109 passes 1,000 cfm. When closed, 70MOD-105 and 70MOD-109 have a design leakage rate of 15 scfm/ft^2.

The habitability analysis assumes the Control Room is manually placed in the isolate mode 30 minutes after an accident and 70MOV-108 fails to close. This bounds all potential leakage past the valves and the time it takes for the valves to close.

The motor operated valves (70MOV-107 and 70MOV-108), which are powered from redundant AC buses, fail in the "as-is" position on a loss of power. The motor operated dampers (70MOD-105 and 70MOD-109) fail closed on loss of power.

The Control Room radiation dose calculation, discussed in Section 9, showed that manual isolation in 30 minutes, with a single failure of 70MOV-108 in the open position and accounting for unfiltered flow past bypass damper 70DMPR-105 and leakage through closed damper 70MOD-105, was acceptable.

The current manual isolation arrangement is acceptable because the doses are within GDC 19 guidelines considering a failure to manually close the normally open bypass damper 70DMPR-105, and postulating a worst case single failure.

(i) Chlorine or Toxic Gas Detectors

No chlorine or toxic gas detectors are currently installed at FitzPatrick.

(j) Self-Contained Breathing Apparatus (SCBA) Availability

There are currently eight self-contained breathing apparatus, each containing a one-half hour capacity, and four spare bottles located in the Control Room (Ref. 6 and 13). SCBAs are provided to protect operators against the potential affects of smoke inhalation. The Emergency Plan Procedures have been revised to require that periodic checks be conducted to ensure proper quantity of SCBAs are in place in the Control Room at all times.

Based on the analyses summarized in Section 8, there are no toxic gas hazards, and protective clothing need not be stored in the Control Room.

Conclusion

Adequate quantity of self-contained breathing apparatus (SCBAs) are available in the Control Room to assure immediate availability to six Control Room personnel. Eight SCBAs provide one extra SCBA for every three required to meet the single failure criterion. This arrangement does not need to satisfy the seismic or single failure requirements of Regulatory Guides 1.78 and 1.95 for air supply apparatus because, based on the analysis summarized in Section 8, there currently is no chlorine or toxic gases stored in the vicinity of the plant that could incapacitate the control room operators.

(k) Bottled Air Supply

Five air cylinders of 330 cu. ft /cylinder capacity and five face masks with air lines are located in the Control Room, in the Operations Area. These cylinders provide a total volume of 1650 cu. ft. and are tied together by two independent manifolds, with the first manifold connecting two of the cylinders and the second manifold connecting the other three cylinders.

Per Regulatory Guide 1.3, a breathing rate per person was assumed to be 3.47E-4 m^3/sec, which is equivalent to 1.25 m^3/hr or approximately 44 cu. ft./hr. At this rate, the five cylinders can provide up to 6.25 hours of air for six persons. SRP 6.4, Rev. 2, Section II.7, states a six hour onsite bottled air supply should be available with unlimited offsite replenishment capability. Offsite replenishment capability for the air cylinders is provided by the Oswego Fire Department.

Conclusion

There currently exist sufficient quantities of air cylinders and face masks/air lines to provide one mask for five persons in the Control Room. The current availability of five 330 cu. ft. cylinders arranged together by manifolds provides sufficient air to satisfy the six hour requirement for six people. The manifold arrangement does not need to satisfy the seismic or single failure requirements of Regulatory Guides 1.78 and 1.95 for air supply apparatus because, based on the analyses summarized in Section 8, there currently is no chlorine or toxic gases stored in the vicinity of the plant that could incapacitate the control room operators.

Emergency Plan Procedures require that periodic checks be conducted to ensure proper quantity of air cylinders and face masks/air lines are in place in the Control Room.

(l) Emergency Food and Potable Water Supply

Dry food supplies are stored in a locker with controlled access, to be used for emergency conditions (See Ref. 13). Sufficient supplies are stored year-round to maintain at least six persons for five days in an emergency situation.

Seven 5-gallon bottled water containers are stored in a locker with controlled access, in the new operators' kitchen, to be used for emergency conditions (Refs. 6 and 13). This quantity is sufficient to maintain at least six persons for five days in an emergency situation. This quantity would provide for a minimum of one container per person (one gallon per day) with one extra container provided.

Conclusion

Adequate quantity of emergency food and water supply is stored within the Technical Support Center to sustain six personnel for a minimum of five days.

(m) Normal and Emergency Control Room Personnel Capacity

A minimum of four to eight individuals are required to be on-shift at all times. Minimum shift manning requirements are detailed in Table 6.2-1 of FitzPatrick's Technical Specifications, "Minimum Shift Manning Requirements." During start-up,

shutdown and run modes, Technical Specifications require a minimum of eight individuals on-shift, with one Reactor Operator (RO) and one Senior Reactor Operator (SRO), in the Control Room. During refueling and cold conditions, four individuals are required on-shift with one RO in the Control Room. The Shift Technical Advisor's (STA) position may be combined with one of the SRO positions.

In the event of an emergency, non-essential personnel will be evacuated from the site. The number of personnel permitted into the Control Room is limited to those that require access. This policy will remain in-effect in the event of an accident. Emergency support personnel are assigned to either the Technical Support Center (TSC) or the Emergency Offsite Facility (EOF).

Sufficient supplies of food, water, and air are available in the Control Room to maintain six persons for five days under emergency conditions. Fewer personnel may be on-shift if an SRO is used as an STA.

Conclusion

The Control Room capacity is adequate to maintain a staff of six persons for five days in an emergency condition.

(n) Potassium Iodide Drug Supply

No supplies of potassium iodide are maintained within the Control Room. The thyroid dose due to iodine, as described in Section 9 of this report, does not warrant the use of potassium iodide.

5.0 Onsite Storage of Chlorine and Other Hazardous Materials

This information is provided to satisfy the guidance in Section III.5.c of SRP 6.4.

(a) Total amount and Size of Containers

Table 1 summarizes the onsite storage of hazardous chemicals and their associated quantities.

(b) Closest Distance From Control Room Air Intake

Table 1 summarizes the onsite storage of hazardous chemicals and their distance from the Control Room. Figure 6 shows their onsite location.

Carbon Dioxide Intrusion During Relay Room Fire Protection Discharge Test

During a discharge test of the Relay Room's CO_2 fire protection system, CO_2 leaked from the Relay Room into the Control Room resulting in higher than anticipated CO_2 levels in the Control Room. The Relay Room CO_2 system is currently inoperable but "available" until modifications can be completed and a satisfactory test conducted. Procedures currently require operators to don breathing apparatus or SCBAs should it be necessary to actuate the system. After the installation of the modification, the Authority will return the Relay Room CO_2 fire suppression system to operable status.

Modifications to the CO_2 system and a test to confirm the adequacy of the modifications are scheduled for the current refueling outage. The habitability of the Control Room will be assured during and following an actuation of the system by the use of breathing air masks or SCBAs, if required.

6.0 Offsite Manufacturing, Storage, or Transportation of Hazardous Chemicals

This information is provided to satisfy the guidance in Section III.5.b of SRP 6.4.

(a) Facilities Within a Five Mile Radius

The facilities storing or manufacturing hazardous materials within a 5 mile radius of the FitzPatrick plant are listed in Table 2. The information in this table is the best available, based on information provided by the local emergency preparedness committee and other sources. Quantities below 100 pounds are not included on Table 2. The list of hazardous materials in Table 2 was reviewed to identify materials with the potential to form a toxic vapor cloud and reach the FitzPatrick Control Room outside air intake in the event of a catastrophic failure of a chemical storage container. Table 2 identifies those materials for which a dispersion analysis was performed in Section 8, or the reasons for eliminating those materials which were not considered a potential hazard to Control Room habitability.

(b) Distance From Control Room

Table 2 lists the distances to the facilities identified in Section 6(a) and Figure 10 shows their locations with respect to the FitzPatrick plant.

(c) Quantity of Hazardous Chemical in One Container

Offsite storage of hazardous materials is presented in Table 2. The quantity stored in one container was conservatively assumed to be equal to the total quantity. Hazardous chemical storage is typically reported in terms of ranges, for example, 0-99 pounds, 100-999 pounds, etc. The quantity listed in the table represents the maximum value reported in each range. These maximum quantities were used in the screening analysis, for those cases where materials were eliminated as potential hazards due to their quantity, distance, and toxicity in accordance with Regulatory Guide 1.78 Table C-2 (Ref. 44). Actual storage container capacities are given in Table 3 for those chemicals analyzed in Section 8.0.

(d) Frequency of Hazardous Chemical Transportation Traffic

The U. S. Coast Guard Marine Safety Office, the New York State Police, the New York State Department of Transportation, and Conrail were contacted to identify hazardous materials transported within a five mile radius of the plant.

The shipping lane nearest the plant is approximately seven miles away, and primarily serves vessels traveling to and from the port of Oswego. The Port of Oswego is the main shipping port in the area and is approximately nine miles southwest of the plant. According to the U. S. Coast Guard (Ref. 33), hazardous

chemicals are not routinely handled there. Potash and urea, which are used in fertilizers, are routinely handled at the port.

The New York State Department of Transportation (Ref. 34) reports that routine shipments of hazardous materials must use interstate highways. Therefore, the only shipments on NY Route 104 or other roads in the vicinity of the plant would be those traveling to or from the location where the material will be stored. The frequency and quantity of transported hazardous material will be evaluated as part of Section 8.0. Table 3 identifies the truck capacities and shipping frequency for those materials analyzed in Section 8.0.

The Owsego Local Emergency Planning Committee contacted Conrail on behalf of the Authority. Conrail reported that no hazardous materials are transported within a five mile radius of FitzPatrick (Ref. 35).

Table 1
Onsite Storage of Chlorine and Other Hazardous Chemicals (Note 1)

Toxic Chemical	Location	Distance from Control Room Outside Air Intake feet (meters)	Quantity
Liquid Nitrogen	Outside Reactor Building	180 (54)	10,000 gal (Note 2)
Carbon Dioxide	Turbine Building	129 (39)	20,000 lbs
	Turbine Building	313 (95)	6,000 lbs
	Radwaste Building	465 (141)	28,000 lbs
Propane	Outside Security Building	565 (172)	1,000 gal

Notes for Table 1:

(1) Other hazardous chemicals stored in quantity onsite, which are not considered a threat to Control Room habitability are:

•	Sodium Hydroxide	5,000 gal tank in the Water Treatment Building, in the process of being decommissioned and empty except for residue.
•	Sulfuric Acid	5,000 gal tank in the Water Treatment Building, in the process of being decommissioned and empty except for residue.
•	Diesel Fuel	Low volatility liquid.
•	Gasoline	Stored underground.
•	Sodium Hypochlorite	No chlorine is stored onsite. Water treatment facilities use sodium hypochlorite which is not considered a chlorine hazard. (See Reference 39, SRP 6.4, Rev. 2, Section IV, "Evaluation Findings.")
•	Hydrogen	Hydrogen is a simple asphyxiant, and is much lighter than air

(2) Stored in two 5,000 gallon containers

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Nine Mile Point Nuclear Station Co. Rt. 1A Lake Road Scriba, NY 13093	Betz DTS	2	99,999	.945
	Carbon Dioxide	3	99,999	.945
	Clam-Trol CT-1	2	99,999	.945
	Copper-Trol CU-1	2	99,999	.945
	Ethylene Glycol	2	99,999	.945
	Fuel Oil #2	2	9,999,999	.945
	Gasoline	5, 6	99,999	.945
	Hydrogen	3	99,999	.945
	Nitrogen	3	999,999	.945
	Paints	2	99,999	.945
	Sodium Hydroxide	2	99,999	.945
	Sodium Hypochlorite	2	99,999	.945
	Sulfuric Acid	Analyzed	999,999	.945

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Pori International Inc. Alcan Aluminum Plant PO Box 5114 Lake Road North Oswego, NY 13126	Calcium Diatomaceous Earth	1	9,999	3.625
	Filter Aid	1	9,999	3.625
	Calcium Hydroxide	1	99,999	3.625
	Filter Cake	1	99,999	3.625
	Reclaimed Fuel Oil	2	99,999	3.625
Pori International Inc. Alcan Aluminum Plant PO Box 5114 Lake Road North Oswego, NY 13126	Sulfuric Acid	Analyzed	99,999	3.625
	Waste Oil	2	99,999	3.625
Scriba Mini Mart Box 60, 104 East Oswego, NY 13126	Gasoline - Unleaded	5	99,999	4.126
	Gasoline - Unleaded Mid-grade	5	9,999	4.126
	Kerosene	2, 5	999	4.126

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air intake (miles)
Oswego Wire, Inc. Rt. 1 North Drive One Wire Drive Oswego, NY 13126	1,1,1 Trichloroethane	5	999	4.657
	Acetone	5	999	4.657
	Ammonium Chloride	1	9,999	4.657
	Xylene	5	999	4.657
	Beryllium	1	999	4.657
	Cadmium	1	999	4.657
	Chromium	1	999	4.657
	Copolymer of Sodium Acrylate and Acrylamide	1	999	4.657
	Copper	1	999,999	4.657
	Copperweld	1	999,999	4.657
	Fluoboric Acid	5	9,999	4.657

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Oswego Wire, Inc. Rt. 1 North Drive One Wire Drive Oswego, NY 13126	Hydrochloric Acid	5	999	4.657
	Lead	1	999	4.657
	Lead Fluoborate	1	999	4.657
	Methanol (4%)	4	999	4.657
	Nickel	1	999	4.657
	Nitrogen	3	99,999	4.657
	Sodium Hydroxide	1 or 2	9,999	4.657
	Sulfuric Acid	Analyzed	9,999	4.657
	Toluene	5	999	4.657
	Wastewater treatment sludge from electroplating operations	2	9,999	4.657

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Alcan Rolled Products Company PO Box 28 Lake Road North Oswego, NY 13126	A-103 Salt Flux	1	999,999	3.640
	AEP-5 Amcor Salt Flux	1	99,999	3.640
	Acetylene	3	999,999	3.640
	Alcor Plastic	1	99,999	3.640
	Alfol 14 Alcohol	1, 2	99,999	3.640
	Alfol 1416 Alcohol	1, 2	99,999	3.640
	Alugard 70 Castable	1	99,999	3.640

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Alcan Rolled Products Company PO Box 28 Lake Road North Oswego, NY 13126	Aluminum - 1000 Series	1	9,999,999	3.640
	Aluminum - 2000 Series	1	999,999	3.640
	Aluminum - 3000 Series	1	9,999,999	3.640
	Aluminum - 4000 Series	1	999,999	3.640
	Aluminum - 5000 Series	1	9,999,999	3.640
	Aluminum - 6000 Series	1	999,999	3.640
	Aluminum - 7000 Series	1	9,999,999	3.640
	Aluminum - 8000 Series	1	999,999	3.640
	Aluminum Chrome Master Alloy	1	99,999	3.640
	Aluminum Dross	1	999,999	3.640
	Aluminum Scrap	1	99,999,999	3.640
	Aluminum Scrap - UBC	1	9,999,999	3.640
	Argon	3	99,999	3.640
	Argon (75%) Carbon Dioxide (25%)	3	99,999	3.640
	Automatic Floor Scrub 170	2	99,999	3.640
	B-207-1B Aluminum Hot Rolling Oil	2	99,999	3.640
	B-216-AC1	2	99,999	3.640

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Alcan Rolled Products Company PO Box 28 Lake Road North Oswego, NY 13126	B-216-AC1-10	2	99,999	3.640
	Bone Ash	1	99,999	3.640
	CE 1295	4	99,999	3.640
	Carbon Dioxide	3	999,999	3.640
	Carbon/Graphite Grades	1	99,999	3.640
	Caustic Soda 50% Rayon Grade	2	99,999	3.640
	Celite	1	99,999	3.640
	Chlorine	Analyzed, 7	99,999	3.640
	DV-38	1	99,999	3.640
	Daralube 545AB	2	99,999	3.640
	Dearborn 150	2	99,999	3.640
	Drewsperse 739 Antifoulant	2	99,999	3.640
	Endcor 4682	2	99,999	3.640
	Epal 1416 Alcohol	1, 2	99,999	3.640
	Franco Lite 21 Light Weight	1	99,999	3.640
	Fuel Oil #2	2	999,999	3.640
	Gasoline	5	99,999	3.640

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Alcan Rolled Products Company PO Box 28 Lake Road North Oswego, NY 13126	Graphite Fluxing Tube @ PO4 Oxid Ret.	1	99,999	3.640
	Greenpak 83-MP	1	999,999	3.640
	Hot Mill Waste Oil	2	9,999,999	3.640
	Iron-Aluminum Addition Agent	1	99,999	3.640
	Kensol 50 & 50T	2, 8	999,999	3.640
	Kensol 51	2, 8	999,999	3.640
	LTC LT-33 DC Aluminum Casting Lube	2	99,999	3.640
	Magnesium	1	999,999	3.640
	Manganese	1	99,999	3.640
	Mizzou Castable	1	99,999	3.640
	Mobil Hydraulic Oil AW 46	2	999,999	3.640
	Mobil NS 150	2	99,999	3.640
	Mobil NS 46	2	99,999	3.640
	Mobil Vacuoline 148	2	99,999	3.640
	Mobilgear 634	2	99,999	3.640
	Nalco 6461 Liquid	2	999,999	3.640
	Nalco A6468AB Liquid	2	99,999	3.640

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Alcan Rolled Products Company PO Box 28 Lake Road North Oswego, NY 13126	Nitrogen	3	999,999	3.640
	Norpar 15	2, 8	999,999	3.640
	Nutmeg NCC	5	99,999	3.640
	Nyad and Nycor Wollastonite	1	99,999	3.640
	Oleic Acid	2	99,999	3.640
	Oxygen	4	99,999	3.640
	Perlite	1	99,999	3.640
	Propane	3	999,999	3.640
	Quintolubric 822-220	2	99,999	3.640
	Reclaimed Fuel Oil - Alcan	2	999,999	3.640
	Silicon Metal	1	99,999	3.640
	Sodium Chloride	1	99,999	3.640
	Tap Hole Cones	1	99,999	3.640
	Tibor	1	99,999	3.640
	Tool and Trough Coating	1	99,999	3.640
	Tribol 1100 Gear Oils	2	99,999	3.640
	Tribol E1440 Fire Resistant Hydraulic Fluids	2	99,999	3.640

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Location	Name of Hazardous Chemical	Analyzed or Eliminated (See Note)	1994 Reported Quantity (EPCRA Tier II) (lbs)	Distance from Control Room Air Intake (miles)
Alcan Rolled Products Company PO Box 28 Lake Road North Oswego, NY 13126	United Bearing Oil #2500 Special	2	99,999	3.640
	United Bearing Oil #3000	2	99,999	3.640
	United Hydraulic Oil #225	2	99,999	3.640
	VSL-35	1	99,999	3.640
	Waste Rolling Oil	2	999,999	3.640
	Zendox 21	1, 8	99,999	3.640
	Zinc	1	99,999	3.640
Sithe/Independence Station Lake Road North Scriba, New York 13126 (Note 9)	Carbon Dioxide	3	99,999	2.75
	Sulfuric Acid	Analyzed	99,999	2.75
	Sodium Hydroxide	1 or 2	999,999	2.75
	Sodium Hypocholrite	2	99,999	2.75
	Aqueous Ammonia (30%)	Analyzed	999,999	2.75
	Nalco 35	2	99,999	2.75
	Nalco 7208	2	99,999	2.75
	Nalco 8300	2	99,999	2.75
	Fuel Oil #2	2	9,999,999	2.75

TABLE 2

Offsite Storage of Hazardous Chemicals Within Five Miles of the FitzPatrick Control Room Intake

Notes for Table 2

Reasons for elimination from consideration as a FitzPatrick Control Room habitability hazard.

1. Solid

2. Low volatility liquid or liquid slurry

3. Simple asphyxiant stored off site

4. Vapor not a toxic inhalation hazard

5. Regulatory Guide 1.78 Table C-2 exclusion based on quantity stored, distance, and toxicity

6. Gasoline at Nine Mile Point is stored in a single 2,000 gallon underground storage tank

7. The maximum chlorine tank size at ALCAN is a one-ton (2,000 lb) cylinder

8. No longer used by ALCAN

9. The chemical species and quantities listed for the Sithe Independence Station were not on the Tier II report to the LEPC, since the plant has not been operating for one year.

7.0 Technical Specifications

(a) Chlorine Detection System

No chlorine detection system exists at the FitzPatrick site. No chlorine hazard exists at the FitzPatrick site; See the hazardous material analyses in Section 8. Therefore, detectors are not addressed in the Technical Specification.

(b) Control Room Filtration System

LCOs, AOTs and SRs for the Control Room Ventilation System are contained in Technical Specifications Section 3.11.A "Main Control Room Ventilation."

Two amendments (114 and 129) were requested by the Authority and approved by the NRC. These amendments added a periodic surveillance test and a new LCO to make these specifications consistent with the Standard Technical Specification (STS). With the issuance of these two amendments, FitzPatrick's Technical Specifications satisfy the guidance of NUREG-0737, Item III.D.3.4 and NRC Generic Letter 83-36 (Ref. 22) for Control Room Ventilation System. No new requirements need be proposed.

Pressurization Tests

The FitzPatrick Technical Specifications do not require periodic test of the system's capability to pressurize the Control Room volume to 0.125" w.g., but do require that tests be conducted once every 18 months to assure that system capacity is within 10% of its design value of 1,000 cfm. (See Technical Specification Section 4.11.A.4, Page 238.)

Verification of Isolation

The FitzPatrick Technical Specifications do not require periodic surveillance tests to verify Control Room isolation by test signals. Such tests are unnecessary because the system is manually isolated. Tests are performed quarterly to confirm Control Room isolation in accordance with Technical Specification surveillance requirements 4.11.A.1, "Main Control Rocm Ventilation."

Damper Closure Times

The FitzPatrick Technical Specifications do not require periodic surveillance tests to verify damper closure times. Such tests are unnecessary because damper closure time is not critical. Radiological dose calculations assume that the Control Room is not placed in the isolate mode until 30 minutes after the start of the accident. In addition, the system is manually isolated and there is no automatic isolation

circuitry.

Filter Testing Requirements

HEPA filter and charcoal adsorber surveillance tests are conducted once every six months in accordance with Technical Specification 4.11.A.1, Page 237. The Authority erroneously stated on page 16 of the prior response to III.D.3.4 (Reference 20) that the HEPA and charcoal adsorbers were maintained and operated in accordance with Regulatory Guide 1.52.

Amendment 114

The Authority committed to prepare and submit changes to the FitzPatrick Technical Specifications in the 1981 Control Room evaluation report. These changes added a requirement to test the Control Room Ventilation System to verify its flow rate once every eighteen months (Ref. 29).

In response to NRC staff questions on these changes, the Authority prepared and submitted a report which compared FitzPatrick's Technical Specifications with the STS (Ref. 28). That report concluded that the existing LCOs, AOTs, and SRs for FitzPatrick's Control Room Ventilation System are different from the corresponding portions of the STS. The report also concluded that these differences do not result in a lower level of safety than that provided by the STS.

Based on this information, the NRC staff issued Amendment 114 to the FitzPatrick Technical Specifications requiring the Authority to add the flow rate surveillance test to the Technical Specifications. In the Amendment 114 transmittal letter, the staff asked the Authority to submit additional changes adopting the STS LCO for Emergency Control Room Ventilation Systems.

Amendment 129

The Authority submitted a second Technical Specification amendment request on May 16, 1989 adding an AOT of 14 days with one emergency filter train out-of-service and a three day LCO with both filter trains out of service. (Before this change became effective, plant operation could continue for seven days with both filter trains out of service.) The NRC staff subsequently issued this change as Amendment 129 on May 31,1989.

8.0 Hazardous Materials Analyses

This Section evaluates the habitability of the FitzPatrick Control Room following a postulated onsite and offsite accidental release of toxic chemicals. Release scenarios considered are the catastrophic rupture of storage tanks or transport containers. The chemical releases analyzed were identified in Section 6 by a screening analysis of all chemicals reported to the Oswego county local emergency planning commission on the Emergency Planning and Community Right to Know Act (EPCRA). Information regarding substances stored at Sithe Indenpendence Station were obtained by telephone with Sithe personnel.

The analytical techniques used to evaluate Control Room habitability are taken from guidance provided in NRC Regulatory Guide 1.78 (Ref. 44) and in NRC NUREG-0570 (Ref. 45). The toxic chemical releases were analyzed using Stone & Webster computer program "VAPOR", EN-199, Version 02 Level 01 (Ref. 46) which implements the methodology of NUREG-0570 complimented by the assumptions of Reg. Guide 1.78.

The evaluation was based on the following assumptions:

1. The entire contents of the storage tanks are assumed to be released instantaneously for catastrophic releases.

2. If delivery frequency was approximately 10 times a year or greater, and the delivery truck capacity was larger than the storage tank size, the postulated release was based on the catastrophic failure of the delivery truck. This consideration was applied to both the onsite carbon dioxide and liquid nitrogen analyses, as well as the aqueous ammonia analysis at the Sithe/Independence Station.

3. Spills that can form pools are assumed to spread to a uniform depth of 1 cm as recommended in NUREG-0570 regardless of any containment curbs.

4. For the purposes of this analysis, it is assumed that the wind blows directly from the release towards the Control Room fresh air intake.

5. It was assumed that the fresh air intake is located at the same elevation as the release (ground level) with the exception of carbon dioxide, propane, and aqueous ammonia releases. Carbon dioxide and propane, which are much heavier than air, are assumed to remain at ground level, underneath the elevated Control Room fresh air intake. For the analysis of the aqueous ammonia, since ammonia (which is the toxic matierial released to the air from the spill) is lighter than air, the guidance of NUREG-0570 is followed, and the release elevation is taken to be the same as the elevated air intake

elevation.

6. The worst-case impact on Control Room habitability was conservatively determined using a wind speed of 0.5 m/sec.

7. Except for onsite carbon dioxide and propane analysis, the analyses assumed an F stability class. For the onsite carbon dioxide and propane analyses, all other stability classes were also evaluated, and unstable stability classes A and C respectively, for carbon dioxide and propane, were used to maximize the concentration at the elevated intake.

8. An outside ambient temperature of 55°F was assumed for evaporation calculations in the VAPOR program. This value was chosen to maximize the potential outside air intake for normal mode operation. As stated in Section 4(c), the maximum flow rate under these conditions is 13,500 cfm, however, for conservatism 15,000 cfm was used in the analysis. The analysis presented in the August 1981 report assumed an outside ambient temperature of 90°F to maximize evaporation rate of spilled liquids, combined with the design air intake rate of 1,920 cfm (Ref. 52).

The results of the dispersion analysis are presented in Table 3, and transient concentration profiles inside and outside of the Control Room are presented in Figures 11 through 15 (the results for the sulfuric acid release cases were not plotted).

Nitrogen and propane are not toxic, and are treated as simple asphyxiants, with the "toxic" limit based on reduction of the oxygen concentration in the Control Room below 16% by volume.

The results for the onsite carbon dioxide and propane take into account the actual height of the control room air intake above grade since these vapors are much heavier than air and the distance to the control room air intake is short. Due to a higher molecular weight (1.5 times greater than air) and much colder temperatures upon release (boiling points of -78.5 C and -42.2 C), carbon dioxide and propane gas will be approximately 2 to 2.5 times heavier than air (Reference 48).

For carbon dioxide, the NIOSH recommended value consistent with the definition of "toxicity limit" in R.G. 1.78 is used. The R.G. 1.78 value appears to be much smaller than would be indicated by the definition of "toxicity limit" (2-minute exposure that would not impair escape) given that the latest TLV-STEL, which is a 15-minute average exposure that would not impair escape, is 54 g/m^3 (Reference 44, 49, 52).

The toxicity limit for chlorine identified in R.G. 1.78 is essentially equivalent to the

IDLH value for chlorine given in Reference 47. The IDLH concentration is based on a 30-minute exposure compared to the R.G. 1.78 definition of toxicity limit (2-minute exposure). A more recent evaluation of toxicity limit for chlorine is given In NUREG/CR-5669 (Reference 56). NUREG/CR-5669 recommends a value of 30 ppm (0.090 g/m^3) as an appropriate toxicity limit value, which is approximately twice the value given in R.G. 1.78.

There are several conservatisms in the analysis for all of the offsite chemicals, that would indicate a much lower actual impact. For example, the stable, low wind speed condition (F stability at 0.5 m/sec wind speed) used in the analysis would in reality tend to result in much plume meander in the lateral direction that would serve to further disperse the cloud. In fact, NRC Regulatory Guide 1.145 (Ref. 55) allows an additional credit (factor of 4) in performing dispersion analyses for accidental radiological release dose calculations, for F stability, low wind speed conditions. There are also numerous obstacles between the release point and the control room intake that would serve to further disperse the plume.

Conclusion

Based on the results of this evaluation, there are no toxic gas hazards that require either gas detectors or automatic isolation of the Control Room ventilation system.

Table 3
SUMMARY OF HAZARDOUS MATERIALS ANALYSIS*

Chemical	Location	Total Storage	Max. per Cont.	Dist. from Intake (Note 3)	Truck Shipm't size	Freq. Ship'd	Release analyzed	Credited Elevated Intake	Toxicity Limit (gm/m^3)	Control Room Conc. (gm/m^3)
Carbon Dioxide	Onsite	54,000 lbs	28,000 lbs	21 meters	40,000 lbs	9 per year	40,000 lbs	Yes	54.8 (Ref. 49, 52)	16.8
Liquid Nitrogen	Onsite	10,000 gal	5,000 gal	51 meters	7,200 gal	17 per year	7,200 gal	No	274 (Ref. 50, 54)	103.2
Liquid Nitrogen	NMP	37,300 gal	11,300 gal	682 meters	6,300 gal	12 per year	11,300 gal	No	274 (Ref. 50, 54)	52.7
Propane	Onsite	1,000 gal	1,000 gal	153 meters	2,600 gal	2 per year	1,000 gal	Yes	43.1 (Ref. 51, 54)	2.03
Sulfuric Acid	NMP (Note 1)	10,000 gal	10,000 gal	838 meters	3,100 gal	2 per year	10,000 gal	No	.002 (Ref. 44)	7.9E-5
Sulfuric Acid	ALCAN	5,000 gal	5,000 gal	3.625 miles	5,000 gal	9 per year	5,000 gal	No	.002 (Ref. 44)	2.7E-6
Chlorine	ALCAN	20 tons	1 ton	3.640 miles	1 ton 14 cyls	5 per year	1 ton	No	.090 (Ref. 56)	.039
Aqueous Ammonia	Sithe (Note 2)	60,000 gal	30,000 gal	2.75 miles	6,000 gal	3 per week	6,000 gal	Yes	.21 (Ref. 56)	.197

Notes:
1. Sulfuric acid releases at Oswego Wire and Sithe/Independence Station are enveloped by the release analyzed for Nine Mile Point.
2. The aqueous ammonia at the Sithe/Independence Station is stored in two double-walled 30,000 gallon tanks. The outer tanks have leak detection systems. There is no direct connection to atmosphere from the outer tanks, and any leakage due to failure of an inner tank is fully contained. A releasee based on a delivery truck failure was analyzed.
3. Distances usd for analysis of onsite releases were conservatively less than the actual distances shown in Table 1.

* Ref. 54

Figure 10

SITES STORING HAZARDOUS MATERIALS WITHIN A FIVE MILE RADIUS OF FITZPATRICK
March 1994

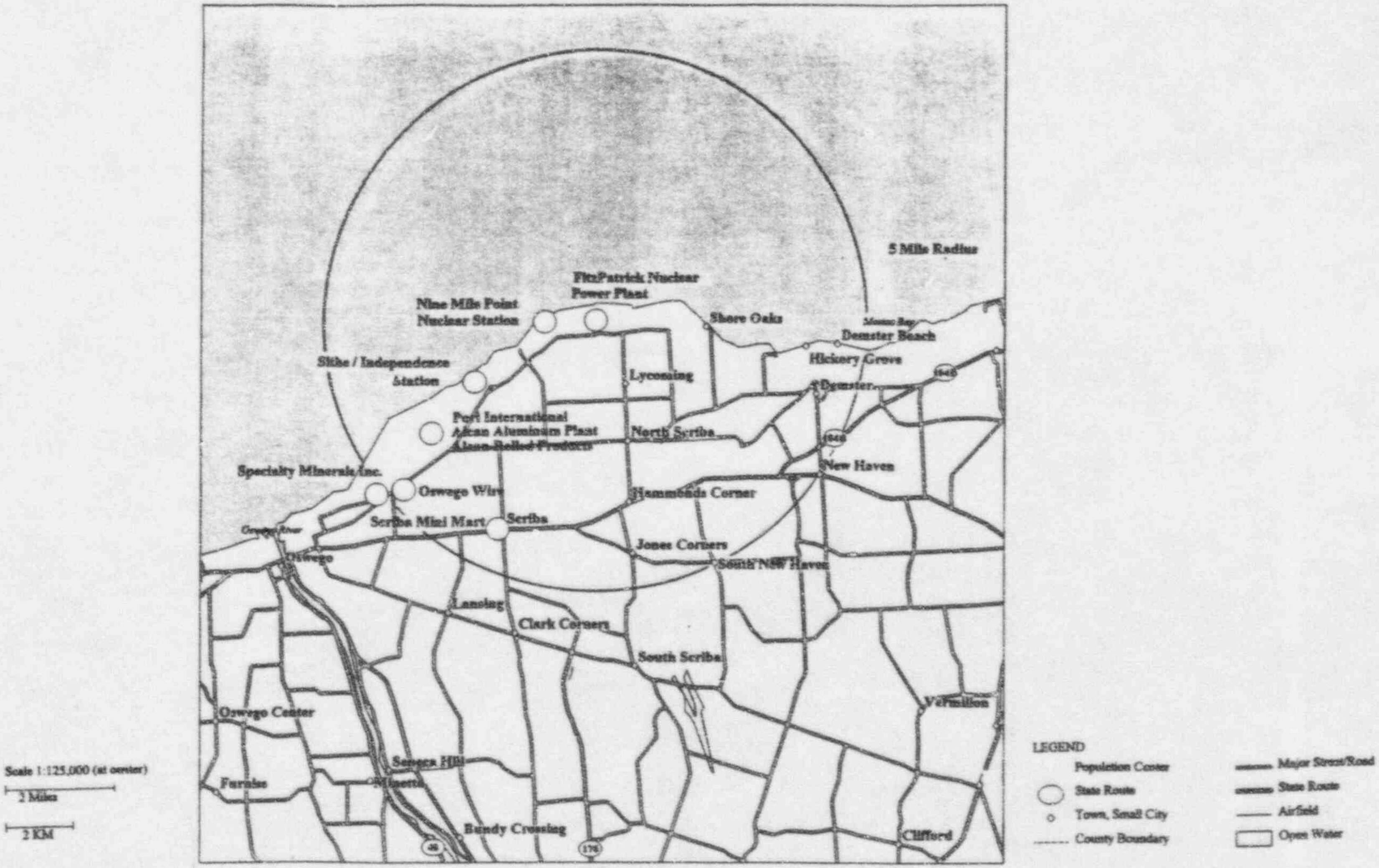


Figure 11

TRANSIENT HAZARDOUS CHEMICAL CONCENTRATIONS AT THE CONTROL ROOM INTAKE, AND INSIDE THE CONTROL ROOM AFTER AN ACCIDENTAL CHEMICAL RELEASE OF CHLORINE AT ALCAN

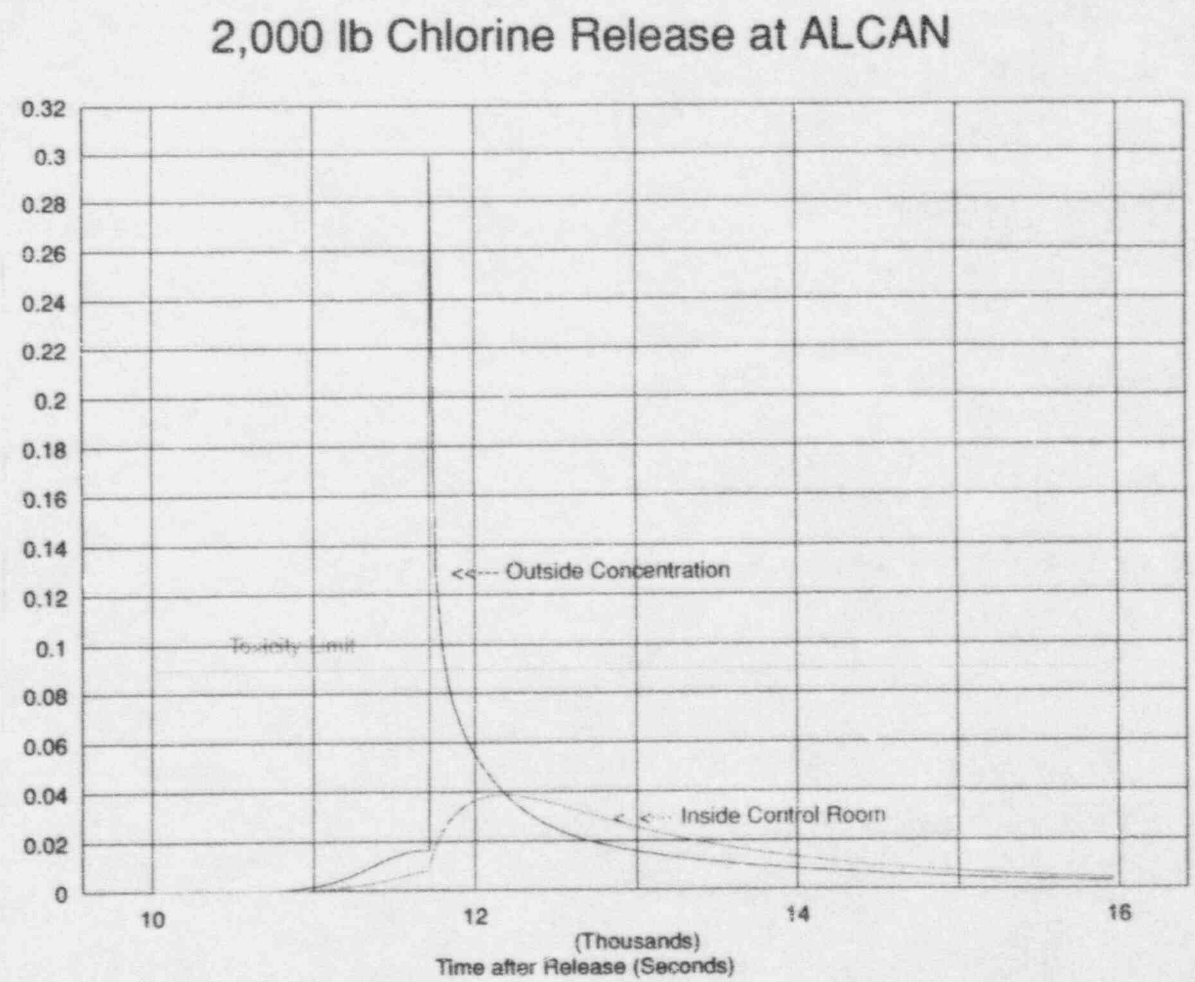


Figure 12

TRANSIENT HAZARDOUS CHEMICAL CONCENTRATIONS AT THE CONTROL ROOM INTAKE, AND INSIDE THE CONTROL ROOM AFTER AN ACCIDENTAL CHEMICAL RELEASE OF ONSITE CARBON DIOXIDE

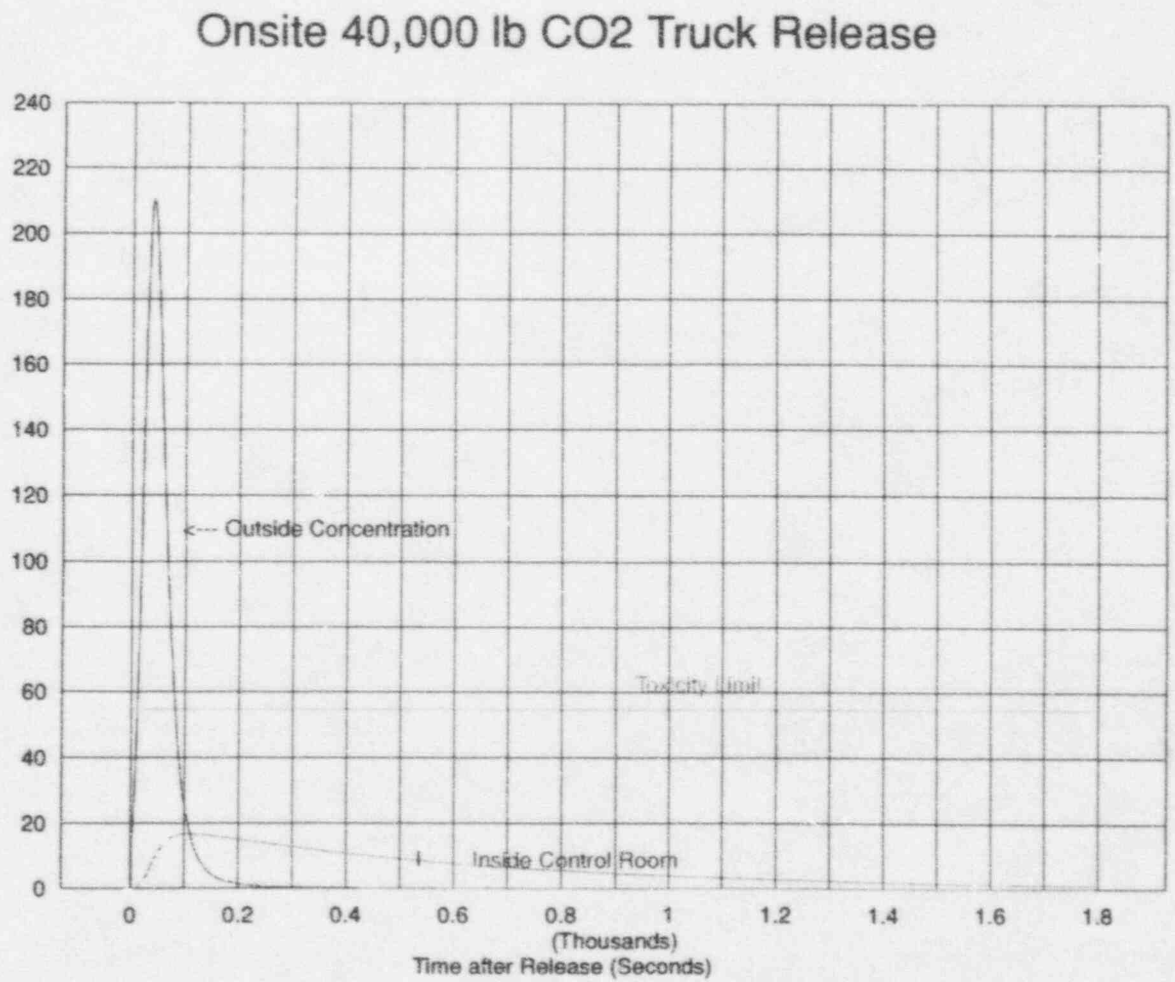


Figure 13

TRANSIENT HAZARDOUS CHEMICAL CONCENTRATIONS AT THE CONTROL ROOM INTAKE, AND INSIDE THE CONTROL ROOM AFTER AN ACCIDENTAL CHEMICAL RELEASE OF ONSITE NITROGEN

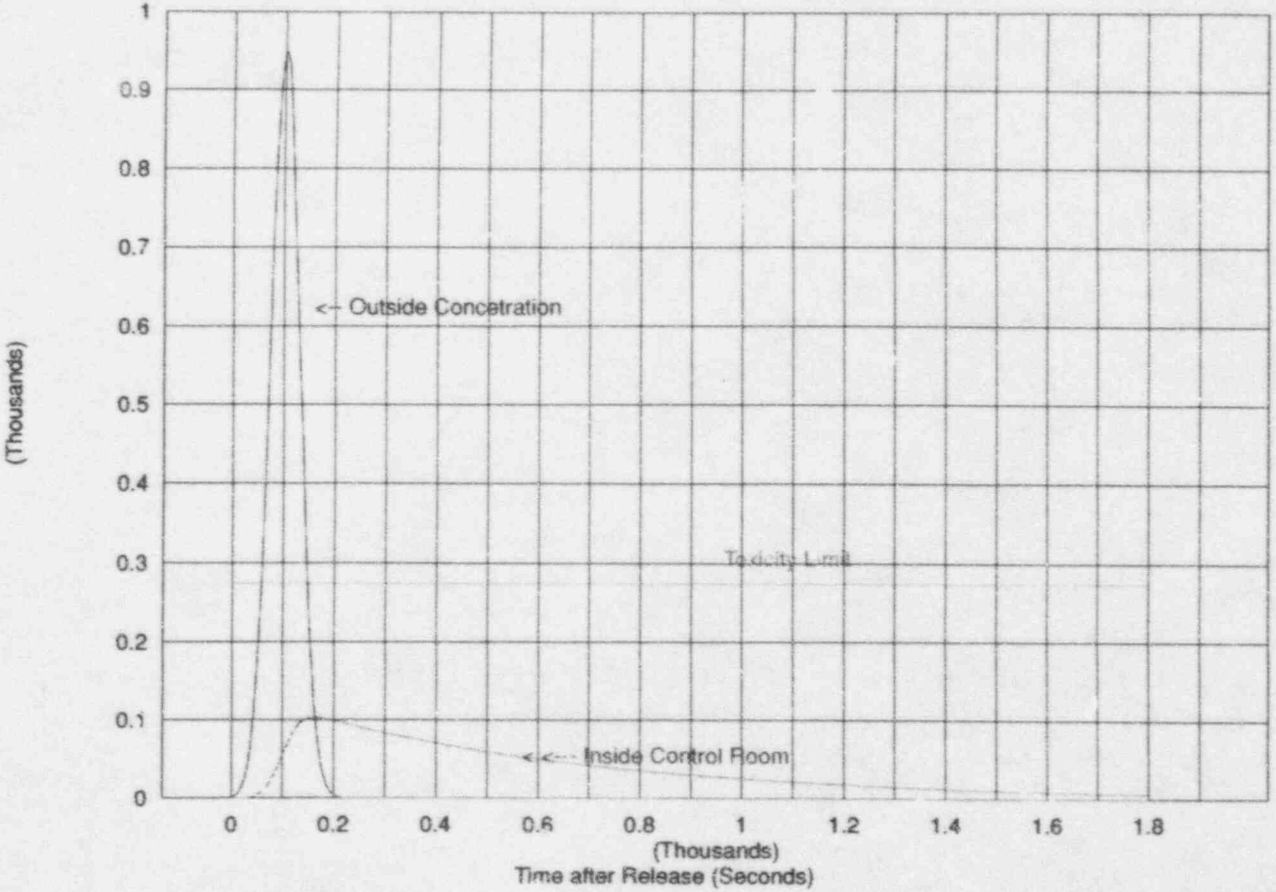


Figure 14

TRANSIENT HAZARDOUS CHEMICAL CONCENTRATIONS AT THE CONTROL ROOM INTAKE, AND INSIDE THE CONTROL ROOM AFTER AN ACCIDENTAL CHEMICAL RELEASE OF ONSITE PROPANE

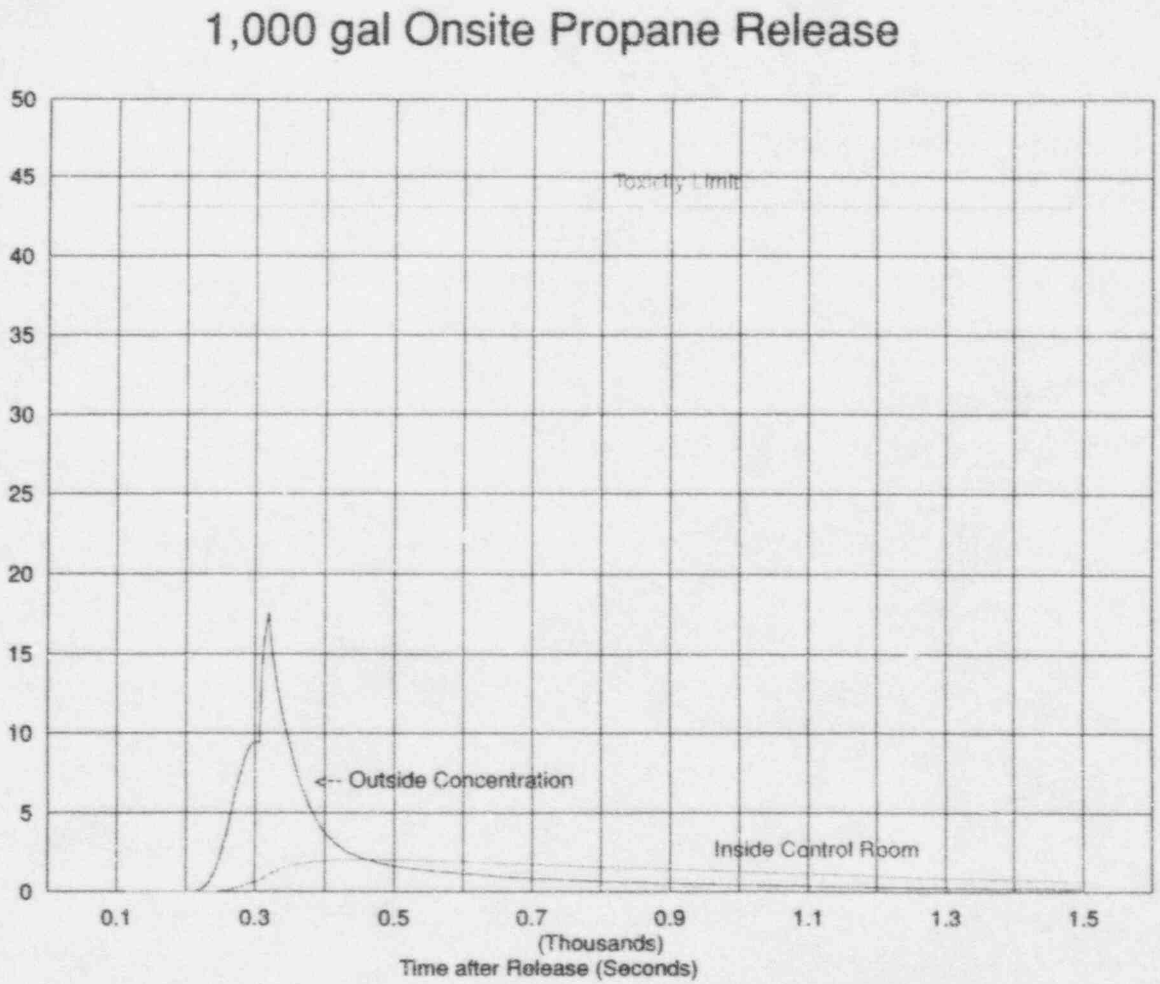
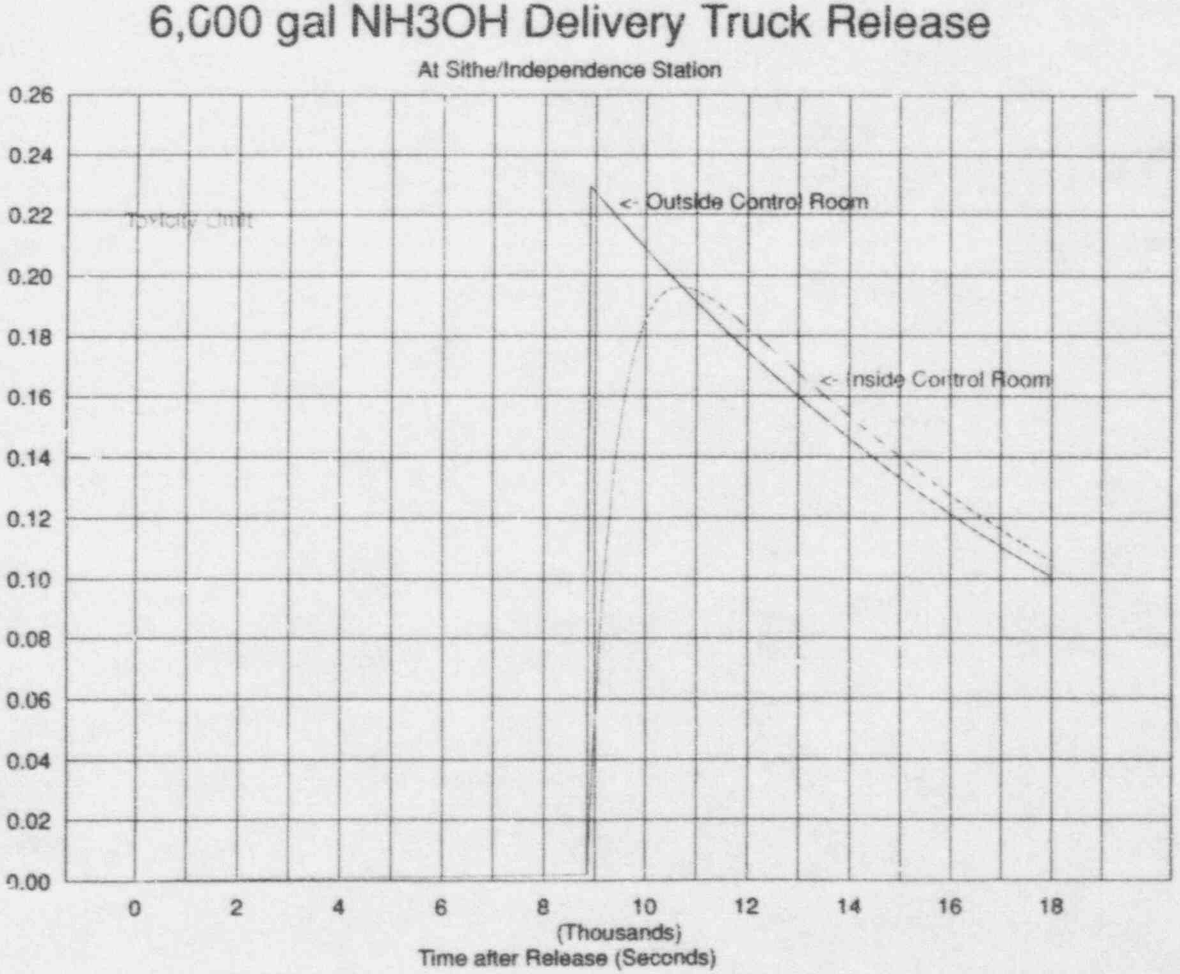


Figure 15

TRANSIENT HAZARDOUS CHEMICAL CONCENTRATIONS AT THE CONTROL ROOM INTAKE, AND INSIDE THE CONTROL ROOM AFTER AN ACCIDENTAL CHEMICAL RELEASE OF AQUEOUS AMMONIA AT SITHE INDEPENDENCE STATION



9.0 Design Basis Accident (DBA) Analyses

Analysis and Results

The potential radiological affects of Design Basis Accidents (DBAs) on Control Room operators were analyzed in Reference 9.

The dose contributions from the DBAs considered in the analysis are summarized in Table 4. This analysis assumed the following conditions associated with the Control Room emergency ventilation system:

- System capability to accommodate a worst case single failure.

- System capability to maintain a 0.125" w.g. positive Control Room volume pressure to prevent unfiltered inleakage.

- One or both emergency filter trains operating, providing between 1,000 and 2,000 cfm of filtered makeup air.

- Post-accident unfiltered flow of 2,100 cfm (infiltration leakage).

- 90% charcoal filter efficiency.

- The potential for maximum outside air intake rate of 15,000 cfm, prior to initiation of isolate mode.

- Isolation time of 30 minutes for LOCA and Control Rod Drop Accident.

- Isolation times of 12 (1000 cfm post-isolation flow) and 15 minutes (2000 cfm post-isolation flow) were used for Main Steam Line Break and Refueling Accident. These times yielded the worst case results. Longer isolation times resulted in lower doses.

- Maximum normal reactor coolant activity level of 0.2 micro Ci/gm I-131 Dose Equivalent (DE), the limit in the STS (Ref. 11). (Current Technical Specification limits for the Reactor Coolant System (RCS) radioactivity concentration is 3.1 micro Ci/gm I-131 dose equivalent. The Failed Fuel Action Plan (Ref. 23) requires placing the Control Room in the isolate mode when activity exceeds 0.01 micro Ci/gm I-131 dose equivalent.)

During the 1994/1995 refueling outage, the plant will be modified to delete the Main Steam Isolation Valve (MSIV) closure and scram functions associated with

high main steam line radiation (Reference 58). The effect of this modification on the radiological consequences of a Control Rod Drop Accident have been evaluated with and without offgas system isolation (Reference 59). The pre-modification consequences are bounding.

Conclusion

The acceptance criteria for Control Room Habitability from 10 CFR 50, Appendix A, General Design Criterion 19, and SRP 6.4 Section II.6, are as follows (30 day accident dose):

Habitability Acceptance Criteria	
Whole Body	5.0 Rem
Skin	30.0 Rem
Thyroid	30.0 Rem

The dose acceptance criteria for Control Room habitability are satisfied for the DBAs. Input parameters compare favorably to those detailed in Section III.3.b of SRP 6.4. The results are summarized in Table 4.

Table 4
POST DESIGN BASIS ACCIDENT CONTROL ROOM DOSES OVER ACCIDENT DURATION OF 30 DAYS

Accident Scenario - (1000 cfm post-isolation filtered flow)	Dose - Rem		
	Whole Body	Thyroid	Skin
Loss of Coolant	9.867E-03	2.447E+00	1.180E-01
Main Steam Line Break	9.641E-04	2.409E+00	6.080E-03
Control Rod Drop	9.079E-03	6.262E+00	9.810E-02
Refueling	2.329E-04	3.209E-03	3.524E-03

Accident Scenario - (2000 cfm post-isolation filtered flow)	Dose - Rem		
	Whole Body	Thyroid	Skin
Loss of Coolant	1.007E-02	1.943E+00	1.190E-01
Main Steam Line Break	8.274E-04	1.975E+00	5.216E-03
Control Rod Drop	9.117E-03	5.018E+00	9.803E-02
Refueling	2.091E-04	2.609E-03	3.096E-03

10.0 Summary - Compliance with GDC 19 and SRP 6.4

GDC 19 "Control Room"

10 CFR 50, Appendix A, GDC 19 states:

> "A Control Room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents. Adequate radiation protection shall be provided to permit access and occupancy of the Control Room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, for the duration of the accident.
>
> Equipment at appropriate locations outside the Control Room shall be provided (1) with a design capability for prompt hot shutdown of the reactor, including necessary instrumentation and controls to maintain the unit in a safe condition during hot shutdown, and (2) with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures."

The FitzPatrick Control Room habitability system meets the requirements of GDC 19 "Control Room" with respect to maintaining the Control Room in a safe and habitable condition under accident conditions by providing adequate protection against radiation such that the radiological exposures are within the limits of GDC 19.

The GDC do not apply to FitzPatrick because its construction permit was issued on May 20, 1970, before the GDC became effective on May 21, 1971. See Federal Register Vol. 32, No. 132, dated July 11, 1967, pages 10213 through 10218; and SECY-92-223 dated September 18, 1992 regarding resolution of deviations identified during the systems evaluation program. GDC 11 "Control Room" in the 1967 draft Appendix A is equivalent to the 1971 GDC but differs slightly, stating:

> "The facility shall be provided with a Control Room from which actions to maintain safe operational status of the plant can be controlled. Adequate radiation protection shall be provided to permit access, even under accident conditions, to equipment in the Control Room or other areas as necessary to shutdown and maintain safe control of the facility without radiation exposures of personnel in excess of 10 CFR 20 limits. It shall be possible to shut the reactor down and maintain it in a safe condition if access to the Control Room is lost due to fire or other cause."

FitzPatrick was designed and constructed to meet the Atomic Energy Commission's 1967 draft general design criteria, to the extent practical. This was acknowledged in the AEC's 1972 Safety Evaluation Report for FitzPatrick's Operating License, Section 14 (Ref. 37.)

Compliance with Standard Review Plan 6.4

The Control Room Ventilation System compares favorably with the NRC staff guidance in Standard Review Plan 6.4, with the exceptions detailed in this report. Based on the results of the analysis summarized in Section 8, the system is capable of assuring that plant operators are adequately protected against the effects of accidental releases of toxic and radioactive gases.

A single failure analysis of the Control Room Emergency Ventilation System was performed (Ref. 10) and several single failures were identified which could potentially prevent the Control Room Emergency Ventilation System from performing its design function. The potential single failures have been identified, and resolution of the issues raised are discussed in Section 3. The effects of the single failures were analyzed in LER-93-019-02 (Ref. 8), and the worst case single failure was determined to be a failure of 70MOV-108 to close. The effects of this single failure were assessed in the radiation dose habitability analysis (Ref. 9), and the results were within the 10 CFR 50, Appendix A, GDC 19 limits.

11.0 References

1. Safety Evaluation JAF-SE-94-044, "Changes to the Control Room and Relay Room Ventilation Systems UFSAR Description, Section 9.9.3.1," dated April 20, 1994.

2. Control Room Heating, Ventilation and Air Conditioning, Drawing 11825-FB-35B, Revision 6.

3. Equipment Room, Heating, Ventilation and Air Conditioning, Drawing 11825-FB-35C, Revision 10.

4. Control Room Plans and Elevation, Drawing 11825-FA-21A, Rev. 7.

5. Calculation 11825-70-22, "Administration System #70 FN-6A and B Booster", dated February 1, 1972.

6. JAFP-94-0329,"Open Item Verification NUREG-0737 Response" dated July 1, 1994 (Attachment 1).

7. Calculation 11825-70-04, "Calc. for Air Conditioning System Cooling Load," dated September 29, 1970.

8. LER-93-019-02, "Potential Design Inadequacies in the Control Room Ventilation System," dated May 27, 1994.

9. JAF-CALC-RAD-00028, "Control Room Post-Accident Radiological Habitability - Assessment of Current Ventilation System Configuration," dated April 19, 1994.

10. PAS-29934, "Control Room Emergency Ventilation Air Supply System Single Failure Analysis," dated November 22, 1993

11. NUREG-1433, "Standard Technical Specifications, General Electric Plants, BWR/4," dated September 1992.

12. Regulatory Guide 1.52, Rev. 2, "Design, Testing and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants," March 1978.

13. New York Power Authority, James A. FitzPatrick Nuclear Power Plant Technical Services Memorandum, JTS-93-0708, "Closure of Control Room Restoration Task B2.C6.2," dated November 5, 1993.

14. Regulatory Guide 1.3, Rev. 2, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant Accident for Boiling Water Reactors," dated June 1974.

15. NUREG-0578, "TMI-2 lessons learned Task Force Summary Report and Short-Term Recommendations", July 1979.

16. NUREG-0696, "Functional Criteria for Emergency Response Facilities," September 1980.

17. Surveillance Test ST-18, "Main Control Room Emergency Fan and Damper Operability Test," Rev. 7.

18. Radiation Protection Procedure RP-RESP-301, "SBGTS, CREVASS and TSCVASS Filter Testing," Rev. 0.

19. PASNY Purchase Order APO-86, Specification for Furnishing and Delivery of Air Handling and Refrigeration equipment.

20. NYPA letter, JPN-81-60, J.P. Bayne to Thomas A. Ippolito (NRC), Response to "JAFNPP Docket No. 50-333, NUREG-0737, Control Room Habitability Requirements," dated August 31, 1981.

21. NRC letter dated February 24, 1982, D. B. Vassallo to L. W. Sinclair regarding "NUREG-0737, Item III.D.3.4, Control Room Habitability." Include Safety Evaluation Report on NUREG-0737, Item III.D.3.4.

22. NRC Generic Letter 85-36 "NUREG-0737 Technical Specifications" dated November 1, 1983.

23. NYPA, James A. FitzPatrick, Administrative Procedure, AP-08-02, Rev. 0. "Failed Fuel Action Plan"

24. LER-93-019-01, "Potential Design Inadequacies in the Control Room Ventilation System, dated November 29, 1993.

25. Reasonable Assurance of Safety, RAS:NED-RAS-93-007, Rev. 0, "Reasonable Assurance that James A. FitzPatrick Nuclear Power Plant can be safely Operated Above Cold Shutdown While There Are Outstanding Identified Deviations with the Control Room and Relay Room Ventilation Systems."

26. Fax from Larry Normandeau (NYPA) to Dennis Mahoney (SWEC) "Flow Balancing Test Data of 8/17/94," dated August 23, 1994.

27. LER-93-019-0, "Potential Design Inadequacies in the Control Room Ventilation System," dated September 23, 1993.

28. NYPA letter, JAFP-86-059, "Verify Design Flow Requirements for Control Room Emergency Ventilation System-Control Room Habitability-NUREG-0737," dated December 19, 1986.

29. NYPA letter, JPN-86-018, regarding "Technical Specification Changes - Main Control Room Emergency Ventilation Air Supply System Capacity Test," dated April 15, 1986.

30. James A. FitzPatrick Operating Procedure, OP-55B, Rev. 9, "Control Room Ventilation and Cooling."

31. Stone and Webster Calculation No. 12966-RP-84-3, Rev. 0, dated 11/20/80, "Dose Rates in Control Room From Reactor Bldg. Contaminated Air After a LOCA."

32. Tenera report "Evaluation of Control Room Emergency Ventilation System for Single Failure Susceptibility" dated April 15, 1994.

33. Letter from K. A. Redig, U. S. Coast Guard Marine Safety Office, to W. R. Stephan of Stone and Webster dated February 2, 1994.

34. Telecon with NYDOT between R. Nelson (SWEC) and Carol Rice (NYDOT) dated October 18, 1994.

35. Oswego County Emergency Management Office letter, G. T. Brower, Director to B. T. Young, NYPA, dated October 25, 1994 regarding Conrail shipments of hazardous material within five miles of FitzPatrick.

36. K. G. Murphy and K. M. Campe, "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Design Criteria 19," AEC Thirteenth Air Cleaning Conference, August 1974.

37. AEC Safety Evaluation Report dated November 20, 1972 including supplements 1 and 2.

38. NRC letter dated February 3,1987, D. R. Muller to J. C. Brons regarding "Redundant Emergency Outside Air Intake Damper - Control Room Habitability Requirements (NUREG-0737, Item III.D.3.4). Includes Safety Evaluation Report for Item III.D.3.4 for FitzPatrick.

39. NUREG-0800, NRC Standard Review Plan, Section 6.4, "Control Room

Habitability System," Revision 2, dated July 1981.

40. NYPA memorandum, dated November 14, 1994, (NED-E-DLC-94-302), R. Sergi to J. Costedio regarding system 70 instrumentation cables.

41. Safety Evaluation JAF-SE-94-042, dated April, 20, 1994, Revison 0, titled "Revision of FSAR Section 11.5.3.9 and 14.8.1.5, Return of Control Room Ventilation System to Normal Mode of Operation Following 1994 Maintenance Outage."

42. NYPA memorandum, J. A. Gray, Jr to A. Zaremba, (JAG-94-154) dated April 29, 1994 regarding "Revision to JAG-93-145, Evaluation of Control Room Ventilation Intake Radiation Monitor Classification."

43. NYPA DDOI-JAF-CREVASS-070-032, dated February 7, 1994 regarding discrepant information regarding Control Room and Relay Room Ventilation System damper capacities; Safety Significance Screening/Priority II.

44. Regulatory Guide 1.78, Rev. 0, "Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release", dated June 1974.

45. Nuclear Regulatory Commission, NUREG-0570, "Toxic Vapor Concentrations in the Control Room Following a Postulated Accidental Release," June 1979.

46. Stone & Webster computer program "VAPOR", EN-199, Version 02 Level 01, Linkedit Date - Time 01/06/92 - 12:53:40.

47. Material Safety Data Sheets, Revised November, 1991, Genium's Reference Collection.

48. "Handbook of Chemistry and Physics," The Chemical Rubber Publishing Company, Cleveland, Ohio, 1961.

49. "1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices". American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.

50. Patty, Frank, A., "Industrial Hygiene and Toxicology, Second Revised Edition". Interscience Publishers, New York, pp. 917-918, 1963.

51. Tilton, B. E. and R. M. Bruce, "Review Criteria for Vapor-Phase Hydrocarbons". Environmental Criteria and Assessment Office, U.S. Environmental Protection Agency, EPA-600/8-80-045, page 6-150, 1980.

52. "Criteria for a Recommended Standard: Occupational Exposure to Carbon Dioxide, Publication No. NIOSH 76-194, August, 1976.

53. Stone & Webster Calculation No. 12966.84-WM-3, "Toxic Chemical Analysis", dated 12/8/80.

54. Stone and Webster Calculation, JAF-CALC-CRC-01953, "Toxic Chemical Control Room Habitability Analysis," Rev. 0, dated January 10, 1995.

55. Regulatory Guide 1.145, Rev. 0, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants", dated February 1983

56. NUREG/CR-5669 (PNL-7522), "Evaluation of Exposure Limits to Toxic Gases for Nuclear Reactor Control Room Operators", published July, 1991.

57. NYPA letter, W. J. Cahill, Jr. to USNRC dated November 16, 1994 (JPN-94-059) regarding updated response to NUREG-0737, Item III.D.3.4, Control Room Habitability.

58. NYPA letter, W. J. Cahill, Jr. to the NRC, dated July 15, 1993 (JPN-93-050) regarding "Proposed Change to the Technical Specifications, Elimination of the Main Steam Isolation Valve Closure Function and Scram Function of the Main Steam Line Radiation Monitors."

59. NYPA Calculation, JAF-CALC-RAD-00041, "Radiological Assessment of a Control Rod Drop Accident Without MSIV Closure at Pre-Uprate Conditions."

60. Stone and Webster Calculation, JAF-CALC-CRC-01951, "Effect of a Single Failure of one of two Recirculation Dampers on Control Room and Relay Room HVAC System Flow Balance," Rev. 0, dated January 12, 1995.

61. NYPA LER-94-008, dated December 5, 1994, "Relay Room Ventilation System Isolation Valve Cable and Design Document Concerns," attached to JAFP-94-0591, from H. P. Salmon to USNRC.