CAROLINA POWER AND LIGHT COMPANY

BRUNSWICK NUCLEAR PROJECT - UNITS 1 AND 2

DESIGN BASIS DOCUMENT

CONTROL BUILDING HEATING, VENTILATING, AND AIR CONDITIONING SYSTEM

DOCUMENT NO. DBD-37

REVISION 1

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RECORD OF REVISION

REVISION	DATE	SECTIONS REVISED	SUMMARY OF CHANGES
1	12/19/92	All	Incorporated changes implemented by PM 91-055, included validation report comments, and numerous revisions to bring document into compliance with the writers guide and standard format of other approved DBDs.

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FOREWORD

The Brunswick Nuclear Project Design Basis Documents (DBDs) are intended for the primary use of the NED design engineer. Additional personnel expected to use this document for design basis reference would include Technical Support, Licensing and Regulatory Compliance personnel.

To provide consistency in the content of the BNP DBDs, a system's design basis is defined to consist of:

1. System Functional Requirements

2. Regulatory Requirements/Commitments Relative to System Design

3. Original Design Codes/Standards of Record (unless clearly superseded by a regulatory commitment to a later code/standard).

To assist the user and provide clarification on certain aspects of the system, information that does not meet the definition of design basis may be included in this document. The Brunswick DBDs are formatted, however, to avoid confusion for the intended user, clearly differentiating the system design basis from supporting information by underlining design basis statements.

The Brunswick DBDs are written with an extensive use of references to supplement the document text. Prior to changing any design information in this DBD, the user should review all related references to assure an understanding of the context from which the reference was extracted. The inclusion of information subject to frequent revision has been intentionally limited in this document.

Industry issues such as Appendix R and Regulatory Guide 1.97, as well as topics such as shielding and ALARA, are common to multiple systems. Specific system design requirements imposed by such "generic issues" are often complex and have been addressed in separate generic issue design basis documents. The generic issue documents are referenced, as appropriate, within this document.

TABLE OF CONTENTS

0.0 INTRODUCTION

This section presents general information for users of the Design Basis Document. This information is for background and is not design basis.

0.1 SYSTEM IDENTIFICATION

This section includes a brief identification of the CBHVAC System and its subsystems.

Control Building Heating, Ventilation and Air Conditioning System (CBHVAC) is defined in System Description SD-37. The system file number is 8220. Pre-operational testing was accomplished via PO-55 (refs.: 6.1.4.4, 6.1.4.5).

0.1.1 *SUBSYSTEMS*

The CBHVAC System is divided into the following subsystems:

0.1.1.1 *Intake and Exhaust Ventilation Subsystem*

The ventilating air for the Control Building is drawn in through the intake grill (located in the roof of the Mechanical Equipment Room) and the Intake Tornado Check Valves to the supply plenum (Make-up Air Casing). These components and the Intake Roll Filters are included in this subsystem. The Exhaust Tornado Check Valves and the common ductwork at these check valves is included in this subsystem. Controls associated with these components are included in this subsystem.

0.1.1.2 *Control Room Normal Ventilation Subsystem*

This subsystem includes a recirculation air filter, dampers, ductwork, air conditioning units, heating coils, and Control Room Supply Fans, which recirculate air from the recirculating air plenum through the Control Room and back to the recirculating air plenum. The Control Room Normal Ventilation Subsystem also includes the Normal Inlet Damper, the Control Room Supply Fan Discharge Dampers, the Control Room Exhaust Fan and Damper, and the controls associated with these components. This system provides conditioned air at a positive static pressure during normal (non-emergency) operation.

0.1.1.3 *Control Room Emergency Ventilation Subsystem*

This subsystem consists of two filtering trains (one for operation, one for standby). Each train consists of an Emergency Air Filter and Emergency Recirculation Fan, the associated ductwork, dampers, and controls. The Emergency Recirculation Dampers and ductwork, including the ductwork from the discharge of the Emergency Fans to the tie in at the Recirculation Air Filter Plenum are included in this subsystem.

0.1.1.4 *Battery Room Ventilation Subsystem*

The Battery Room Ventilation Subsystem consists of the ductwork, supply and exhaust dampers, fans, electric heaters, and associated controls which take air from the intake air plenum to the Battery Rooms, and then exhaust the hot air and battery-generated gases to the atmosphere through the tornado-pressure check valve. This subsystem includes the negative static pressure controls for the Battery Rooms.

0.1.1.5 *Cable Spreading Room Ventilation Subsystem*

The Cable Spreading Room Ventilation Subsystem consists of the ductwork, supply and exhaust dampers, fans, and associated controls which take air from the intake air plenum to the Cable Spread Rooms, and then exhaust the hot air to the atmosphere through the tornado-pressure check valves.

0.1.1.6 *Mechanical Equipment Room Ventilation Subsystem*

The Mechanical Equipment Room Ventilation Subsystem consists of the ductwork, supply and exhaust dampers, fans, and associated controls which take air from the intake air plenum to the Mechanical Equipment Room (located on 70' elevation), and then exhaust the hot air to the atmosphere through a tornado-pressure check valve. This subsystem also includes the electric unit heaters for the Mechanical Equipment Room and the ductwork and fire dampers to the Elevator Machine Room.

0.1.1.7 *Computer Room Air Conditioning Subsystem*

This subsystem consists of an independent air conditioning unit that recirculates air to maintain Computer Room temperature below a predetermined setpoint. The ductwork and fire dampers are included in this subsystem.

0.1.1.8 *CBHVAC Instrument Air Subsystem*

This subsystem consists of two emergency air compressors which provide control air for the HVAC pneumatic controllers, dampers, and other pneumatic controls. The intake filters, filter dryer, pressure regulators, receiver tanks, relief valves, automatic drains, and all other controls associated with the air compressors is included in this subsystem.

0.2 SYSTEM PURPOSE

This section includes a brief statement of the purpose of the system and a brief synopsis of the historical evolution of the CBHVAC System. It includes only major changes and is not meant to be all-inclusive.

0.2.1 The purpose of the Control Building Heating, Ventilation, and Air Conditioning System is to maintain areas of the CB at the temperature conditions which provide optimum operation of equipment, comfort and safety of personnel, and to limit the spread of contamination during normal operations and postulated design basis accidents.

The system is designed to:

- Maintain the areas of the Control Room at the temperature conditions which provide for proper operation of equipment,
- Maintain occupied areas within the temperature and humidity ranges desired for human occupancy,
- Limit the introduction of outside contaminants that could present a threat to human life, and

- Provide for the safe removal and disposal of fumes, vapors, and gases.

0.2.2 *SYSTEM HISTORY*

0.2.2.1 *Chlorine Protection*

The CBHVAC System was originally designed for normal ventilation as described above and for habitability relative to radiation events. During the licensing process, a large scale chlorine release became a concern. The entire chlorine detection and isolation function was added to accommodate this requirement during the 1973 to 1975 time frame. The system was designed based on a draft of Regulatory Guide 1.95 (ref.: 6.1.2.12) and analyses performed by UE&C based on other standards (refs.: 6.2.8.1 and 6.2.8.2). Numerous modifications have been made to ensure the system meets the required criteria for detection and isolation during a chlorine event. As part of the response to NUREG-0737, a reanalysis of offsite hazards was performed (see Section 0.2.2.4) during the early 1980s.

0.2.2.2 *Instrument Air Compressors*

The original Instrument Air Compressors were provided by Johnson Controls as part of Specification 252-22 (ref.: 6.2.7.18) contract work. Early in the construction phase, it was determined that the specified air compressors were not adequate to operate the test function of the Tornado Check Valves being purchased from Techno-check via Specification 248-57 (ref.: 6.2.7.14). A change was implemented in 1975 and two new compressors purchased via Brown and Root Purchase Order 3797 (ref.: 6.2.4.1). The change was not documented by a specification change.

0.2.2.3 *Protection From Smoke*

By original design, the Control Room had a smoke removal mode of operation, but it was considered inadequate for the criteria of BTP APCSB 9.5-1 (ref.: 6.1.1.7). During BNP's response to BTP APCSB 9.5-1 in the late 1970s, and the AEC's evaluation of that response, the AEC required changes to the smoke removal mode for more efficient operation (ref.: 6.2.1.6). In addition, heat detectors were required in the Emergency Filtration Trains for detection of a charcoal fire. Several other changes were made for compliance with BTP APCSB 9.5-1 including the addition of more fire dampers and the addition of the cowling at the discharge of the booster fans.

0.2.2.4 *NUREG-0737, Item III.D.3.4*

In 1979 and the early 1980s (following TMI), the adequacy of operator protection from radiation events came into question. As part of the TMI Action Plan, BNP was required to evaluate the existing habitability system against the Standard Review Plan (ref.: 6.5.16) Sections 2.2.1-2.2.2, 2.2.3, 6.4, and 9.4. The original report was submitted to the NRC in 1980. A revision (ref.: 6.1.1.13) was provided to the NRC in March of 1983. An SE was issued based on the 1983 revision of this document (ref.: 6.6.1.3). As part of the 1983 revision, BNP committed to maintaining the Control Room at 1/8 inch positive pressure during the radiation recirculation mode. After intensive effort directed at the ability to maintain 1/8 inch positive pressure, CP&L determined that this

was not economically feasible. Instead, after negotiating with the Commission, an analysis (ref.: 6.1.1.27) was performed in 1985 to determine the effect of increased unfiltered inleakage on the dose rates to the Control Room operators. This analysis was performed for LOCA conditions. During the Commission's review of this document, questions arose on the doses during a MSLB accident. A second SE on Control Room Habitability as related to Radiation protection was issued in 1989 which addresses the MSLB and indicates it is the worst case accident for Control Room habitability. (ref.: 6.6.1.7)

0.2.2.5 *Positive Pressure*

The BNP Control Room Emergency Zone was originally designed for 1/4 in. W.G. positive pressure. The original analysis assumed that all electrical conduit, duct, and equipment access penetrations would be sealed to zero leakage. No leakage was assumed through cracks in block walls or around door frames (frame to wall interface). Doors were assumed to be tight fitted and ungasketed. A total of 225 scfm was calculated as required to maintain the 1/4 in. W.G.; however, 1000 scfm was provided for conservatism. (ref.: 6.1.1.2, Section M14.4) Start-up testing and subsequent periodic testing verified only slightly positive pressure could be maintained. A quantification of the pressure was not attempted until the NUREG 0737 requirements came into effect as discussed in Section 0.2.2.4 (this explains our current licensing requirement).

0.2.2.6 *Battery Room Heating*

The original design of the Battery Room Ventilation Subsystem was that heating in the Battery Rooms was not required, but that Battery Room temperature could be maintained by reducing outdoor air flow during the winter (ref.: 6.1.2.3). After several years of plant operation, electric heaters were added to the supply ducting for the Battery Rooms as an economic decision to prevent entering LCOs and possible subsequent plant shutdown (refs.: 6.2.1.11 and 6.2.1.12).

0.2.2.7 *Seismic Qualification of Ductwork*

The original installation of the Control Room Ductwork consisted of sheet metal and accessories provided by Bahnson Company via Specifications 226-001 (ref.: 6.2.7.9) and 226-2 (ref.: 6.2.7.10). Seismic supports, designed by UE&C, were provided to Bahnson for installation only. As part of the evaluation for I.E. Bulletin 79-07 (ref.: 6.6.4.2), UE&C documented a review of the ductwork's seismic qualification (ref.: 6.1.2.21); however, they were unable to find the calculations. These calculations were reconstituted. In 1989, it was discovered that the isometrics that were part of the seismic package did not match the as-built condition. NCR A-89-013 (ref.: 6.2.8.15) was initiated to document the concern. The initial evaluation of the field conditions was documented in EER 89-307 (ref.: 6.2.2.7). The long term evaluation of the supports is being performed via calculation OVA-0020 (ref.: 6.2.3.12) and revision 1 to EER 89-307. As of the issuance of Revision 0 of this DBD the calculation and revision 1 to the EER were not completed.

0.3 SYSTEM SCOPE AND BOUNDARIES

In order to ensure consistency and avoid unnecessary duplication, the BNP System Description for the CBHVAC System (SD-37) has been used, as much as practical, to identify/establish the CBHVAC boundaries. This document will define the boundaries in more detail than those provided by the System Description.

CAUTION: When performing modifications to this system, the capacity of the interfacing systems should be reviewed to verify the interfacing system capacity is not exceeded.

0.3.1 *SCOPE*

The CBHVAC System consists of the fans, ductwork, dampers, and associated controls and accessories located in the Control Building. It also includes the CBHVAC Instrument Air Subsystem with the associated compressors, receiver tanks, air dryers, tubing and controls. The air conditioning units, evaporator coils, booster fans, and heating coils are included in this boundary. Associated control switches and indications located on the RTGB are included. Although the Chlorine Detectors are a part of the Chlorination System (System 43.1), they will be considered in this DBD due to their importance in the operation of the CBHVAC System. The Area Radiation Monitors are part of the Area and Environs Radiation Monitoring System (System 11.1); the Control Building smoke and heat detectors are part of the Fire Detection and Suppression System (System 41).

0.3.2 *BOUNDARIES*

0.3.2.1 *Air Side Boundaries*

The air side boundaries for CBHVAC System will start at the point of outdoor intake (grill located in the CBHVAC Mechanical Equipment Room roof) and continue through the outdoor air discharge (screen on the cowls at the booster fan discharge). For the Computer Room Air Conditioning units, which are located on the Computer Room roofs, the air side will start at the surface of the finned coils and continue through the discharge of the fan.

The boundary between the CBHVAC System and other systems located in ventilated rooms will be the air side surface of the equipment being ventilated. The CBHVAC system will include the room air.

0.3.2.2 *Annunciator System*

The boundary is the contacts on the switch in the CBHVAC System which provides the output to the Annunciator System. The contacts are in the CBHVAC System.

0.3.2.3 *Chlorination System Boundary - System 43.1*

The boundary is the contacts on the switch (Chlorine Detector) in the Chlorination System which provides the input to the CBHVAC System. The contacts are in Chlorination System, but the detectors will be discussed in Section 4 of this DBD.

0.3.2.4 *Area and Environs Radiation Monitoring System - System 11.1*

The boundary is the contacts on the switch (ARM) in the Radiation Monitoring System which provides the input to the CBHVAC System. The contacts are in the Area and Environs Radiation Monitoring System (System 11.1). See DBD-11 for information on the Area and Environs Radiation Monitoring System.

0.3.2.5 *Fire Detection System - System 42*

The boundary is the contacts in the Fire Detection Logic Cabinet which provides the input to the CBHVAC System. The contacts are in the Fire Detection System. See SD-41 and 42 for additional information on the Fire Suppression and Detection Systems.

0.3.2.6 *Electrical System Boundaries - Systems 50, 51, and 52*

The boundary is the load side of the first protective device (circuit breaker or fuse) immediately upstream of the system logic circuit. If power for the logic is from a distribution panel or subpanel, the boundary is the load side of the circuit breaker in the distribution panel. If the power is provided from a stepdown transformer in an MCC cubicle, the boundary will be the load side of the control power fuse. For 480 V power, the boundary for the CBHVAC System will be the load side of the contactor, breaker, or fuse, whichever is further downstream. Any specialty items required by the CBHVAC System that are within the boundary of the electrical distribution system will be included in the CBHVAC System. See DBD-50 for information on the AC Electrical System. Cables and raceway will be included in the Generic Issue DBD (DBD-112) for these items.

0.3.2.7 *Control Building Structural Boundaries - System 58*

0.3.2.7.1 **Equipment**

The boundary between a piece of equipment in the CBHVAC System and a concrete foundation is the equipment base (legs or plate) where it contacts the foundation. The anchor bolts are included in the structural foundation boundary, which is part of the Control Building (DBD-58).

0.3.2.7.2 **Piping, Raceway, Conduit, and Ductwork Supports**

Piping analysis qualifies the pipe and permanent structural attachments to the pipe (i.e., WPAs - Welded Pipe Attachments). The boundary for piping extends to the outer surface of the piping, raceway, conduit, and ductwork supports with the independent structural supports and supporting steel being in the structural boundary. Therefore, the piping, raceway, conduit, and ductwork and permanent attachments are in the CBHVAC System, while the independent structural supports are in the Control Building System (DBD-58). Seismic supports will be discussed on DBD-102 (ref.: 6.2.5.6).

0.3.2.8 *Floor and Equipment Drains - System 47*

Valves, automatic drain traps, drains, and vents (including the first isolation valve or closure flange or cap on drains and vents) connected to CBHVAC System components are within the CBHVAC System boundary. The boundary within the Floor and Equipment Drain system is the downstream side of the first isolation valve, if there is such a valve, or at the drain pipe/ floor drain interface for open drains. For automatic drain traps, the trap and connecting piping are included in the CBHVAC System.

0.4 DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

0.4.1 *DEFINITIONS*

The following is a list of definitions for terms used in this document.

0.4.1.1 *Accident*

An accident is a single event, not reasonably expected during the course of plant operations, that has been hypothesized for analysis purposes or postulated from unlikely but possible situations, and that causes or threatens a rupture of a radioactive barrier. A pipe rupture qualifies as an accident; a fuel cladding defect does not. (ref.: 6.1.1.2, p. 1.2-2)

0.4.1.2 *Active Component*

A device characterized by an expected significant change of state or discernible mechanical motion in response to an imposed design basis load demand upon the system. Examples are: switch, relay, valve, pressure switch, turbine, transistor, motor, damper, pump, analog meter. (ref.: 6.1.1.2, p. 1.2-2)

0.4.1.3 *Availability*

Availability is the probability that an item will be operable when called upon to perform its specified function. (ref.: 6.1.1.2, p. 1.2-2)

0.4.1.4 *Class 1/1E*

Structures, systems, or components that are essential to the safe shutdown and isolation of the reactor or whose failure or damage could result in significant release of radioactive material. (ref.: 6.3.23) When suffixed by an "E", this refers to electrical systems and components. "1" and "I" have been used interchangeably in the past.

0.4.1.5 *Control Room Envelope*

The area of the Control Building defined as essential for post-accident operation by SRP Section 6.4. (ref.: 6.5.16, p. 6.4-3)

0.4.1.6 *Control Room Emergency Zone*

The terms Control Room Emergency Zone and Control Room Envelope are synonymous. These terms are used interchangeably in published documents.

0.4.1.7 *Design Basis Accident*

A design basis accident is a hypothesized accident, the characteristics of which are utilized in the design of those systems and components pertinent to the preservation of radioactive material barriers and the restriction of radioactive material release from the barriers. The potential radiation exposures resulting from a design basis accident are greater than any similar accident postulated from the same general accident assumptions; for example, the consequences of a complete severance of a recirculation loop line are more severe than those resulting from any other single pipeline failure inside the primary containment. (ref.: 6.1.1.2, p. 1.2-3)

0.4.1.8 *Engineered Safety Features*

The ESF systems for this facility are designed to perform preventive and mitigative functions when called on during the course of any design basis accident (DBA). These functions are related to two general objectives:

1) To protect the fuel barrier (maintain fuel cladding integrity, prevent cladding melt, minimize extent of fuel rod perforations, etc)

2) To minimize potential offsite doses (mitigate the cause and consequences of accidents, containment, filter, control elevated release, etc)

The design philosophy is that these functions must be maintained under all DBA conditions. (ref.: 6.1.1.1, p. 1.5.8)

0.4.1.9 *Habitable*

Habitable is defined as adequate protection for personnel against accidental releases of toxic and radioactive gases (ref.: 6.5.16, p. 6.4)

0.4.1.10 *Incident*

An incident is an event, abnormal operating transient or accident, not considered part of planned operation. (ref.: 6.1.1.2, p. 1.2-4)

0.4.1.11 *Independence*

Systems, structures, or components are considered independent when there is no common mode failure for any design basis event. (ref.: 6.3.23)

0.4.1.12 *May*

May denotes permission - neither a recommendation nor a requirement. (ref.: 6.1.4.1)

0.4.1.13 *Nuclear Safety System*

A nuclear safety system is a safety system, the actions of which are essential to a safety action required in response to an abnormal operational transient. (ref.: 6.1.1.2, p. 1.2-4)

0.4.1.14 *Offsite*

All properties or areas not considered onsite. (ref.: 6.1.1.4)

0.4.1.15 *Onsite*

Any areas included within CP&L-owned property that is contiguous with the plant structure proper and other plant associated facilities. (ref.: 6.1.1.4)

0.4.1.16 *Operable - Operability*

A system, subsystem, train, component, or device shall be operable or have operability when it is capable of performing its specified function(s). Implicit in this definition shall be the assumption that the necessary attendant instrumentation, controls, normal and emergency electric power sources, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support functions. (ref.: 6.1.1.3)

0.4.1.17 *Operating*

A system or component is operating when it is performing its required action in the required manner. (ref.: 6.1.1.2, p. 1.2-5)

0.4.1.18 *Operational*

The objective operational, along with its noun and verb forms, is used in reference to the working or functioning of the plant, in contrast to the design of the plant. (ref.: 6.1.1.2, p. 1.2-5)

0.4.1.19 *Passive Component*

A device characterized by an expected negligible change of state or negligible mechanical motion in response to an imposed design basis load demand upon the system. Examples are: cable, piping, valve in a stationary position, resistor, capacitor, fluid filter, indicator lamp, cabinet, case, etc. (ref.: 6.1.1.2, p. 1.2-6)

0.4.1.20 *Physical Barrier*

Fences, walls, ceilings and floors constructed to offer resistance to penetration, the openings in which are secured by grates, doors, etc. such that the integrity of the wall is not lessened by any opening. (This definition is abbreviated from Reference 6.4.5, Paragraph 2. See this reference for a more complete definition.)

0.4.1.21 *Planned Operation*

Planned operation is normal plant operation under conditions in the absence of significant abnormalities. Operations subsequent to an incident (transient, accident, or special event) are not considered planned operations until the procedures being followed or equipment being used are identical to those used during any one of the defined planned operations. (ref.: 6.1.1.2, p. 1.2-7)

0.4.1.22 *Protective Action*

A protective action is an ultimate action at the system level which contributes to and is essential to the accomplishment of a safety action. System level actions which are essential to accomplishing reactor scram, reactor vessel isolation, containment isolation, pressure relief, automatic depressurization, and standby core cooling are some of the protective actions. (ref.: 6.1.1.2, p. 1.2-10)

0.4.1.23 *Protective Function*

A protective function encompasses the monitoring of one or more plant variables or conditions and the associated initiation of intra-system actions which eventually result in a protective action. (ref.: 6.1.1.2, p. 1.2-11)

0.4.1.24 *Rated Power*

Rated Power refers to operation at a reactor power of 2436 MWt; This is also termed 100 percent power. Rated steam flow, rated coolant flow, rated neutron flux, and rated nuclear system pressure refer to the values of these parameters when the reactor is at rated power. See also "Design Power" definition. (ref.: 6.1.1.2, p. 1.2-12)

0.4.1.25 *Refuel Mode*

The reactor is in the refuel mode whenever the reactor mode switch is in the refuel position, the vessel head closure bolts are less than fully tensioned or the head is removed, and the reactor coolant temperature is ≤ 212 °F. See the Technical Specifications for allowances for other mode switch positions. (ref.: 6.1.1.3)

0.4.1.26 *Reliability*

Reliability is the probability that an item will perform its specified function without failure for a specified time period in a specified environment. (ref.: 6.1.1.2, p. 1.2-13)

0.4.1.27 *Safety*

The word safety, when used to modify such words as objective, design basis, action, and system, indicates that the objective, design basis, action, or system is related to concerns considered to be of safety significance, as opposed to the plant mission - to generate electrical power. Thus, the word safety is used to identify aspects of the plant which are considered to be of primary importance with respect to safety. A safety objective or design basis does not necessarily indicate that the system is an Engineered Safety Feature (ESF). (ref.: 6.1.1.2, p. 1.2-13)

0.4.1.28 *Safety Action*

A safety action is an ultimate action in the plant which is essential to the avoidance of specified conditions considered to be of primary safety significance. The specified conditions are those that are most directly related to the ultimate limits on the integrity of the radioactive barriers or the release of radioactive material. These are safety actions associated with planned operation, abnormal operational transients, accidents, and special events. Safety actions include such action as the indication to the operator of the values of certain process variables, reactor trip, core standby cooling, and reactor shutdown from outside the Control Room. (ref.: 6.1.1.2, p. 1.2-14)

0.4.1.29 *Safety Objective*

A safety objective describes in functional terms the purpose of a system or component as it relates to conditions considered to be of primary significance to the protection of the public. This relationship is stated in terms of radioactive material barriers or radioactive material release. Only systems which have safety objectives are safety systems. (ref.: 6.1.1.2, p. 1.2-15)

0.4.1.30 *Safety-Related*

A term applied to those plant features necessary to ensure the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and maintain it in a safe condition, or the capability to prevent or mitigate the consequences of accidents which could result in off-site exposures comparable to the guideline exposures of NRC regulation 10 CFR 100 (ref.: 6.4.6). (ref.: 6.1.4.2)

0.4.1.31 *Safety System*

A safety system is a system, group of systems, components, or group of components the action of which are essential to accomplishing a safety action. (ref.: 6.1.1.2, p. 1.2-15)

0.4.1.32 *Scram*

Scram or reactor trip refers to the automatic rapid insertion of control rods in response to the detection of undesirable conditions. (ref.: 6.1.1.2, p. 1.2-15)

0.4.1.33 *Secondary Containment Integrity*

Secondary Containment Integrity means that the Reactor Building is closed and the following conditions are met: 1) All reactor Building ventilation system automatic isolation valves are operable or secured in the closed position. 2) The standby gas treatment system is operable. 3) At least one door at each access opening is closed. 4) The sealing mechanism associated with each penetration is operable. (refs.: 6.1.1.2, p. 1.2-15,16 and 6.1.1.3, Section 1.0)

0.4.1.34 *Shall or Will*

Shall or will denotes a requirement. The action will be accomplished in the manner stated. (ref.: 6.1.4.1)

0.4.1.35 *Should*

Should denotes a recommendation. The action will be accomplished in the manner stated or by an equally effective alternative method. (ref.: 6.1.4.1)

0.4.1.36 *Single Failure*

A single failure means an occurrence which results in the loss of capability of a component to perform its intended safety functions. Multiple failures resulting from a single occurrence are considered to be a single failure. Fluid and electrical systems are considered to be designed against an assumed single failure if neither (1) a single failure of any active component (assuming passive components function properly) nor (2) a single failure of a passive component (assuming active components function properly), results in a loss of the capability of the system to perform its safety function. (ref.: 6.4.2) 10 CFR 50, Appendix A (ref.: 6.4.2) also states (in Note 2 on the definition of single failure), 'Single failures of passive components in electrical systems should be assumed in designing against a single failure. The conditions under which a single failure of a passive component in a fluid system should be considered in designing the system against a single failure are under development'. BNP's interpretation of the single failure requirements are explained in References 6.1.1.2, Section 14.2 and

6.1.1.1, Section 15.0.3.2. BNP does not consider failures of passive mechanical components in designing for a single failure for this system. (refs.: 6.1.1.2, page 14.2-3 through 6 and 6.1.1.1, Section 15.0.3.2) See DBD-110 (ref.: 6.2.5.10) for additional explanation of single failure criterion.

0.4.1.37 *Test Interval*

The test interval is the elapsed time between initiation of identical tests. (ref.: 6.1.1.2, p. 1.2-17)

0.4.1.38 *Toxic Gas*

Compounds of the type listed in Reg. Guide 1.78 that produce vapors hazardous to personnel under the conditions that the chemicals will be stored. (ref. 6.5.10)

0.4.1.39 *Vital Area*

A Vital Area is an area which contains vital equipment within a structure, the walls, roof, and floor of which constitute physical barriers as defined by 10 CFR 73.2. (ref.: 6.4.5)

0.4.1.40 *Vital Equipment*

Vital Equipment is any equipment, system, device, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation. Equipment of systems which could be required to function to protect public health and safety following such failure, destruction, or release are also considered vital. (ref.: 6.4.5)

0.4.2 *ABBREVIATIONS AND ACRONYMS*

The following is a list of abbreviations and acronyms that are used in this document.

0.4.2.1 AC - Alternating Current
0.4.2.2 AEC - Atomic Energy Commission
0.4.2.3 ALARA - As Low As Reasonably Achievable
0.4.2.4 ANSI - American National Standards Institute
0.4.2.5 AOD - Air Operated Damper
0.4.2.6 ARM - Area Radiation Monitor
0.4.2.7 ASHRAE - American Society of Heating, Refrigeration, and Air-conditioning Engineers
0.4.2.8 ASME - American Society of Mechanical Engineers
0.4.2.9 ASSD - Alternate Safe Shutdown
0.4.2.10 ASTM - American Society of Testing and Materials
0.4.2.11 BESU - Brunswick Engineering Support Unit (no longer exists)
0.4.2.12 BNP - Brunswick Nuclear Project
0.4.2.13 BSEP - Brunswick Steam Electric Plant
0.4.2.14 BTP - Branch Technical Position
0.4.2.15 BTU - British Thermal Unit
0.4.2.16 CB - Control Building
0.4.2.17 CBHVAC - Control Building Heating, Ventilating and Air Conditioning System
0.4.2.18 CFM - Cubic Feet per Minute, a volumetric measurement of air flow
0.4.2.19 CFR - Code of Federal Regulations
0.4.2.20 CL - Chlorine gas
0.4.2.21 CP&L - Carolina Power and Light
0.4.2.22 DB - Design Basis
0.4.2.23 DBA - Design Basis Accident
0.4.2.24 DBD - Design Basis Document

0.4.2.25 DBE - Design Basis Earthquake
0.4.2.26 DC - Direct Current
0.4.2.27 °C - Degrees Centigrade
0.4.2.28 °F - Degrees Fahrenheit
0.4.2.29 EDG - Emergency Diesel Generator
0.4.2.30 ERFIS - Emergency Response Facility Information System
0.4.2.31 ESF - Engineered Safety Feature
0.4.2.32 FSAR - Final Safety Analysis Report
0.4.2.33 FPM - Feet Per Minute, an air velocity measurement
0.4.2.34 GDC - General Design Criteria, as in 10 CFR 50, Appendix A
0.4.2.35 HEPA - High Efficiency Particulate Absorber
0.4.2.36 HP - Horsepower
0.4.2.37 Hr - Hour
0.4.2.38 HVAC - Heating, Ventilating, and Air Conditioning
0.4.2.39 IEEE - Institute of Electrical and Electronics Engineers
0.4.2.40 in. W.G. - Inches of water column, gauge
0.4.2.41 LER - Licensee Event Report
0.4.2.42 LOCA - Loss of Coolant Accident
0.4.2.43 MCC - Motor Control Center
0.4.2.44 MSLB - Main Steam Line Break
0.4.2.45 NEMA - National Electric Manufacturer's Association
0.4.2.46 NFPA - National Fire Protection Association
0.4.2.47 NRC - Nuclear Regulatory Commission
0.4.2.48 NUREG - Acronym for certain documents issued by the Office of Nuclear Regulation
0.4.2.49 N_2 - Nitrogen
0.4.2.50 OBE - Operating Basis Earthquake
0.4.2.51 POM - Plant Operating Manual
0.4.2.52 PSIG - Pounds per square inch Gauge
0.4.2.53 R.G. - Regulatory Guide
0.4.2.54 RPM - Revolutions per Minute
0.4.2.55 RTGB - Reactor-Turbine-Generator Board (Main Control Board)
0.4.2.56 SCBA - Self-Contained Breathing Apparatus
0.4.2.57 SCFM - Standard Cubic Feet per Minute
0.4.2.58 SD - System Description
0.4.2.59 SE - Safety Evaluation (NRC Generated)
0.4.2.60 SER - Safety Evaluation Report (NRC generated)
0.4.2.61 S.G. - Safety Guide
0.4.2.62 SMACNA - Sheet Metal and Air-conditioning Contractors National Association, Inc.
0.4.2.63 SOV - Solenoid Operated Valve
0.4.2.64 SRP - Standard Review Plan (ref.: 6.5.16)
0.4.2.65 UE&C - United Engineers and Constructors
0.4.2.66 UFSAR - Updated Final Safety Analysis Report
0.4.2.67 UL - Underwriter's Laboratory
0.4.2.68 VA - Ventilating Air
0.4.2.69 VAC - Alternating Current Voltage
0.4.2.70 VDC - Direct Current Voltage

1.0 SYSTEM FUNCTIONAL REQUIREMENTS

The information in this section is primarily design basis. Specific quantitative information and information resulting from the outputs of calculations relating to these bases will, for the most part, be found in Section 3.0.

A hierarchical structure has been used to avoid duplication of information. If a design basis falls into more than one of the categories, it will be listed in the first category to appear in this document, with a reference in later sections. (e.g., a system functional requirement that results from a Regulatory Guide will appear in Section 1.1, with a reference in Section 2.2.)

1.1 GENERAL SYSTEM FUNCTION

This section includes the primary design basis functional requirements of the CBHVAC System. It will not include static requirements such as seismicity, quality requirements, etc. These will be included in Sections 3.0 and 4.0.

1.1.1 *HABITABILITY*

1.1.1.1 *General*

1.1.1.1.1 <u>The Control Building HVAC System shall be designed to permit continuous occupancy of the Control Room Emergency Zone under normal operating conditions and under the postulated design basis accidents throughout the life of the plant. The Emergency zone consists of the Control Room, including critical document reference file; Computer Rooms and the electronic workrooms; operator Wash Room and Kitchen.</u> Areas not requiring access are generally excluded from the emergency zone. (refs.: 6.1.1.2, Sections 7.18.3.6, M10.13, and M14.1; 6.1.1.1, Section 6.4.1.f; 6.1.1.13, p. A-23) This requirement is derived from GDC-19 (Section 2.1.6). (ref.: 6.5.16, p. 6.4-1)

1.1.1.2 *Radiation Protection*

1.1.1.2.1 <u>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, or its equivalent to any part of the body, for the duration of the accident.</u> This requirement is part of GDC 19 (See Section 2.1.6) In addition, NUREG-75/87 (ref.: 6.5.16), Section 6.4, p. 5, establishes the whole body equivalents as 30 rem to the thyroid and 30 rem to the skin. <u>These doses to an individual shall not be exceeded for postulated design basis accidents.</u> (refs.: 6.6.1.1, p. 6-21 and 6.6.1.7)

1.1.1.2.2 Upon receipt of a high radiation signal, the CBHVAC System is automatically realigned to the emergency mode of operation. The fresh air inlets close, isolating the Control Room. At the same time, the charcoal filter unit begins operation, recirculating the Control Room air to minimize contaminated build-up in the occupied areas. In this mode of operation, 1000 scfm is supplied as filtered make-up and 1000 scfm is recirculated through the charcoal filter. (ref.: 6.6.1.1) See References 6.2.3.7 and 6.2.3.8 for instances where automatic isolation is not required to meet the safety function of the CBHVAC System.

1.1.1.3 *Toxic Gas Protection*

1.1.1.3.1 Control Room operators shall be adequately protected against the effects of accidental release of toxic gases. (refs.: 6.5.15, 6.5.16, p. 6.4-5)

1.1.1.3.1.1 There shall be no chronic effects from exposure to toxic gas; acute effects, if any, shall be reversible within a short period of time (several minutes) without the benefit of any measures other than the use of self contained breathing apparatus. (ref.: 6.1.1.13, p. A-10; 6.5.16, p. 6.4-5) See Section 3.6.10.5 for quantitative limits for chlorine.

1.1.1.3.1.2 Adequate protection from an on-site chlorine release will be achieved if provisions are included in the plant design to automatically isolate the Control Room to limit the potential build-up of chlorine within the Control Room and if equipment and procedures are provided to assure immediate use of breathing apparatus by the Control Room operators. (ref.: 6.6.1.1) The Chlorine Detection Subsystem should automatically isolate the Control Room and provide an indication in the Control Room to alert the Control Room operators of a chlorine release. (ref.: 6.5.11, p. 2, 4, 6.1.1.25)

1.1.1.4 *Smoke*

Sufficient controls shall be available to reduce the volume of normal make-up air, and/or to place the Control Room Emergency Ventilation Subsystem in service to remove smoke filled air from the Control Room. These controls function to remove smoke generated either within or external to the Control Room. Controls also permit complete or partial bypassing of the recirculation system and exhausting Control Room air directly to atmosphere. (ref.: 6.1.1.2, p. 7.18-9)

1.1.2 *TEMPERATURE CONTROL*

The CBHVAC System shall maintain areas of the CB at the temperature conditions acceptable for operation of the equipment located in the building. (ref.: 6.4.2, Criterion 4 and 6.1.1.2, Section M10.13) See Sections 2.1.4 and 3.6.9 for more information.

1.1.3 *CONTROL OF FLAMMABLE VAPORS*

1.1.3.1 Provisions shall be made for sufficient diffusion and ventilation of gases from storage batteries to prevent the accumulation of explosive mixtures. (ref.: 6.4.7, Section 305 (j)(7)) Hydrogen concentration shall be maintained below 2% (by volume). (ref.: 6.6.1.2, Section 5.3.2)

1.2 SYSTEM INTERFACES

This subsection identifies those systems which either "provide support to" (i.e., supporting systems) or "are supported by" (i.e., supported systems) the CBHVAC System. The discussion will describe the function provided by or to the interfacing system and will identify the design basis parameters associated with the interface.

CAUTION: When performing modifications to this system the capacity of the interfacing systems should be reviewed to verify the interfacing system capacity is not exceeded.

1.2.1 *SUPPORTING SYSTEMS*

1.2.1.1 *Fire Detection System - System 41*

The Control Room Area Fire Detection System sends an initiation signal to the CBHVAC System when smoke or heat is detected in one of the zones of the Control Building. The CBHVAC System receives additional signals from the heat detectors in the Emergency Filtration Train Charcoal beds. See Section 3.0 for automatic actions that occur on a Fire Detection System Signal.

1.2.1.2 *Chlorination System - System 43.1*

Detection of a high chlorine signal from the Control Building intake plenum detector or from the chlorine loading area detectors results in an isolation signal being sent to the emergency and the normal make-up damper, as well as other parts of the CBHVAC System. See Section 3.0 for automatic actions that occur on a high chlorine signal.

1.2.1.3 *480 VAC Distribution System - System 50*

The 480 VAC Distribution System provides power to the CBHVAC System fans from separate divisions to ensure that a loss of power will not remove more than one supply fan from service at a time (except Appendix R and Station Blackout scenarios). The safety related portion of the 480 VAC Distribution System will be covered in DBD-50 (ref.: 6.2.5.2).

1.2.1.4 *120 VAC Distribution System - System 52*

The 120 VAC Distribution System provides redundant, safety related power to the CBHVAC System controls. The control power is divisionalized and separated to ensure operation of the CBHVAC System when required. The safety related portion of the 120 VAC Distribution System will be covered in DBD-50 (ref.: 6.2.5.2). (ref.: 6.1.1.2, page M10.13-1)

1.2.1.5 *Area and Environs Radiation Monitoring System - System 11.1*

The Area and Environs Radiation Monitoring System provides an input to the CBHVAC System on a high radiation signal in the Control Room intake duct or in the electronic equipment room. See 3.1 for automatic actions that occur on a high radiation signal.

1.2.1.6 *Floor and Equipment Drain System - System 47*

The Floor and Equipment Drain System provides the pressure boundary, in the form of loop seals, for floor drains within the Control Room Emergency Zone.

1.2.2 *SUPPORTED SYSTEMS*

The following safety related systems are supported by the CBHVAC System since they are located in the CB. As described in Section 1.1.2, it is part of the function of the CBHVAC System to control temperature in the range required by the equipment located in the building. In addition to those systems listed here, systems that have controls located in the Control Room are supported by the CBHVAC. The CBHVAC System also functions with the CB Structure to provide protection from tornadoes and other natural events. (ref.: 6.1.1.2, p. M10.28-1; p. 10.10-9) See Sections 2.1.2 and 3.4 for information on protection from natural events.

1.2.2.1 *480 VAC Electrical Distribution System - System 50*

The portions of the 480 VAC Distribution System located in the Control Building are provided with an environment in which they can operate by the CBHVAC System. (ref.: 6.1.1.2, p. M7.9-1)

1.2.2.2 *Plant Batteries - System 51*

The Battery Rooms are supplied with ventilation by the CBHVAC in order to provide an appropriate temperature environment for proper operation. The CBHVAC also maintains a negative static pressure in the Battery Rooms with respect to adjacent areas to prevent the exfiltration of battery-generated gases.

1.3 TRANSIENT RESPONSE FUNCTIONS

1.3.1 *UFSAR CHAPTER 15 TRANSIENTS*

1.3.1.1 The CBHVAC responds to Chapter 15 transients that result in the release of radiation by isolating and entering the recirculation mode on a Control Room Area or Control Room Intake High Radiation Signal from the Area Radiation Monitoring System. The CBHVAC System does not respond directly to an accident signal, but to the high radiation signal. The accidents and special events evaluated in Chapter 15 which are listed as requiring the Control Room Emergency Ventilation System are:

- Control Rod Drop Accident. A supporting calculation is not retrievable, but the methodology, assumptions, and results of the bounding analysis may be found in UFSAR (ref.: 6.1.1.1) Section 15.4.6.

- Pipe Breaks Inside Primary Containment (up to and including a Design Basis LOCA). Current analysis may be found in NUS-4758 (ref.: 6.1.1.27)

- Fuel Handling Accident. A supporting calculation is not retrievable, but the methodology, assumptions, and results of the bounding analysis may be found in UFSAR (ref.: 6.1.1.1) Section 15.7.10.

- Pipe Breaks Outside Primary Containment, up to and including a design basis MSLB. An analysis using all of the current design basis assumptions is not retrievable, but summaries may be found in UFSAR, Section 15.6.3 (assuming pressurization to 1/8 in. W.G.). For information on the effects of increased unfiltered inleakage on Control Room Operator Doses following a Design Basis MSLB, see References 6.2.3.8 and 6.6.1.1.

1.3.2 *CHLORINE RELEASE EVENT*

The design basis chlorine release is based on a complete rupture of a 55-ton chlorine tank car. A complete supporting calculation is not retrievable, but the methodology, assumptions, and results of the bounding analysis may be found in UFSAR Section 6.4 and Reference 6.2.8.5. A chlorine release is detected by the Chlorine Detectors (System 43.1), which signal the CBHVAC System. The CBHVAC System goes into full recirculation mode, with no outdoor air intake (except for the Battery Rooms). The Emergency Filtration trains do not start since they do not remove chlorine and may be damaged by it. (refs.: 6.1.1.2, Section M14.5; 6.1.1.13, page 4-5; and 6.2.8.5)

1.3.3 *FIRE PROTECTION/APPENDIX R TRANSIENTS*

The Appendix R scenarios affecting the Control Room are primarily those which occur in the Control Building. For a fire in the Cable Spreading Rooms, Mechanical Equipment Room, or Control Room Emergency Zone, the Fire Detection System shuts down selected fans to prevent fanning the fire. See Section 3.1.5.3 for automatic actions on a fire signal. If the fire continues to grow such that ASSD procedures are required, the entire Control Room is assumed to be inaccessible. (ref.: 6.1.1.36)

If the fire is in one of the Battery Rooms, the operators are instructed (by procedure) to shut down the ventilation to that Battery Room. This is to allow proper operation of the fire dampers in the ducts. (ref.: 6.2.1.15, Field Revision 22) If the fire causes sufficient damage, Procedures are provided for shutdown without the affected Battery Room. (ref.: 6.1.1.36)

Fires in other areas of the plant may affect the Control Room if smoke from the fire is drawn into the Control Room. For these cases, the Emergency Filtration Trains may be run to prevent excessive introduction of smoke and remove residual smoke. (refs.: 6.1.1.2, 10.10-6 and 7.18-9; 6.6.1.2, Section 4.4.1) If excessive smoke has been introduced, the smoke removal isolation dampers on the 70' elevation may be closed and the access doors opened. This action will allow the Control Room Normal Ventilation System to draw smoke laden air out of the Control Room and discharge it to the Mechanical Equipment Room where it may be discharged to atmosphere. This plan will also be effective in removing smoke from a fire within the Control Room after the fire has been extinguished. See drawing F-4207 (ref.: 6.2.6.4) for smoke removal flow paths. See Sections 2.1.3, 2.2.3, 3.1.5, and 4.5.8 and DBD-101 for additional information on Fire Protection/Appendix R.

1.3.4 *STATION BLACKOUT*

For a Station Blackout event, as described in Reference 6.4.1, the CBHVAC System may not be available for the first hour, until the appropriate cross ties are made allowing operation of the single operable Emergency Diesel Generator. In order to ensure that Control Room Temperature during this first hour does not exceed 120°F, administrative controls have been implemented to keep the Control Room below 78° during normal operation and to implement around the clock trouble shooting if the temperature exceeds 85°F. Calculations have demonstrated that with a normal temperature of 85°F, the 120°F limit will not be exceeded. (ref.: 6.1.1.34 and 6.6.1.13) Ventilation equipment is then restarted. See Calculation 8S20-E-01 (ref.: 6.2.3.23) for loads that are restarted. (ref.: 6.6.1.10) See DBD-111 (ref.: 6.2.5.11) and Reference 6.2.3.25 for more information on Station Blackout. See Section 2.2.3.1 for design basis requirements relative to Station Blackout.

2.0 REGULATORY IMPOSED DESIGN REQUIREMENTS

This section identifies regulatory requirements and/or commitments that have some degree of applicability to the CBHVAC System design basis or relevance to the CBHVAC System design.

2.1 GENERAL DESIGN CRITERIA

The following is a listing of the applicable General Design Criteria from 10 CFR 50 Appendix A (ref.: 6.4.2). The "General Design Criteria for Nuclear Power Plants," listed in Appendix A to 10 CFR Part 50, were used during the licensing phase as the basis for an audit of the design features of the Brunswick Plant. Because of their general nature, the criteria can not always be applied literally but, in some instances, must be applied with interpretation and adaptation. In those instances, the conformance of plant design to the interpretations and adaptations are discussed here.

The wording of these GDCs is taken directly from Appendix F to the original FSAR (ref.: 6.1.1.2). Although the introductory text to the Appendix states that the GDC's were taken from the July 7, 1971 amendment, the actual wording compares to the February 20, 1971 amendment. In the SER (ref.: 6.6.1.1), the AEC stated that the intent of the May 21, 1971 version (effective date of the 2-20-71 amendment) was met. The actual wording BNP has committed to is that given in Appendix F to the original FSAR. Due to the general nature of the 'compliance' provided in Appendix F, most of the 'compliance' sections here are taken from other references, as indicated in the individual criteria.

The following sections are primarily design basis; however, some non-design basis information is provided here for clarity. Only those portions that are underlined are design basis.

2.1.1 *GENERAL DESIGN CRITERION 1 - QUALITY STANDARDS AND RECORDS*

Structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. A quality assurance program shall be established and implemented in order to provide adequate assurance that these structures, systems, and components will satisfactorily perform their safety functions. Appropriate records of the design, fabrication, erection, and testing of structures, systems, and components important to safety shall be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit.

Compliance:

The portions of the CBHVAC System needed to meet the safety function of the system are required to be purchased, installed, and maintained to Nuclear Quality Standards. (ref.: 6.1.1.2, Table D-1, p. MD.6-2) Section 4 of this DBD will provide Quality Class information for key components. See Section 2.3 for codes and standards of record. EDBS screen 404 provides the data base listing for BNP component level Quality Classification.

2.1.2 *GENERAL DESIGN CRITERION 2 - DESIGN BASIS FOR PROTECTION AGAINST NATURAL PHENOMENA*

Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiche without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed.

Compliance:

The CBHVAC System shall be designed, with appropriate margin for uncertainties, to permit safe plant operation or shutdown even under conditions of the most severe natural phenomena which have been conservatively postulated to occur at the site. (ref.: 6.1.1.2, Appendix F) See Section 3.4 for additional information on structural requirements and Section 4 for seismic requirements for key components. General information on Hazards Analysis and Seismic Qualification may be found in DBD-106 (ref.: 6.2.5.7) and DBD-102 (ref.: 6.2.5.6), respectively.

2.1.3 *GENERAL DESIGN CRITERION 3 - FIRE PROTECTION*

Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and Control Room. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety. Fire-fighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components.

Compliance:

The CBHVAC System shall support the operation of the Fire Suppression System and corresponding programs, as outlined in our responses to those programs. These responses are contained in References 6.1.1.8, 6.1.1.9, 6.1.1.7, 6.1.1.18, and 6.1.1.36.

The CBHVAC System is designed to isolate the various compartments in case of a fire and to remove particulates from the air in the operating area which consists of the Control Room and Electronic Equipment Rooms. (ref.: 6.1.1.2, Section 14.3-9)

No combustibles are located in close proximity to the Control Building Emergency Ventilation System Charcoal filters. Portable fire extinguishers and a carbon dioxide hose reel are located nearby. Detectors shall be provided in the filter banks and water hose racks shall be provided in the area. (ref.: 6.1.1.7, p. IV.C.3.d.4-5 and 6.6.1.2, Section 4.4.2, page 4-7)

The CBHVAC System shall have the capability for smoke removal from the Control Room. To exhaust smoke, dampers and doorways will be manipulated manually by personnel responding to a fire. (ref.: 6.1.1.7, p. IV.C.2.a-34 and 6.6.1.2, Section 4.4.1, p. 4-7)

The Fire Detection System in the Control Building should be designed to minimize spurious starts of the CBEAF subsystem. (refs.: 6.1.3.2, 6.1.3.3, 6.1.3.4)

See Sections 1.3.3, 2.2.3.2, and 3.1.5 for other fire protection related information. See Section 4.5.8 for information on fire dampers. General information on BNP's compliance with 10 CFR 50, Appendix R (ref.: 6.4.4) may be found in DBD-101 (ref.: 6.2.5.5).

2.1.4 *GENERAL DESIGN CRITERION 4 - ENVIRONMENTAL AND MISSILE DESIGN BASES*

Structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

Compliance:

The CBHVAC System shall be designed to maintain an environment in the CB acceptable for operation of the equipment located in the building. (ref.: 6.1.1.2, p. M7.9-1) The safety function of the CBHVAC System shall not be defeated by dynamic effects listed in this GDC. (ref.: 6.1.1.2, Appendix F) All tanks outside primary containment containing gas under pressure have been reviewed for effects of a potential tank rupture. Failure of these tanks shall not effect Seismic Category I (safety related) equipment. (ref.: 6.1.1.2, Section M10.24)

2.1.5 *GENERAL DESIGN CRITERION 5 - SHARING OF STRUCTURES, SYSTEMS, AND COMPONENTS*

Structures, systems, and components important to safety shall not be shared between nuclear power units unless it is shown that their ability to perform their safety functions is not significantly impaired by the sharing.

Compliance:

The Control Building and associated equipment are shared between the two units. This sharing shall not impair the ability to safely shutdown one unit while mitigating an accident in the other unit. (ref.: 6.1.1.2, p. B-7) An emergency air supply system controls interaction with any atmospheric radioactivity outside of the Control Building. Supply air passing through this system is treated by HEPA filters. The building is held at a slightly positive pressure to limit infiltration. (ref.: 6.1.1.2, p. B-14)

Smoke or dust generated inside the building are controlled by filtration of recirculated air. Battery rooms are divided to physically separate the facilities for Unit No. 1 and Unit No. 2. These provisions significantly reduce possible interactions at the Control Building. Control Room access and occupancy are not prevented by an accident in either reactor, up to and including the most severe postulated accidents. (ref.: 6.1.1.2, p. B-14)

2.1.6 *GENERAL DESIGN CRITERION 19 - CONTROL ROOM*

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, or its equivalent to any part of the 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.

Compliance:

The Brunswick Plant is provided with one common Control Room for the two units. The Control Room has been designed for continuous occupation under a "fortress" concept; i.e., it is located in a building which is designed to functionally survive the design basis earthquake, it is adequately shielded to reduce loss-of-coolant accident doses to its occupants to less than 5 rems to the whole body for the duration of the accident, and it shall have redundant ventilation and air conditioning equipment to assure continuous habitability during all conditions. The level of safety desired by Criterion 19 shall be maintained and shall not be compromised. (ref.: 6.1.1.1, Section 3.0; 6.1.1.2 Appendix F; 6.6.1.1, p. 6-21; 6.6.1.1, p. 6-21; and 6.6.1.7)

The results of Reference 6.1.1.26, Table 1, demonstrate that the doses would not exceed General Design Criteria 19 limits.

The Brunswick Plant Control Room shall be designed to support habitation during all adverse conditions. These conditions include: hurricanes and subsequent tidal actions, tornadoes, earthquakes, and a radiation cloud over the site. (ref.: 6.1.1.2, Section 14.3-9)

The Control Building Mechanical Equipment Room is not required to be habitable for mitigation of any accidents nor for safe shutdown of the plant. (ref.: 6.1.1.2, Section M10.50)

2.2 ADDITIONAL REGULATORY COMMITMENTS

This section identifies regulatory commitments that establish requirements, in addition to the GDCs listed above for the CBHVAC System design basis. These are typically Regulatory Guides, Regulations, Generic Letters, etc., to which BNP is committed. Specific information may be found in Sections 3.0 and 4.0.

2.2.1 *QUALITY ASSURANCE PROGRAM REQUIREMENTS*

The specific provisions of the Corporate Program are contained in Reference 6.1.4.2.

2.2.1.1 *10 CFR 50, Appendix B, Quality Assurance Program Requirements (ref.: 6.4.3*

BNP's Quality Assurance Program shall meet the requirements of 10 CFR 50 App. B (ref.: 6.4.3). (ref.: 6.1.1.2, p. 13.4-2) The portions of the CBHVAC System that meet the criteria of 10 CFR 50 App. B shall be included in the Quality Assurance Program. (ref.: 6.1.1.2, p. MD.6-1 & 2) See Section 4.0 of this DBD for key components subject to the requirements of this regulation. EDBS screen 404 contains the data base for BNP quality classifications.

2.2.1.2 *Regulatory Guide 1.33, Rev. 0, Quality Assurance Program Requirements (ref.: 6.5.5)*

BNP complies with the provisions of R.G. 1.33, Rev. 0, including the requirements and recommendations for administrative controls described in ANSI N18.7 (ref.: 6.3.5) with the exceptions stated in Section 1.8 of Reference 6.1.1.1. (refs.: 6.1.1.2, pp. 13.4-3 and 13.4-3A; 6.1.1.1, sect. 1.8; and 6.1.1.12)

2.2.1.3 *R.G. 1.64, Revision 0, Quality Requirements for the Design of Nuclear Power Plants (ref.: 6.5.8)*

Compliance with the provisions of R.G. 1.64, Rev. 0, for those areas of the QA Program applicable to the design and modification of the plant shall be met by complying with the applicable guidance of ANSI 45.2.11-1974, with the exceptions listed in Reference 6.1.1.1, Section 1.8. (refs.: 6.1.1.1, Sect. 1.8 and 6.1.1.12)

2.2.1.4 *Regulatory Guide 1.74, Rev. 0, Quality Assurance Terms and Definitions (ref.: 6.5.9)*

BNP shall comply with the provisions of R.G. 1.74, Rev. 0. (refs.: 6.1.1.1, sect. 1.8 and 6.1.1.12) Please note this document is the same as ANSI-N45.2.10.

2.2.2 *HABITABILITY REQUIREMENTS*

2.2.2.1 *Regulatory Guide 1.3, Rev. 1, Assumptions for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors (ref.: 6.5.1)*

The assumptions of Regulatory Guide 1.3, Revision 1, 1973, shall be used in evaluating the radiological impact of a Loss of Coolant Accident. (refs.: 6.1.1.2, Page 14.4-27; 6.1.1.13, Appendix E and; 6.1.1.1, Sections 2.3.4.1, 15.6.4.3.3 and 15.6.4.4)

The breathing rates given in R.G. 1.3, Rev. 1 shall be used in evaluating the impact of a Control Rod Drop Accident or an MSLB Accident. (ref.: 6.1.1.2, Sections 14.4.2.6 and 14.4.5.2 and 6.1.1.1, Sections 15.6.3.5, 15.4.6.6)

2.2.2.2 *Safety Guide 1.5, Assumptions for Evaluating the Potential Radiological Consequences of a Steam Line Break for Boiling Water Reactors (ref.: 6.5.2)*

The assumptions of Safety Guide 1.5 should be used in evaluating the radiological effects of a steam line break on Control Room Habitability. The NRC has used S.G. 1.5 in evaluating the BSEP MSLB Accident for compliance with NUREG-0737, Item *III.D.3.4*. (ref.: 6.6.1.7)

NOTE: This is not in conflict with the reference in Section 2.2.2.1 to using the breathing rates provided in Regulatory Guide 1.3. The breathing rates provided in both guides are the same; both were taken from TID-14844 (ref.: 6.6.4.5)

2.2.2.3 *Regulatory Guide 1.52, Rev. 1, Design, Testing and Maintenance Criteria for Engineered Safety Feature Atmosphere Clean-up System Air Filtration and Adsorption Units of Light-water-cooled Nuclear Power Plants (ref.: 6.5.6)*

The carbon filters included with the emergency filtration trains shall be able to satisfy the in-place testing acceptance criteria of Regulatory Guide 1.52, Revision 1, dated July 1976 as specified by Tech Spec. 3/4.7.2. This requirement is imposed by reference in NUREG-75/087, Sections 6.4 and 9.5.1.

2.2.2.4 *Regulatory Guide 1.78, June 1974, Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release (ref.: 6.5.10)*

Although BNP does not have a specific commitment to R.G. 1.78, the scoping analysis for toxic gas hazards was performed in accordance with this Regulatory Guide. Chemicals with concentrations at the Control Room air intake less than the toxic limit were eliminated from further study. See Reference 6.1.1.13, Section 2, and 6.1.1.1, Section 6.4.4 (Amendments 3 & 4) for details.

BNP is committed to remaining aware of offsite hazards and protecting operators as required. Toxic substances stored or transported in the vicinity of the site that may pose a threat to the plant operators upon a postulated release shall be reviewed and appropriate protection implemented. Also see NUREG-0737 and NUREG-75/087 requirements. (refs.: 6.5.15, 6.5.16, p. 6.4-12, and 6.6.1.1, supp. 1)

2.2.2.5 *Regulatory Guide 1.95, Rev. 1, Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chemical Release. (ref.: 6.5.11)*

The intent of R.G. 1.95, Rev. 1, shall be met by the design of the chlorine detection and isolation system. The BNP Control Room does not conform to any of the six types listed in the Regulatory Guide; however, protection of the Control Room operators from accidental chlorine release is accomplished by the habitability system. The guidance of R.G. 1.95 has been used. See Reference 6.1.1.13 for details.

2.2.2.6 *NUREG-75/087, Revision 1, Standard Review Plan*

The applicable portions of the standard review plan are Sections 2.2.1-2.2.2, 2.2.3, 6.4, 6.5.1 and 9.4.1. BNP shall meet the intent of these sections of the SRP as described in References 6.1.1.13 and 6.6.1.3. These are met in intent, though not in detail. Point-by-point evaluations are provided for Sections 6.4, 6.5.1, and 9.4.1. See also Sections 3 and 4 for compliance.

2.2.2.7 *TID-14844, Calculation of Distance Factors For Power and Test Reactor Sites (ref.: 6.6.4.5)*

Control Room Dose calculations shall be based on TID-14844 releases. (ref.: 6.1.1.13, Appendix E)

2.2.2.8 *NUREG-0737, Clarification of TMI Action Plan Requirements, Item III.D.3.4 (ref.: 6.5.15)*

The Control Room Ventilation System shall meet the requirements for Control Room Habitability outlined in NUREG-0737, Item III.D.3.4. (refs.: 6.6.1.3 and 6.6.1.7)

This item requires that licensees submit a detailed report on compliance with SRP Sections 2.2.1-2.2.2, 2.2.3, and 6.4. References 6.5.10, 6.5.11, and 6.6.2.1 are used for guidance. SRP 6.4 invokes the applicable requirements of SRPs 6.5.1 and 9.4.1. BNPs submittal in response to this requirement may be found in References 6.1.1.13 and 6.1.1.27. The essence of this document is to make the referenced SRPs part of BNPs design basis.

See Section 0.2.2.4 for historical evolution of compliance to this item.

2.2.3 *MISCELLANEOUS REGULATORY REQUIREMENTS*

2.2.3.1 *10 CFR 50.63, Loss of All Alternating Current Power (ref.: 6.4.1)*

The CBHVAC System shall meet the requirements of 10 CFR 50.63 as defined in BNP's submittals (refs.: 6.1.1.33, 6.1.1.34, 6.6.1.10, 6.6.1.12, and 6.6.1.13). See Section 1.3.4 for additional information relative to this regulation.

2.2.3.2 *10 CFR 50, App. R, Fire Protection Program for Nuclear Facilities Operating Prior to January 1, 1979*

The CBHVAC System shall meet the requirements of 10 CFR 50, Appendix R (ref.: 6.4.4) as outlined in Reference 6.1.1.36.

See Sections 1.1.1.4, 1.1.3.1, 1.3.3, 2.1.3, 3.2, and 4.5.8 for additional information on Fire Protection related requirements.

2.2.3.3 *NLS-87-101, Appendix R Safety Evaluation Report Comments (ref.: 6.1.1.30)*

The Control Room shall be maintained at a positive pressure relative to the Cable Spread Rooms to preclude or minimize smoke infiltration and preclude or retard fire propagation. (ref.: 6.1.1.30, page 7) See Reference 6.6.1.9 for NRC acceptance of this exemption.

2.2.3.4 *10 CFR 73, Physical Protection of Plants and Materials (ref.: 6.4.5)*

Ventilation openings into vital areas from non-vital areas shall be protected from unauthorized intrusion and personnel access to vital equipment. (ref.: 6.4.5) See Sections 2.3.1.1 and 3.4.7 for additional information on security requirements.

Vital equipment in the CBHVAC System shall be located only within a vital area which shall be located within a protected area (ref.: 6.4.5, Section 46(c)). This requirement must be considered whenever relocating or installing vital equipment. Vital/non-vital classification of equipment may be found in the Physical Security Plan (ref.: 6.1.1.35) or by contacting the BNP Security Manager.

2.2.3.5 *29 CFR 1910, Occupational Safety and Health Act (ref.: 6.4.7)*

Compressed air tanks shall be in accordance with 29 CFR 1910 Subpart M Paragraph 169. (ref.: 6.1.1.2, Section M10.24)

This requirement is applicable to the CBHVAC Air Receiver tanks. Also see Paragraph 1.1.3.1 for 29 CFR 1910 requirements.

2.2.3.6 *Regulatory Guide 1.97, Rev. 2, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident (ref.: 6.5.12)*

Instrumentation shall be provided to meet the intent of the requirements of Regulatory Guide 1.97, Rev. 2 as defined in the BSEP submittals, through Revision 2 (refs: 6.1.1.16, 6.1.1.17, 6.1.1.19, 6.1.1.21 and 6.1.1.21) and as accepted in the SE dated 05/14/85 (ref.: 6.6.1.5). Section 3.1.7 lists the instruments required by R.G. 1.97. See DBD-107 (ref.: 6.2.5.8) for additional information on R.G. 1.97.

In response to the requirement for Emergency Ventilation Damper Position, Brunswick interprets this variable (D24) to be dampers which could release radiation to the surrounding plant environment or expose Control Room personnel to radiation (ref.: 6.1.1.17, p. 29)

2.2.3.7 *Generic Letter 82-33, Requirements for Emergency Response Capability (ref.: 6.6.5.1)*

Design of CBHVAC System components on the Control board shall comply with the human factors requirements of GL 82-33. (ref.: 6.6.5.1, 6.6.1.4, 6.1.1.14, and 6.1.1.15) See Section 3.1.1.9 for additional information on designing for Human Factors.

2.2.3.8 *Generic Letter 88-14, Instrument Air Quality (ref.: 6.6.5.4)*

Instrument air used for safety related instruments and control components shall be of a quality compatible with the devices using the air. Safety-related air operated components shall function as intended on a loss of normal instrument air, including failing to the safe position on a loss of instrument air, or be supplied with a safety grade air supply. (ref.: 6.1.1.32 and 6.6.1.8)

2.3 CODES/STANDARDS OF RECORD

The following is a listing of codes and standards which are applicable, in part or entirely, to the CBHVAC System and which are tied to actual commitments. In cases where only a certain section of the standard is design basis, that section is specified. A reference to one section of a standard does not indicate commitment with the entire standard. Codes and standards which are utilized for good engineering practice, but are not required to meet the design basis may be found in Sections 3 and 4 or in the component specifications.

2.3.1 *ANS/ANSI/ASME STANDARDS*

See Section 2.2.1 for references to QA codes and standards of record.

2.3.1.1 *ANS 3.3-1982, Industrial Security for Nuclear Power Plants (supersedes ANSI N18.17-1973 (ANS 3.3- 1973)) (ref.: 6.3.3)*

BNP's Physical Security Program meets the requirements of ANS 3.3-1982. (ref.: 6.1.1.35) The requirements as related to ventilation systems are as follows: Openings in physical barriers (other than doors, gates, hatches, etc.) should not exceed 96 square inches if the smaller dimension exceeds six inches. Where this is not achievable, compensatory measures should be implemented to ensure that the integrity of the barrier is not compromised. (ref.: 6.3.3, Section 5.2.1) See Paragraph 3.4.7 for additional information on these requirements.

2.3.1.2 *ANSI B31.1.0 - 1967, Power Piping (ref.: 6.3.4)*

Piping in the CBHVAC System shall be designed in accordance with ANSI B31.1.0 -1967. (ref.: 6.1.1.2, Section A.2, Table A-4; 6.2.7.18; and 6.2.7.2)

2.3.1.3 *ANSI N509-1976, Nuclear Power Plant Air Cleaning Units and Components. (ref.: 6.3.10)*

The HEPA filters, filter and adsorber mounting frames, filter housing, fan, mounting, ductwork, and dampers shall meet the recommendations of ANSI N509-1976. (ref.: 6.1.1.13, Appendix A)

For instrumentation provided to meet the intent of ANSI N509, see section 3.1.2.4.

2.3.1.4 *ANSI N510-1975, Testing of Nuclear Air Cleaning Systems. (ref.: 6.3.11)*

Provisions for visual inspections and in-place testing in accordance with ANSI N510-1975 shall be provided. (ref.: 6.1.1.13, p. A-36, A-37 and 6.1.1.3, Section 4.7.2)

2.3.1.5 *ASME Section VIII - 1971, Boiler and Pressure Vessel Code*

The Control Room HVAC Air Compressor receiver tanks shall be designed in accordance with ASME Section VIII. (ref.: 6.1.1.2, Section A.2, Table A-4 and 6.2.7.18) This criteria is also a requirement of 29 CFR 1910 (See Section 2.2.3.5)

2.3.2 *IEEE STANDARDS*

2.3.2.1 *IEEE 279-1971, Criteria for Protection Systems for Nuclear Power Generating Systems, (ref.: 6.3.22)*

The CBHVAC System shall meet the single failure criteria as described in IEEE 279-1971. (ref.: 6.1.1.2, Sect. M8.8) See Section 3.1.6 for additional information.

IEEE 279 was withdrawn in 1985, but still applies to BNP. See DBD-110 (ref.: 6.2.5.10) for additional information on single failure criterion.

2.3.2.2 *IEEE 308-1971, Class 1E Electric Systems for Nuclear Power Generating Stations (ref.: 6.3.23)*

Class 1E equipment shall meet the requirements of IEEE 308-1971 (ref.: 6.1.1.2, p. M8.1-3)

Class 1E equipment shall be able to perform its function under normal and design basis events. The CBHVAC System shall maintain the environment in the CB such that equipment in the CB can perform its function. (ref.: 6.1.1.2, section M10.5)

2.3.2.3 *IEEE 323-1971, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations (ref.: 6.3.24, 6.3.25)*

Class 1E equipment shall meet the requirements of IEEE 323-1971. (ref.: 6.1.1.2, p. M8.1-3)

Class 1E equipment shall be qualified to perform in the environment in which it will be operating both during normal operation and post-accident. The CBHVAC System shall maintain the environment in the CB such that equipment will perform for it's qualified life. (ref.: 6.1.1.2, p. M7.9-1) This requirement applies to equipment supplied for original construction through 09/30/83.

2.3.2.4 *IEEE 323-1974, IEEE standard for qualifying Class 1E Equipment for Nuclear Power Generating Stations (ref.: 6.3.25)*

Replacements for Class 1E equipment needed to meet the requirements of Regulatory Guide 1.97, shall be qualified to IEEE-323-1974. BNP will qualify by testing only Components located in harsh environments. (refs.: 6.1.1.16, 6.1.1.17, 6.1.1.19, and 6.1.1.21) This requirement applies to equipment replaced after our R.G. 1.97 Submittal (09/30/83).

2.3.2.5 *IEEE 344-1971, Guide for Seismic Qualification of Class 1E Electrical Equipment (ref.: 6.3.26, 6.3.27)*

Class 1E equipment in the CBHVAC System shall meet the requirements of IEEE 344-1971. (ref.: 6.1.1.2, M7.8, M7.16, and M8.1-3) This requirement applies to equipment supplied for original construction through 09/30/83.

2.3.2.6 *IEEE 344-1975, Guide for Seismic Qualification of Class 1E Electrical Equipment (ref.: 6.3.27)*

Replacements for Class 1E equipment needed to meet the requirements of Regulatory Guide 1.97, shall be qualified to IEEE-344-1975. (refs.: 6.1.1.16, 6.1.1.17, 6.1.1.19, and 6.1.1.21) This requirement applies to equipment replaced after our R.G. 1.97 submittal (09/30/83).

2.3.2.7 *IEEE 379-1972, IEEE Trial-use Guide for the Application of the Single Failure Criterion to Nuclear Power Generating Station Protection Systems (ref.: 6.3.28)*

The CBHVAC System shall meet the single failure requirements of Section 6.5 of IEEE 379-1972. This criteria, as applied to the CBHVAC System, is for prevention of common mode failure of safety related equipment due to temperature concerns. (ref.: 6.1.1.2, Section M8.8) See Sections 3.1.6 and 3.6.7 for additional information.

3.0 SYSTEM DESIGN REQUIREMENTS

The information in this section will represent calculation outputs, methods used, and design parameters that support the design basis. This information is considered useful both to the designer and the plant engineer, but is not design basis unless it is underlined.

3.1 INSTRUMENTATION AND CONTROL

3.1.1 *GENERAL*

3.1.1.1 The arrangement of the controls and distribution system for the CBHVAC System has been divisionalized providing separation and redundancy to ensure equipment operation. (ref.: 6.1.1.2, Section M8.8-1)

3.1.1.2 Controls drawings provided via Specification 252-22 (ref.: 6.2.7.18) should be in accordance with ISA-S5.1 (ref.: 6.3.32).

3.1.1.3 The instrument air for the CBHVAC control system should be of a quality compatible for use with ventilation control components. (ref.: 6.1.1.32)

3.1.1.4 Complete manual and automatic controls for ventilation, temperature, and pressure control should be provided. (ref.: 6.1.1.2, Section 7.18.3.6.f)

3.1.1.5 Additional monitoring instrumentation includes the Battery Room temperatures and differential pressure, outside air temperature, air conditioning temperatures for Unit 1 and Unit 2, instrument air compressor pressure (upstream and downstream of reducer) and the normal and emergency makeup air damper position indication. (ref.: 6.1.1.13, p. A-26)

3.1.1.6 When the system is placed into operation, either in the emergency mode or the normal mode, system malfunction would be indicated in the Control Room either by air flow switches to show that a fan is not running and limit switches to indicate the associated damper position, or, as in the case of the emergency recirculation system, by the starting of the standby filter train and associated damper positions. The normal and emergency damper positions are also indicated in the Control Room. (ref.: 6.1.1.13, p. A-27)

3.1.1.7 Meteorological data, for use in habitability evaluations, is available on ERFIS via a connection from the Meteorological tower.

3.1.1.8 *Annunciators*

3.1.1.8.1 The following fans are equipped with alarms to notify operators of a fan trip. This is in accordance with good engineering practice.

- Battery Room Fans (one alarm per Battery Room actuated by either a supply or exhaust fan trip) (ref.: 6.6.3.2)
- Cable Spread Room Fans (one alarm per Cable Spread Room actuated by either a supply or exhaust fan trip)
- Control Building Emergency Recirculation Fans (one fail to run alarm per fan and one inoperable alarm actuated by either fan)
- Control Room Supply Air Fans (one alarm per fan)
- Control Room Exhaust Fan

- Control Building Mechanical Equipment Room Fans (actuated by either a supply or exhaust fan trip)
- Condenser Area Booster Fan (one alarm per fan)

The Battery Room Vent Fan Trip Annunciators are also required by original commitments to the AEC. (refs.: 6.1.1.2, Section 7.18.3.6; 6.1.2.17; 6.1.2.18; 6.6.1.2, Section 5.3.2; 6.6.3.1; and 6.6.3.2)

3.1.1.8.2 Control Room alarms are actuated for Control Room intake air high chlorine, low instrument air pressure, low Mechanical Room temperature and various fire alarms including the charcoal filter high temperature alarm. (ref.: 6.1.1.13, p. A-26) A Control Room annunciator is actuated by any one of three Control Room Area Radiation Monitors. (ref.: 6.1.1.13, p. 4-4) Also see POM procedure for UA-3.

3.1.1.9 *HUMAN FACTORS REQUIREMENTS*

Human factors design basis requirements for Control Board instrumentation may be found in Section 2.2.3.7. To meet these requirements, BNP uses the guidelines of NUREG-0700 (ref.: 6.5.14) and the acceptance criteria provided in NUREG-0801 (ref.: 6.5.17). See Reference 6.1.1.31 for BNP's response to the human factors review requirements of this Generic Letter. The guidelines and acceptance criteria required by this Generic Letter have been translated into Design Guides DG-VIII.53 (ref.: 6.2.8.18) and DG-VIII.58 (ref.: 6.2.8.19) for use in design. See DBD-109 (ref.: 6.2.5.9) for additional information on Human Factors Requirements.

3.1.2 *SUBSYSTEM INSTRUMENTATION*

3.1.2.1 *Control Building HVAC Air Compressors Instrumentation*

3.1.2.1.1 The Control Building HVAC Air Compressors are automatically started and stopped by pressure switches. A low instrument air pressure condition is alarmed in the Control Room. Relief valves are provided on each air receiver to protect the receivers and downstream components. Local gauges are provided both before and after the pressure regulating valves for monitoring and verification of alarm conditions.

3.1.2.2 *Battery Room Subsystem Instrumentation*

3.1.2.2.1 The Battery Room Supply and Exhaust dampers close to allow the fire dampers to close to prevent the spread of fire. This is accomplished by manual action of the operators from the Control Room. (ref.: 6.2.1.15, FR 22, P. A10 and A13A) This is to support the design basis requirements of Section 2.1.3.

3.1.2.2.2 The controls for the Battery Room Ventilation Subsystem are arranged for remote manual operation from the Control Room. The loss of the ventilation system in any of the Battery rooms is indicated by an alarm in the Control Room. (ref.: 6.1.1.2, Section 7.18.3.6.g)

3.1.2.3 *Control Room Normal Ventilation Subsystem Instrumentation*

3.1.2.3.1 A thermostatic controller cycles the electrical heating coils located in the air duct, as well as the refrigerant compressors and associated thermostatic expansion valves to regulate the Control Room air temperature to maintain 75 °F.

3.1.2.3.2 See Sections 3.1.3, 3.1.4, and 3.1.5 for automatic events associated with the Control Room Normal Ventilation System

3.1.2.4 *Control Room Emergency Ventilation Subsystem Instrumentation*

3.1.2.4.1 The emergency air filtering trains may be operated in the automatic or manual mode. (ref.: 6.1.1.13, p. 4-7)

3.1.2.4.2 Each system should be provided with instrumentation to signal, alarm, and record pressure drop and flow rate in the Control Room. (ref.: 6.6.1.1, Section 6.5.1) The following instrumentation is provided (ref.: 6.1.1.13, p. A-25, 26):

- Differential pressure gauges are furnished across the following elements: HEPA filters, calibrated flow elements, and charcoal absorbers
- Thermometers are installed before and after every filter bank.
- A local relative humidity indicator (direct reading type) is installed between the HEPA filter bank and the charcoal filters.
- Each emergency filter train contains a calibrated flow measuring device fitted with a pressure drop gauge.

3.1.2.4.3 In the fully open position, each emergency air filtering train damper actuates a limit switch to initiate the start of the filtering train recirculation fan. (ref.: 6.1.1.13, p. 4-8)

3.1.2.4.4 See Sections 3.1.3, 3.1.4, and 3.1.5 for automatic events associated with the Control Room Emergency Ventilation System.

3.1.3 *DETECTION AND AUTOMATIC EVENTS, CHLORINE*

3.1.3.1 The Control Room should be isolated 10 seconds after detectors are exposed to a high chlorine concentration. (5 ppm or greater) (ref.: 6.1.1.1, p. 6.4.1-2 and 6.5.11) Our original commitment was for detection in 3 seconds and isolation in 7 seconds (refs.: 6.1.1.2, Section M14.5 and 6.6.1.1 Page 6.22, 23). Installation of the new Chlorine Detectors redistributed the 10 seconds to five seconds for the detectors and five seconds for the dampers (ref.: 6.2.1.14).

3.1.3.2 Chlorine isolation consists of closing the outside air make-up damper, automatic termination of ventilation to both the Mechanical Equipment Room and Cable Spreading Room and stopping the Control Building Exhaust Fan. If running, the Emergency Air Filtration Fans are also stopped to prevent degradation of the charcoal filters by chlorine. This occurs during each mode of operation. (ref.: 6.1.1.13, pp. 4-5, 4-6, 4-8, 4-9) The normal intake damper resets to its normal mode of operation automatically when the high chlorine condition is removed.

3.1.3.3 The Cable Spreading Room supply and exhaust fans may be operated during an emergency by the use of a key operated bypass switch. See Section 3.6.6.5 for additional information on this feature. (refs.: 6.1.1.2, Section 7.18.3.6 and 6.1.1.13, p. 4-10)

3.1.3.4 The ventilation systems for the Battery Rooms continue to operate during a chlorine event. (ref.: 6.1.1.13, p. 4-6) This is to prevent hydrogen from accumulating to the explosive limit.

3.1.3.5 Detection of high chlorine concentration in the Chlorination Building alarms in the Control Room and at the sensor location. Detection of high chlorine concentration at the tank car or in the Control Room intake will alarm in and automatically isolate the Control Room. (ref.: 6.1.1.2, Section M14.5 and 6.1.1.13, p. 4-5)

3.1.4 *DETECTION AND AUTOMATIC EVENTS, RADIATION*

3.1.4.1 Operation of the Control Room Emergency Ventilation Subsystem is automatically initiated by abnormally high radiation levels detected by the Control Building Area Radiation Monitors. (refs: 6.1.1.13, p. 4-3 and 6.6.1.1 p. 6-21) Two redundant radiation monitors located in the Control Building air inlet plenum are provided to protect against the intake of contaminated outside air. (ref.: 6.1.1.2, Section 7.17.3.7 and 6.1.1.13, p. 4-3) The control action (high radiation trip) is initiated by either a single upscale or two downscale trips. (ref.: 6.1.1.2, Section 7.17.3.7) An additional radiation monitor is provided for the control room general area. A high radiation signal from this ARM also isolates the Control Room.

3.1.4.2 The monitor trip points should be set at 2.5 times the average background radiation level. (ref.: 6.1.1.2, Section M10.13-2 and 6.1.2.16, # 42) This trip setting applies to the control room area monitors. It has been determined by calculation that acceptable operator doses will result from having the Control Room Intake Monitors set higher than 2.5 times background, since the Control Room background radiation level is extremely low. (ref.: 6.2.3.15)

3.1.4.3 Should any of the monitors detect high radiation, the Control Room annunciator is actuated and the following control actions occur automatically: (ref.: 6.1.1.13, p. 4-4, 4-10 and 6.1.1.1, Section 6.4.2.2)

- The Normal Fresh Air Intake Damper for the Control Room is closed. (Also ref.: 6.1.1.2, section 7.18.3.7)
- The Control Room Emergency Ventilation Subsystem is placed in service, with the Emergency Recirculation Damper open. (Also ref.: 6.1.1.2, section 7.18.3.7)
- The Cable Spreading Room Ventilation Subsystems are shut down. Fans may be operated by the use of a key operated bypass switch. See Section 3.6.6.5 for additional information on this feature. (refs.: 6.1.1.2, Sections 7.18.3.6, .7 and 6.1.1.13, p. 4-9)
- The Mechanical Equipment Room Ventilation fans are shut down.
- The Control Building exhaust fan is shut down and the exhaust damper is closed. (Also ref.: 6.1.1.2, section 7.18.3.7)
- The Battery Room Ventilation Subsystem continues to operate during a Radiation Event.

3.1.4.4 The radiation shutdown described in 3.1.4.3 can be accomplished manually by the operator when deemed necessary. (ref.: 6.1.1.2, Section M10.13-_) This is provided when a high Chlorine signal is not present.

3.1.4.5 If the dedicated fan associated with the preferred emergency filter train fails to start or trips, the standby filter train and dedicated fan receive an automatic start signal within 10 seconds of the fail-to-operate condition. Failure of the filter unit fan is annunciated in the Control Room. (ref.: 6.1.1.13, p. 4-8)

3.1.4.6 On loss of power to the radiation monitors, the trip circuits are set to cause an alarm and fail to the safe position (alarm). (ref.: 6.1.1.2, section 7.13.3)

3.1.4.7 On resetting of the high radiation signal, the Normal Intake and Emergency Recirculation Dampers automatically reposition and the Emergency Filtration train shuts down.

3.1.5 *DETECTION AND AUTOMATIC EVENTS, SMOKE/FIRE*

3.1.5.1 A smoke and heat detection system is provided in the Control Room to alert the operator of an abnormal condition which could require Control Room isolation. (ref.: 6.1.1.2, Section M10.13, item (2))

3.1.5.2 Should smoke-filled air be drawn into the Control Room, smoke detectors within the Control Room and Mechanical Equipment Room alarm. Controls are available to reduce the volume of normal makeup air, and/or to place the bypass ventilation system filter trains in service. (refs.: 6.1.1.2, Sections 7.18.4 and 6.1.1.13, p. 4-5) Controls also permit complete or partial bypassing of the recirculation system and exhausting direct to atmosphere. (refs.: 6.1.1.2, Section 7.18.4)

3.1.5.3 On detection of smoke and/or heat the following automatic actions occur:

- The Control Room Emergency Ventilation Subsystem is initiated. (ref.: 6.1.1.13, p. 4-3) This includes closing the Normal Intake Damper and opening the Emergency Recirculation Damper.
- The Control Building Exhaust fan is tripped.
- The Cable Spreading Room supply and exhaust fans are automatically tripped. Fans may be operated by the use of a key operated bypass switch. See Section 3.6.6.5 for additional information on this feature. (refs.: 6.1.1.2, Section 7.18.3.6 and 6.1.1.13, p. 4-10)
- The supply and exhaust fans for the Mechanical Equipment Room automatically trip.

3.1.5.4 A review was conducted to evaluate and document the adequacy of the present location of the smoke detectors for introduction of smoke from the outside. This review was conducted to determine the necessity of adding a smoke detector in the Control Room Normal Intake Duct. The review concluded that installation of an additional smoke detector was not warranted. Fire detection equipment is installed in the Mechanical Equipment Room and receives the same air as that of the makeup air duct. A signal from these detectors will also isolate the Control Room. This provides sufficient indication and protection from smoke intrusion. (ref.: 6.1.1.13, p. A-19 and 6.1.2.21)

3.1.5.5 On detection of excessive heat inside an Emergency Filtration Train, the train automatically shuts down (ref.: 6.1.1.13, p. 4-8) and the inlet and outlet dampers close. This one of the justifications for not providing automatic suppression in the trains. Other factors justifying omission of automatic suppression are that the radiation loading following an accident is low and that the units are normally isolated. (ref.: 6.6.1.2, Section 4.4.2)

3.1.5.6 On resetting of the Fire Detection System, the Normal Intake and Emergency Recirculation Dampers automatically reposition and the Emergency Filtration Train shuts down.

3.1.6 *SINGLE FAILURE SUPPORTING INFORMATION*

3.1.6.1 Electrical power required by the Control Room Normal Ventilation System is powered from separate divisionalized MCCs. No single failure shall cause loss of power to two of the three MCCs. (ref.: 6.1.1.2, Section M10.13-1)

3.1.6.2 Single active failure criterion is satisfied except for 2L-D-CB, 2J-D-CB, 2H-D-CB, and SV-916. (ref.: 6.1.1.13, A-11) See Section 4.5.2 for damper failure position criteria. This is acceptable because:

- On loss of power or damper controller failure the 2H and 2J dampers are spring loaded to fail safe (closed). (ref.: 6.1.1.13, A-11)

- 2H-D-CB can be shut manually by disconnecting the actuator, shifting the damper blade and locking the damper in place. (ref.: 6.1.1.13, A-13; 6.6.1.3, p. 3)

- Failure of 2H-D-CB solenoid or loss of air would cause the damper to fail-safe to the shut position. (ref.: 6.1.1.13, p. A-13).

- Failure of the ventilation exhaust fan would not cause loss of critical ventilation since operating either one of the two emergency recirculation fans associated with the emergency air filters will provide necessary ventilation. (ref.: 6.1.1.2, Section M10.13-1)

- On loss of power, 2L-D-CB, the fresh air make-up damper fails safe (closed). (ref.: 6.1.1.13, p. A-11)

- Failure of SV-916 to function during a chlorine release event does not affect either damper 2J-D-CB or 2L-D-CB. This is because 2J-D-CB is already closed and SV-916 does not control 2L-D-CB during this casualty. (ref.: 6.1.1.13, p. A-13) If an EAF train is running, 2J-D-CB would be open and would require operation of SV-916 to close. Failure of the SOV during this event would still be acceptable since This failure would be less severe than the failure of 2L-D-CB, which has previously been evaluated as acceptable. (ref.: 6.1.3.6)

- Failure of SV-916-1 causes 2L-D-CB to close. (ref.: 6.1.1.13, A-13)

- Failure of Solenoid Valve SV-916 to properly function after radiation or smoke detection would cause Damper 2L-D-CB to remain open and Damper 2J-D-CB (emergency recirculation damper) to remain shut. This was determined to be the worst case degradation of the CBHVAC following a single failure of an active component during a casualty. (ref.: 6.1.1.13, p. A-12)

- The whole body and thyroid radiation limits of GDC 19 are not exceeded upon failure of SV-916 during a LOCA, therefore this instance does not result in a threat to Control Room personnel. (ref.: 6.1.1.13, p. A-12)

- Failure of the Solenoid Valve SV-916 during smoke detection would allow smoke to enter the Control Room, if the origin of the smoke was from outside the Control Building. Filtration of recirculated air would not occur. In this case, the operators would have access to emergency air breathing apparatus, if needed, until personnel were able to manually close the inlet air damper and open the recirculation damper. (ref.: 6.1.1.13, p. A-13)

- Failure of the Control Building Exhaust Damper (2H-D-CB) is not a concern for smoke or radiation emergencies because the exhaust fan is stopped during these events and the Control Room remains pressurized. (ref.: 6.1.1.13, p. A-13)

3.1.6.3 No single failure in the Chlorine Detection System shall prevent automatic isolation of the Control Room Ventilation System in the event of an accident which causes the chlorine detectors to alarm. (refs.: 6.1.1.2, Section M14.5 and 6.1.1.1, Table 6.4.4-2)

3.1.7 *REGULATORY GUIDE 1.97, REVISION 2 INSTRUMENTATION*

3.1.7.1 The following instruments/indications in the CBHVAC System are provided for conformance with R.G. 1.97, Revision 2, Type D variable - Emergency Ventilation Damper Position:

- Emergency Recirculation Damper position (open-closed)
- Normal Make-up Damper position (open-closed)
- Cable Spreading Room Supply Fan - Unit 1 and 2 (on-off)
- Cable Spread Room Exhaust Fan - Unit 1 and 2 (on-off)
- Mechanical Equipment Room Supply Fan (on-off)
- Mechanical Equipment Room Exhaust Fan (on-off)
- Emergency Recirculation Fans - A and B (on-off)
- Control Room Exhaust Fan (on-off)
- Mechanical Equipment Room Exhaust Damper position (open-closed)
- Mechanical Equipment Room Supply Damper position (open-closed)
- Cable Spreading Room Exhaust Damper position - Unit 1 and 2 (open-closed)
- Cable Spreading Room Supply Damper position - Unit 1 and 2 (open-closed)
- Control Room Exhaust Damper position (open-closed)
- Emergency Recirculation Fans - A and B Supply Damper position - (open-closed)
- Emergency Recirculation Fans - A and B Exhaust Damper position - (open-closed)

3.2 ELECTRICAL

3.2.1 Electrical equipment should be capable of direct connection to the Electrical Distribution System. Refer to DBD-50 (ref.: 6.2.5.2) for requirements of the electrical systems.

3.2.2 Refer to DBD-112 (ref.: 6.2.5.12) for general requirements for cable and raceway.

3.2.3 Motors in the CBHVAC System are provided with space heaters to maintain the internal equipment temperatures above the dewpoint when the motor is not in service. The heaters are connected to energize when the motors are not in service. (ref.: 6.2.7.8)

3.2.4 The system is powered from the emergency Electrical Distribution System for reliability during all operating conditions. (ref.: 6.1.1.2, Section 7.18.3.6)

3.3 MECHANICAL

3.3.1 *GENERAL/CODES AND STANDARDS FOR SYSTEM DESIGN*

3.3.1.1 The Cable Spreading Room, Mechanical Equipment Rooms, Control Room, and Battery Rooms are independently ventilated to minimize the potential for the spreading of smoke throughout the building. Fire dampers are provided for penetrations through firewalls. (ref.: 6.1.1.13, p. A-18)

3.3.1.2 Self-contained breathing apparatus (SCBA) for Control Room personnel should be on hand. A six hour bottled air supply should be available onsite with unlimited offsite replenishment capability. (ref.: 6.5.16, p.6.4-6; 6.5.11, p. 4) See Sections 3.6.1.7 and 3.6.7.1 for additional information on SCBAs.

3.3.1.3 NED Design Guide IV.8, 'HVAC System Design' (ref.: 6.2.8.17) contains useful information for the design of HVAC Systems. It should be noted that the design guide is a generic document written for use in multiple applications and where deviations arise between this document and the design guide, this document shall prevail.

3.3.1.4 *SMACNA Standards*

3.3.1.4.1 The CBHVAC System was originally designed and constructed to SMACNA's 'High Velocity Duct Construction Manual', Second Ed., dated 1969 (ref.: 6.3.34). This standard should be used wherever available for ductwork changes, except as listed in Paragraph 3.3.1.4.2.

3.3.1.4.2 As part of the resolution to NCR-89-013 (ref.: 6.2.8.15), a comparison was done between existing HVAC supports and ductwork and installations known to have withstood seismic events. In analyzing ductwork the allowable stresses were used from SMACNA's 'Rectangular Industrial Duct Construction Standards' (ref.: 6.3.36) and 'Round Industrial Duct Construction Standards' (ref.: 6.3.37), as appropriate. Changes to ductwork should consider the allowable stresses listed in these standards. See Sections 0.2.2.7 and 3.4.3.6 for additional information on the referenced NCR and seismic concerns.

3.3.1.4.3 Other SMACNA standards appropriate for use for design changes to the CBHVAC System are:

3.3.1.4.3.1 SMACNA, HVAC Duct System Design Tables and Charts (ref.: 6.3.38)

3.3.1.4.3.2 SMACNA, Accepted Practice for Industrial Duct Construction (ref.: 6.3.39)

3.3.1.4.3.3 SMACNA, HVAC Duct Construction Standards, Metal and Flexible (ref.: 6.3.35)

3.3.1.5 *ASHRAE Standards*

3.3.1.5.1 The CBHVAC System should be balanced using the techniques outlined in the ASHRAE Standards (ref.: 6.3.13).

3.3.1.5.2 The original design of the CBHVAC System was in accordance with the 1972 version of ASHRAE's Fundamentals Handbook (ref.: 6.3.13). This was used for testing, balancing, minimum required make-up air rates, and contamination concentrations (from gases such as CO_2). This version should be used for modifications where available.

3.3.1.5.3 Other ASHRAE Standards appropriate for use with the CBHVAC System are:

3.3.1.5.3.1 ASHRAE Equipment Handbook (ref.: 6.3.12)

3.3.1.5.3.2 ASHRAE Fundamentals Handbook (I-P or SI Edition) (ref.: 6.3.14)

3.3.1.5.3.3 ASHRAE HVAC Systems and Applications Handbook (ref.: 6.3.15)

3.3.1.5.3.4 ASHRAE 41.1, Standard Method for Temperature Measurement (ref.: 6.3.16)

3.3.1.5.3.5 ASHRAE 41.3, Standard Method for Pressure Measurement (ref.: 6.3.17)

3.3.1.5.3.6 ASHRAE 41.7, Standard Method for Measurement of Flow of Gas (ref.: 6.3.18)

3.3.1.5.3.7 ASHRAE 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems (ref.: 6.3.19)

3.3.2 *CONTROL ROOM EMERGENCY VENTILATION SUBSYSTEM REQUIREMENTS*

3.3.2.1 The Control Room Emergency Ventilation Subsystem consists of two filtering trains. One filtering train is required for system operation with the other serving as the standby train. (ref.: 6.1.1.13, p. 4-3)

3.3.2.2 The Control Room Emergency Ventilation Subsystem provides the additional filtering necessary to maintain habitable conditions within the Control Room area during emergency situations. (ref.: 6.1.1.13, p. A-18) These emergency situations are those related to introduction of smoke or radiation into the Control Room.

3.3.2.3 Expected conditions for the filter system, including maximum pressure and pressure differential, radiation dose rate received by the components, relative humidity, and maximum and minimum temperature should be based on the conditions in a postulated design-basis accident. (ref.: 6.5.16, Section 6.5.1-3) The maximum differential pressure on the system would be expected during a tornado; however, tornado check valves are installed to ensure the HVAC System integrity during this event. The combined normal pressure drop across the HEPA filters and adsorber banks is less than 8.5 in. W.G. A sudden pressure drop across the filters would be indicated on the differential pressure gauges. (ref.: 6.1.1.13, p. A-28)

3.3.2.4 An emergency bypass filter system is provided to protect the occupants of the Control Room complex from airborne radioactive particles and to provide some outside air of suitable purity for breathing during emergency situations. The emergency bypass system is sized for the normal minimum outside air requirements for adequate personnel and health requirements in accordance with the latest published ASHRAE standards (ref.: 6.3.13). This system includes high efficiency particulate adsorbers (HEPAs) and carbon filters. (ref.: 6.1.1.2, Section 7.18.3.6.e)

3.3.2.5 Provisions should be made for in-place testing of the filter units initially and routinely thereafter. (ref.: 6.1.1.13, p. A-37)

3.3.2.6 Individual filter systems should be limited to a flow rate of 30,000 cfm (ref.: 6.5.16, Section 6.5.1-3) The volumetric flow rate of the emergency system is less than 30,000 cfm. (ref.: 6.1.1.13, p. A-25) Design flow rate of 2000 scfm ±10% is verified by testing. (ref.: 6.1.1.3)

3.3.2.7 There are no instrument air tube lines from the Control Room to any part of the plant including the drywell or suppression chamber of either reactor, thus eliminating the possibility of direct transfer of radioactive material to the Control Room through pneumatic tubes. No oil, high pressure steam or other process lines directly communicate between the Control Room and the process systems. (ref.: 6.1.1.2, p. 7.18-2)

3.3.2.8 The multi-room area (i.e., Control Room, Computer Room, Electronic Equipment Room) is maintained at a positive static pressure relative to surrounding areas to prevent the inadvertent inflow of toxic gases, radioactive airborne contamination, and smoke. (ref.: 6.1.1.2, 7.18.3.6.a, 6.1.1.13, p. 4-2)

3.3.3 *CONTROL ROOM NORMAL VENTILATION SUBSYSTEM REQUIREMENTS*

3.3.3.1 The Control Room Normal Ventilation Subsystem makeup air and recirculated air are constantly filtered by the recirculation air filter to remove dust, smoke, and other particulates that may be present in the air. (ref.: 6.1.1.13, p. A-18)

3.3.3.2 The Control Room Normal Ventilation Subsystem is equipped with three air conditioning units (one serving as a common spare) capable of handling the large concentrated heat gains from the computers and electronic equipment as well as the variable heat gains from personnel and lighting. (refs.: 6.1.1.13, p. A-16, 6.1.1.2, Section 7.18.3.6)

3.3.3.3 The Control Room cooling coils (evaporator coils) are protected from vertical stratification and resultant coil icing and efficiency loss by elimination of the square corner in the plenum prior to the coil and by turning vanes to direct and distribute the air into the coil. (ref.: 6.1.2.2)

3.3.3.4 Heating coils are provided for the Control Room Area for initial plant start-up and extended winter outages. During other times the heat load in the Control Room area is larger than the anticipated heat loss. (refs.: 6.1.2.2 and 6.1.2.4) See Section 4.9.2 for additional information on the Control Room heating coils.

3.3.4 *BATTERY ROOM VENTILATION SUBSYSTEM REQUIREMENTS*

3.3.4.1 The requirements for ventilation in IEEE-484-1975 should be met. BNP is not committed to this standard, however, its use is good engineering practice. These requirements are:

- Ensure the battery area is ventilated during charging. (ref.: 6.3.30, Section 3.2 (8))
- The area selected for battery installation should be clean, dry, and well ventilated. (ref.: 6.3.30, Section 4.1 (3))

- The optimum cell electrolyte temperature, 77°F(25°C) is the basis for rated performance. A location where this temperature can be maintained will contribute to optimum battery life, performance, and cost of operation. Extreme ambient temperatures should be avoided because low temperatures decrease battery capacity while prolonged high temperatures shorten battery life. (ref.: 6.3.30, Section 4.1 (4))

- The l[illegible]on or arrangement should result in no greater than a 5°F (3°C) [illegible]erature difference between cells at a given time. Local[illegible] heat sources such as direct sunlight, radiators, steam pipes, and space heaters should be avoided. (ref.: 6.3.30, Section 4.1 (5))

- The battery area should be ventilated either by natural or induced ventilation to prevent accumulation of hydrogen and to maintain design temperature. The ventilation system should limit hydrogen accumulation to less than 2% of the total volume of the Battery Room. (ref.: 6.3.30, Section 4.1.4)

3.3.4.2 The Battery Rooms are provided with 15 air changes per hour. There is no possibility of air stagnation since both a supply and exhaust fan have been provided. Should one of these fans fail, the number of air changes would be 6 per hour, which would still not allow build-up of hydrogen. (ref.: 6.1.2.20)

3.3.4.3 Battery Rooms are held at a negative pressure with respect to the rest of the Control Building to ensure hydrogen fumes do not enter other areas. (ref.: 6.1.1.2, Section 7.18.3.6.g; 6.1.1.1, Section 6.4.2.2; and 6.1.1.13, p.4-2)

3.4 CIVIL/STRUCTURAL

3.4.1 *GENERAL*

3.4.1.1 The Control Room Ventilation inlets should generally be separated from major potential release points by at least 100 feet laterally and 50 feet vertically. Actual minimum distances shall be based on the dose analysis. (ref.: 6.5.16, p. 6.4-4)

3.4.1.1.1 The Control Room air intake is approximately 25 meters (82 feet) above grade, located on the roof of the Control Building. (ref.: 6.1.1.13, p. A-7)

3.4.1.1.2 The plant stack, the major potential release point, is located approximately 180 meters (594 feet) away from the Control Room air inlet and is 100 meters (330 feet) above grade. (ref.: 6.1.1.13, p. A-7)

3.4.1.1.3 The Unit 1 and Unit 2 Reactor Buildings are located approximately 40 meters (132 feet) away. (ref.: 6.1.1.13, p. A-7) The Reactor Buildings are treated as a diffuse source (ref.: 6.1.1.13, p. 3-2). The vertical distance to the Control Room intake is not greater than 50 feet for all points on the Reactor Buildings, but the dose analysis determined this to be acceptable.

3.4.1.2 The Battery Room Fans are located outside the Battery Rooms to further reduce the possibility of an explosion caused by battery generated gases and electrical equipment. (refs.: 6.1.2.1 and 6.1.2.2) The exhaust fans are located in the Mechanical Equipment Room near the exhaust valves to place the entire run of ductwork under a negative pressure to prevent dispersion of hydrogen to the rest of the building (ref.: 6.1.1.2, Section 10.10.5.4)

3.4.1.3 The area containing the Control Room Area Condensing Units is divided and baffled to prevent recirculation and short cycling of the intake and exhaust air. (ref.: 6.1.2.2)

3.4.1.4 The minimum distance between toxic gas sources and the Control Room is dependent upon the amount and type of the gas in question, the container size, and the available Control Room protection provisions. See Regulatory guides 1.78 (ref.: 6.5.10) and 1.95 (ref.: 6.5.11) for specific acceptance criteria. (ref.: 6.5.16, p. 6.4-4)

3.4.1.5 The CBHVAC System is not equipped with dual inlets. This deviation from the Standard Review Plan (ref.: 6.5.16) is acceptable due to the shape, size and location of the inlet. Due these factors, it is improbable that a single event would cause blockage or contamination of the inlet. (refs.: 6.1.1.13, p. A-14 and 6.6.1.3)

3.4.1.6 *Structural Codes and Standards*

The following codes and standards are applicable for design of CBHVAC System supports. See DBD-56 and 102 for design basis requirements for supports.

- American Institute of Steel Construction (AISC), Specification for the Design, Fabrication and Erection of Structural Steel for Buildings'. Original construction is per the 1963 (6th) Ed. (ref.: 6.3.1). Work performed after November 1, 1978 should be per the 8th Ed (ref.: 6.3.2). (refs.: 6.1.1.2, page MC.22-2 and 6.1.1.1, Section 3.8.1)
- American Welding Society D.1.1, 'Structural Welding Code - Steel' Revision to be used is per CP&L Corporate Welding Manual (ref.: 6.3.21)
- CP&L Corporate Welding Manual (ref.: 6.2.8.20)

3.4.2 *SHIELDING CRITERIA*

3.4.2.1 The following should be considered in evaluating the adequacy of protection from radiation sources (ref.: 6.5.16, p. 6.4-13):

- The wall, ceiling, and floor thicknesses and materials
- Potential for radiation streaming through penetrations
- Sources internal to the Control Building (such as filter trains)

3.4.2.1.1 Control Building wall and roof concrete thickness is 2.0 feet. (ref.: 6.1.1.1, Section 6.4.2.5 and 6.1.1.13, page 5-3)

3.4.2.1.2 A detailed analysis and description of the shielding is described in a response to NUREG-0578 (ref.: 6.1.1.10, Section 2.1.6.b)

3.4.2.2 The Control Building equipment is subjected only to a mild radiological environment and therefore does not need special qualifications in accordance with IE Bulletin 79-01B (ref.: 6.6.4.1). (ref.: 6.1.1.13, p. A-29)

3.4.3 *SEISMIC CRITERIA*

3.4.3.1 Design basis seismic criteria are provided in DBD-102 and will not be repeated here to avoid duplication. Current response spectra are in Specification 005-011 (ref.: 6.2.7.1). This Specification should be used after 05/27/87.

3.4.3.2 The CBHVAC System is located within the Control Building, which is a Seismic Category I Building. (ref.: 6.1.1.2, Section C.1.2)

3.4.3.3 Detection systems, isolation equipment, recirculating systems, and air supply apparatus should be designated Seismic Category I. (ref.: 6.5.11, p. 4) The ducting should be Seismic Category I and protected against tornado missiles. (ref.: 6.5.16, p. 6.4-11) HVAC equipment, controls, and duct supports are designed to Seismic Category I requirements. (refs.: 6.2.2.7, 6.2.3.31, 6.1.1.13, p. A-15, A-21, 6.2.8.11) See Section 4 of this DBD for seismic classification of Key components.

3.4.3.4 Failure of non-seismic equipment will not have an adverse affect on essential Control Room HVAC equipment. (ref.: 6.5.16, Section 9.4.1) BNP has committed to meeting this criteria. (refs.: 6.1.1.13, p. A-16 and 6.6.1.3)

3.4.3.5 Reanalysis concluded that the duct supports were seismically analyzed in accordance with the prevailing criteria at that time and that the analysis conformed with the requirements of Bulletin 79-07. (ref.: 6.1.1.13, p. A-21)

3.4.3.6 NCR A-89-013 (ref.: 6.2.8.15) identified discrepancies between isometrics used for the seismic reanalysis referenced in 3.4.3.5 and the as-built condition. EER 89-307 (ref.: 6.2.2.7) provided short-term qualification for the ductwork, and made provisions for long term qualification. Long term qualification and resolution of the NCR are to be provided via calculation OVA-0020 (ref.: 6.2.3.12, note this calculation is not currently approved). See Section 0.2.2.7 for a historical evolution of the seismic criteria. See Section 3.4.3.6 for a explanation of SMACNA standards used as part of this evaluation.

3.4.4 *PROTECTION FROM FLOODING AND RAIN*

3.4.4.1 CBHVAC inlets/outlets are protected against still water flooding to elevation 22'-0 and against wave runup to higher elevations. (ref.: 6.1.1.2, Section M2.37.a)

3.4.4.2 The Control Building roof drains are designed so that no buildup of rain is possible, given a peak rainfall rate of 6.5 inches/hr for 5 minutes or 5.3 inches/hr for 6 hours. (ref.: 6.1.1.2, Section M2.37.b) The CBHVAC intake is curbed; the combination of these two prevents flooding of water into the CBHVAC inlets.

3.4.4.3 CBHVAC intake and exhaust openings are located in the roof of the Mechanical Equipment room. The floor of the concrete compartment below the openings is sloped to scuppers (drains), which eliminates rain from entering the building. (ref.: 6.1.1.2, M2.37.c) The CBHVAC Intake Plenum (sheet metal enclosure) is provided with drains to prevent build-up of rain in the plenum. (ref.: 6.1.2.26)

3.4.5 *TORNADO PROTEC 'ON*

3.4.5.1 Design parame rs for tornado protection are provided in DBD-106, 'Hazards Analysis' (ref.: 6.2.5.7). The design basis consists of a pressure drop of 3 psi in 3 seconds. (ref.: 6.1.1.2, Section C.2.4)

3.4.5.2 The CBHVAC System is designed to withstand the effects of a tornado. (refs.: 6.1.1.2, Section 10.10.5.4, 6.2.3.35, 6.1.1.13, p. A-22) It is enclosed in a tornado proof, non-vented structure. (refs.: 6.1.1.2, Sections 10.10.5.4, C.1.2, and C.2.5; 6.1.1.13, pp. A-15 and A-22)

3.4.5.3 Outside air is taken into the Control Building through two tornado pressure-check valves which are designed to prevent flow reverse due to a sudden drop in outside air pressure. (ref.: 6.1.1.13, p. 4-1, A-21, and A-22)

3.4.5.4 Tornado check valves are provided in the common exhaust duct which will close due to excess flow from a sudden pressure drop outside. (ref.: 6.1.1.13, p. A-21 and A-22)

3.4.5.5 Roof openings are provided in lieu of wall louvers for the Control Room area air cooled condensers for ease of protection during tornados. The condensers are located outside the area that is isolated during a tornado and will be subject to low barometric pressure, which will not damage them, but they will not be subject to horizontal wind forces. (ref.: 6.1.2.2)

3.4.6 *PROTECTION FROM INTERNALLY GENERATED MISSILES*

3.4.6.1 The CBHVAC System is protected from missiles generated from breaks in high-and moderate-energy piping (pipe whip, jet impingement, etc.), turbine missiles, or tornado-generated missiles. Adequate protection against internally generated missiles is obtained either by missile barriers or separation or has been shown by analysis not to be of concern. (ref.: 6.1.1.13, p. A-22) There is no high energy piping close to CBHVAC equipment that could cause damage due to pipe whip. (ref.: 6.1.1.13, p. A-15)

3.4.6.2 Rotating equipment in the Mechanical Equipment Room that is subject to producing internally generated missiles are the three Control Room Normal Ventilation fans and the two Emergency Filtration fans. These are protected from the hazards of each other. (ref.: 6.1.1.13, p. A-15)

3.4.6.2.1 The redundant emergency filter trains are separated by a barrier so that damage to one system will not cause damage to the other system. (ref.: 6.1.1.13, p. A-24)

3.4.6.2.2 The emergency filter fans are separated but have only a partial protective barrier between them; however, analysis has shown that these fans pose no missile hazard to each other. (ref.: 6.1.1.13,p. A-25 and 6.2.3.10)

3.4.6.2.3 Calculation OVA-0013 (ref.: 6.2.3.10) was developed for the Emergency Filtration fans. The conclusions were that although a missile could penetrate adjacent ducting, it would not penetrate an adjacent fan housing. This is only the case for a missile that escapes without penetrating the fan housing (missile escapes through duct) This analysis did not take credit for the block walls between the fans or the sheet metal roof on the fans rooms.

3.4.6.3 Within the Mechanical Equipment Room of the Control Building at the 70'-0" elevation, the two tanks associated with the two instrument air compressors could generate missiles that would affect Seismic Category I ventilating equipment and ducts. Protection of the equipment is provided by a reinforced-concrete missile barrier around the tanks. In addition to this barrier, each emergency filtration unit is separated from other equipment by a concrete masonry wall. (ref.: 6.1.2.11)

3.4.6.4 No bulk gas storage is allowed inside structures housing safety-related equipment with the following exceptions: two air receivers in the Reactor Building, starting air receiver in each Diesel Generator Room, and the liquid nitrogen storage tank in the AOG building. (ref.: 6.1.1.7, page IV.C.3.d.2-3) High pressure gas storage containers, when located in safety related buildings, are stored with their long axis parallel to the walls. (ref.: 6.1.1.7, p. IV.C.3.d.2-3)

3.4.7 *SECURITY REQUIREMENTS*

3.4.7.1 The Physical Security Plan at BNP uses the guidance provided in Reference 6.5.18. Detailed information on the Security Plan is contained in Reference 6.1.1.35 (NOTE: This is a SAFEGUARDS document.) If impact to the Security Plan is possible, or if any of the below listed criteria are impacted, contact the Security Supervisor.

3.4.7.2 For openings in vital area physical barriers, as described in 2.3.1.1, if conditions such as height above grade or existing barriers in the opening (even if these barriers do not meet the definition given in 0.4.1.20) cause uncertainty as to the requirement for additional protection, consult the Project Security Manager. See Sections 2.2.3.4 and 2.3.1.1 for design basis statements.

3.5 MATERIALS/CHEMISTRY

3.5.1 All components should be designed for a useful life of 40 years, accounting for corrosion, erosion, and material fatigue based on 100 percent use. In cases where material cannot be designed for 40 years, these items should be identified and periodically replaced. (See specification in Reference Section 6.2.7) Materials exposed to the outside atmosphere should be selected with consideration to the salt air. Although this was not an original requirement of the system, it is good engineering practice.

3.6 GENERAL

3.6.1 *MISCELLANEOUS*

3.6.1.1 Wind dispersion criteria used for the analyses of a chlorine release or a radiological event may be found in References 6.1.1.1, Tables 6.4.4-4 and 6.4.4-5, 6.1.1.13, and 6.1.1.2, Section M14.5.

3.6.1.2 Storage locations of CO_2 and other gases should be such as to eliminate the possibility of significant quantities of gases entering the emergency zone. All pressurized equipment and piping that could cause significant pressure gradients when failed inside buildings should be isolated by multiple pressure barriers such as multiple door vestibules. (ref.: 6.5.16, p. 6.4-13)

3.6.1.3 An analysis has been performed on the effects of discharging all CO_2 fire extinguisher cylinders. The analysis concludes that the CO_2 concentration will not exceed 3% by volume in the Control Room. The concentration in the Mechanical Equipment room may exceed 3%, but habitability of that area is not required. Per ASHRAE guidelines, at concentration of 3% and above, performance deteriorates and basic physiological functions are affected. (ref.: 6.1.1.2, Section M10.50-1)

3.6.1.4 The capacity of the Control Room in terms of the number of people it can accommodate for an extended period of time should be maintained relative to adequacy of self-contained breathing apparatus SCBA and CO_2 buildup. (ref.: 6.5.16 and 6.1.1.13, p. 4-12) Makeup air (1000 cfm) is provided to ensure that carbon dioxide levels do not become excessive indefinitely. The emergency food stockpile is currently stored in the cable access way. (ref.: 6.1.1.13, p. 4-12)

3.6.1.5 The CBHVAC system services an emergency zone consisting of all critical areas, such as the Control Room, kitchen, sanitary facility, the Computer Rooms, and the electronics room. Areas not requiring access are excluded from the zone by administratively closed doors. (ref.: 6.1.1.13, p. 4-11, A-1)

3.6.1.6 Food, water, and medical supplies shall be sufficient to maintain the emergency team (at least five people) for five days. (refs.: 6.1.1.13, p. A-2 and 6.5.16, p. 6.4-2)

3.6.1.7 *Breathing Apparatus*

3.6.1.7.1 Self-contained Breathing Apparatus (SCBA) should be provided for the Emergency Team (at least 5 people). (ref.: 6.5.16, Section 6.4) For BNP's dual unit control room, the requirements apply to both units. See Technical Specifications (ref.: 6.1.1.3, Section 6 for minimum required shift complement.

3.6.1.7.2 The Brunswick Control Room maintains 12 self-contained breathing apparatus' for use by Control Room personnel during emergencies. An additional 19 air packs are located in an accessible location outside the control building. This is for operator protection. (ref.: 6.1.1.13, p. 4-12, A-6, B-3; 6.6.1.2, Section 4.4.3) Additional information/original commitments may be found in References 6.1.1.1, p. 6.4.1-1 and 6.1.1.2, Sections 14.3-9 (smoke) and M14.5-4a (chlorine).

3.6.1.7.3 Adequate air capacity for the breathing apparatus (at least six hours) should be available onsite to ensure that sufficient time is available to transport additional bottled air from offsite locations. (ref.: 6.5.11, p. 4)

3.6.1.7.4 See Sections 3.3.1.2 and 3.6.7.1 for additional information on SCBAs.

3.6.1.8 Applicable technical specifications are:

Chlorine detection - 3/4.3.5.5
Control Building emergency filtration - 3/4.7.2

3.6.2 *CONTROL ROOM NORMAL VENTILATION SUBSYSTEM*

3.6.2.1 The subsystem includes three HVAC trains in parallel, each sized to supply 50% of the ventilation, heating and cooling requirements under design conditions. Normally, one HVAC train is dedicated for the Unit 1 area of the rooms and the second train is for the Unit 2 areas. The third is a redundant train which can be utilized as a backup to either unit by repositioning the dampers. (ref.: 6.1.1.2, Sections 10.10.5.4 and M8.8)

3.6.2.2 The Control Room Normal Ventilation Subsystem is sized to maintain the air space temperature at 75 °F (ref.: 6.1.1.2, Section 10.10.5.4)

3.6.2.2.1 The two active air-conditioning systems circulate conditioned air to their respective areas in Units 1 and 2, while receiving 1000 scfm of filtered outside make-up air. The recirculated air, plus filtered make-up air, is refiltered by the return air filter before entering the cooling coils. (ref.: 6.1.1.2, Section 10.10.5.4)

3.6.2.2.2 In addition to the cooling provided by the Control Room Normal Ventilation Subsystem, each Computer Room is equipped with an air conditioning unit designed to remove 60,000 BTU/hr. These units are designed to lower the temperature in the Computer Rooms to between 65 °F and 70 °F to minimize the possibility of the computers overheating. (ref.: 6.1.2.14 and 6.1.2.15)

3.6.2.3 The Control Room Normal Ventilation Subsystem maintains the Control Room area at a slightly positive pressure relative to surrounding areas to minimize infiltration. (refs.: 6.1.1.1, Sections 6.4.2.4 and 9.4.1.2; 6.1.1.2, Section 7.18.3.6; 6.1.1.3, Section 3.7.3; 6.1.1.26 and 6.1.1.27)

3.6.2.4 The make-up fresh air and the recirculated air are constantly filtered to remove dust, smoke and other particles that may be present in the air. The volume of normal make-up fresh air is sufficient to compensate for the normal exhaust. (ref.: 6.1.1.2, Section 7.18.3.6c)

3.6.2.5 The make-up air for the Control Room Normal Ventilation Subsystem is designed to automatically transfer from the normal make-up mode to the emergency make-up mode after receiving a high radiation signal.

3.6.3 *CONTROL ROOM EMERGENCY VENTILATION SUBSYSTEM*

3.6.3.1 The Control Room Emergency Ventilation Subsystem filters smoke, odors, and airborne radioactivity from the emergency make-up air. (ref.: 6.1.1.2, Section 10.10.5.4)

3.6.3.2 This filter system includes hi-efficiency (HEPA) and carbon filters. (ref.: 6.1.1.2, Section 7.18.3.6e) In addition, as defined in Section 0.1.1, the Emergency Recirculation fan, inlet and outlet damper. and associated ductwork are part of this subsystem.

3.6.3.3 Only one flow train is operating at a time. (ref.: 6.1.1.2, Section 10.10.5.4)

3.6.3.4 The Control Room Emergency Ventilation Subsystem maintains the Control Room area at a slightly positive pressure relative to surrounding areas to minimize infiltration. (refs.: 6.1.1.1, Sections 6.4.2.4 and 9.4.1.2; 6.1.1.2, Section 7.18.3.6; 6.1.1.3, Section 3.7.3; and 6.1.1.27)

3.6.3.5 During the emergency make-up mode, 1000 scfm of outside air is combined with 1000 scfm of recirculated air. This air is drawn through one of two redundant filter trains. The filtering of the 1000 scfm of recirculated air through this filter train will act as clean-up for the conditioned spaces. (refs.: 6.1.1.2, Sections 10.10.5.4, M14.1 and 6.6.1.1, p. 6-21)

3.6.3.6 1000 scfm of recirculated air is adequate to limit background radiation within the Control Room to a safe level. The 1000 scfm of make-up air is more than adequate for approximately 35 people during emergency operation. (ref.: 6.1.2.2) Reference 6.1.2.27 provides a discussion of an actual example of Control Room Oxygen concentration with no make-up air.

3.6.3.7 *Control Room Envelope Leakage Values*

3.6.3.7.1 There are several routes by which potentially contaminated outside air could enter the Control Room, including the following: (ref.: 6.1.1.13, p. 4-13)

- Leakage through the normal outside air makeup damper.
- Leakage into the Control Room air ducts in the Mechanical Equipment Room.
- Leakage into the Control Building elevator shaft, into the Control Building stairwells, and through the Control Room doors.
- Leakage into the Unit 2 cable access way via openings in the cable penetration cutout to the rattle space between the Control and Reactor Buildings.

3.6.3.7.2 The Control Room was determined to have an unfiltered leak rate of 3000 scfm using the methodology outlined in R.G. 1.95. For un-pressurized Control Rooms, the gross leakage characteristic of the Control Room should be determined by pressurizing the Control Room to 1/8 inch water gage and determining the pressurization flow rate. (ref.: 6.5.11, p. 4) Although BNP's Control Room is maintained at a slightly positive pressure, BNP was required to use the unfiltered inleakage determined by this method. (ref.: 6.6.1.3) This leak rate is used to analyze radiation events.

3.6.3.7.3 Doors into the Control Room envelope are low-leakage type. Calculated leakage is 20 SCFM per door. (ref.: 6.2.3.42)

3.6.3.7.4 Doors will be kept administratively closed when not in use. (refs.: 6.5.11, p. 4; 6.1.1.13, p. 4-12, 6.1.2.16, # 45, 6.6.1.1, p. 6-23) This is to minimize leakage into the Control Room in the event of an accident.

3.6.3.7.5 Cable Spreading Room cable penetrations into the Control Room are calculated to leak a total of 2000 SCFM at 1/8 in. w.g. This leakage is accounted for in the radiological habitability analysis. (ref.: 6.2.3.42)

3.6.3.7.6 For radiation events with the Emergency Ventilation Subsystem in operation, unfiltered inleakage is 3000 cfm. (ref.: 6.1.1.27, 6.1.1.26, and 6.6.1.7)

3.6.3.7.7 During a chlorine event, Control Room infiltration rate is calculated to be 1250 CFM. Leakage into the ductwork is 124 scfm. (ref.: 6.1.1.13, p. 4-13, Fig 4.2).

3.6.4 *MECHANICAL EQUIPMENT ROOM*

3.6.4.1 The Mechanical Equipment Room is designed to receive 7500 scfm (ref.: 6.2.7.3) of air to remove the 86,000 BTU/hr heat load generated under summer design conditions (ref.: 6.2.3.36).

3.6.4.2 During the winter months, two 15 KW unit heaters are provided to supplement the heat generated by the equipment to maintain the room above 50 °F. (ref.: 6.2.3.36)

3.6.4.3 *Elevator Machine Room*

The Elevator Machine Room is designed to be supplied 850 scfm (ref.: 6.2.6.1) of outside air to remove the 10,000 BTU/hr (ref.: 6.2.3.36) heat load generated. This limits the bulk average air temperature rise to 11 °F to maintain the temperature below 104 °F during summer design conditions.

3.6.5 *BATTERY ROOMS*

3.6.5.1 *Temperature Control*

3.6.5.1.1 The Battery Rooms may attain a maximum temperature of 1'5 °F when the outside summer air is 93 °F. (ref.: 6.1.1.2, Fig. M7.9-1)

3.6.5.1.2 Winter ventilating air to the Battery Room is controlled so that the space is maintained at not less than 65 °F. (refs.: 6.1.1.2, Section 10.10.5.4 and 6.1.1.1, Section 9.4.1.2)

3.6.5.1.3 The minimum battery cell temperature is 60 degrees F. (ref.: 6.1.1.3, Section 3.8.2.3) The analyses on battery cell temperatures may be found in References 6.2.3.2 and 6.2.3.19.

3.6.5.1.4 Vortex dampers at the supply fans are used to control air flows to the Battery Rooms based on room air temperature.

3.6.5.1.5 Each Battery Room is supplied 3350 scfm (ref.: 6.2.7.3 and 6.2.6) of outside air to remove the 105,000 BTU/hr (ref.: 6.2.3.36) heat load generated during summer design conditions. This limits the bulk average air temperature rise to 32 °F to maintain the room temperature below 125 °F during summer design conditions. During winter the exhaust air flow is reduced to a minimum of 1680 scfm by the automatic temperature control system.

3.6.5.1.6 During the winter months, the supply air flow rate is reduced to 1580 scfm to utilize the approximate 30 KW of heat being released by the batteries and equipment in each room. (ref.: 6.1.2.3)

3.6.5.1.7 Heating for the Battery Rooms is provided by duct heaters located in the supply duct of each room (1A, 1B, 2A, 2B), and are rated for connection to the 480V MCC's. (ref.: 6.2.1.11 and 6.2.1.12)

3.6.5.2 *Negative Pressure Control*

3.6.5.2.1 Vortex dampers at the exhaust fans are used to maintain a negative pressure in the Battery Room relative to the adjacent areas. (ref.: 6.1.1.2, Section 10.10.5.4)

3.6.5.2.2 Each Battery Room is maintained at a negative pressure by exhausting 3450 scfm of air which includes the supply air and 100 scfm of infiltrated air from the adjacent Cable Spread Room. (ref.: 6.1.2.2)

3.6.5.2.3 The Battery Rooms are designed to be ventilated continuously to maintain the hydrogen concentration below safe, acceptable levels. The theoretical quantity of air required under the most severe mode (near the end of the charging period with the room temperature at 125 °F) is 110 scfm per Battery Room. (ref.: 6.2.3.37)

3.6.6 *CABLE SPREADING ROOMS*

3.6.6.1 Each Cable Spreading Room is independently ventilated by supply and exhaust fans through a distribution duct. (ref.: 6.1.1.2, Section 7.17.3.6)

3.6.6.2 The controls for this system are arranged for remote manual operation from the Control Room. (ref.: 6.1.1.2, Section 7.17.3.6)

3.6.6.3 The supply and exhaust for the Cable Spreading Room are provided with tight shutoff dampers for isolation during emergencies. (ref.: 6.1.1.2, Section 7.17.3.6)

3.6.6.4 Each Cable Spreading Room is supplied with 15,500 scfm (ref.: 6.2.7.3 and 6.2.6) of outside air to remove the 185,000 BTU/hr (ref.: 6.2.3.36) of heat generated by the cable and the equipment during full load accident conditions. This limits the bulk average air temperature rise to 11 °F to maintain the room temperature below 104 °F during summer design conditions.

3.6.6.5 After isolation from a high chlorine or high radiation signal, if the temperature in the Cable Spreading Rooms approaches the design limit temperature of 104 °F, the Control Room operator can restore the ventilation, while maintaining Control Room integrity by use of a key-locked bypass switch. (ref.: 6.1.1.2, Section 7.18.3.6) While it is desirable to minimize the contamination levels in the Cable spreading Room, for the purposes of the habitability analyses, no credit for dilution of chlorine or radioactive contaminants in the Cable Spread Room is taken. Paraphrasing, the Cable Spread Room air is assumed to be at the same conditions as the outdoor air. (refs.: 6.2.3.7, 6.2.3.8, 6.1.1.27, and 6.2.8.5) For a radiation event, the doses to equipment in the Cable Spread are assumed to be low. For this reason, the key-locked bypass switch should not be used following a radiation event unless required to maintain equipment operability.

3.6.7 *SINGLE FAILURE CRITERIA*

A single active failure shall not result in the loss of system functional capability (ref.: 6.5.11, p. 4 and 6.5.16, p. 6.4-3). This criterion has been modified as described in Section 3.1.6. (ref.: 6.1.1.13, p. A-11 to 13).

3.6.7.1 *Self Contained Breathing Apparatus*

Single failure criteria requirements can be met for SCBA's by providing one extra unit for every three units required. (ref.: 6.5.11, p.4)

See Sections 3.3.1.2 and 3.6.1.7 for additional information on SCBAs.

3.6.7.2 *Control Room Normal Ventilation Subsystem*

3.6.7.2.1 The Control Room Normal Ventilation subsystem is provided with three HVAC trains. Normally, one of the HVAC trains is dedicated to the Unit 1 areas of these rooms and the second is dedicated to the Unit 2 areas and the third one is a common spare. Each train contains one 100% capacity (for one Unit, 50% for dual Unit Control Room) fan, cooling coil, 15 KW heating element and compressor condenser unit. (ref.: 6.1.1.2, Section 10.10.5.4)

3.6.7.2.2 Redundant fans, cooling equipment and other devices to ensure reliable operation of the system are provided. (ref.: 6.1.1.2, Section 7.18.3.6.g) See Section 4.7.1.2 for additional information on equipment operability requirements.

3.6.7.3 *Control Room Emergency Ventilation Subsystem*

3.6.7.3.1 The Emergency Ventilation Subsystem is provided with two - 100% redundant filter units, fans and inlet and outlet dampers to ensure operation given a single active failure. (refs.: 6.1.1.2, Paragraphs M10.13 and M14.1; 6.1.1.13, page 4-3)

3.6.7.3.2 In an assumed worst-case failure of the CBHVAC system (see Section 3.1.6.2) radiation limits are not exceeded. (ref.: 6.1.1.13, p. A-13)

3.6.7.3.3 Two single failure modes to the Control Building Emergency Air Filtration System were evaluated in Reference 6.2.2.10. One single failure mode is loss of power to the CBEAF Train A Logic which prevents starting either train of CBEAF manually or automatically. The second single failure mode is loss of power to CBEAF Train B (A) Logic with Train B (A) in Preferred and Train A (B) in standby, which prevents automatic starting of the standby Train. Corrective actions to resolve these single failure modes will be implemented by Plant Modification 92-108. (ref.: 6.2.1.22)

3.6.7.3.4 In the event of a Main Steam Line Break with automatic Control Building Isolation, Control Room doses do not exceed the limits of GDC-19 (i.e., 30 REM) with the Emergency Air Filtration (EAF) system unavailable. (ref.: 6.1.2.28 and 6.2.3.13)

3.6.7.4 *Battery Rooms*

Each Battery Room is ventilated by an individual supply fan and an individual exhaust fan that operate in series. The single failure criterion is achieved by having redundant Battery Rooms as compared to having redundant ventilation equipment.

3.6.8 *CONTROL ROOM OPERATOR AND EQUIPMENT DOSES*

3.6.8.1 The dose to the control room operators following a DBA is required to be less than 5 rem to the whole body, 30 rem to the skin and 30 rem to the thyroid (See Sections 1.1.1.2 and 2.1.6).

3.6.8.2 Accidents evaluated for operator doses are (ref.: 6.1.1.2, Sections 14, M14.1, and M14.4):

- Loss of Coolant Accident (LOCA)
- Main Steam Line Break (MSLB) Accident
- Refueling Accident
- Control Rod Drop Accident

3.6.8.3 The calculated doses are based on the following assumptions:

3.6.8.3.1 **LOCA**

The 30-day integrated post-LOCA doses for ventilation flow rates of 3000 scfm unfiltered inleakage, 1000 scfm filtered inleakage, and 1000 scfm recirculated flow, are (in rem): (ref.: 6.1.1.26, 1-10)

- Whole body: airborne 0.003, other 0.413, total 0.416
- Thyroid: airborne 1.72
- Beta skin: airborne 0.044

3.6.8.3.1.1 A calculation was run to determine the sensitivity of total operator doses due to increasing the unfiltered unleakge to an amount great than that referenced above. For unfiltered inleakage of 100,000 scfm or greater the dose does not increase significantly. (ref.: 6.1.1.26, 1-9)

3.6.8.3.1.2 A calculation was performed to determine the effect of delayed isolation of the Control Room following a LOCA. The results are that for a delay of up to 24 hours, the calculated Control Room operator doses are still well below the GDC 19 limits. (ref.: 6.2.3.7)

3.6.8.3.2 **MSLB Accident**

The calculated MSLB Accident doses to a control room operator are:

- 28.1 rem to the thyroid for 24 hour time period and 30 day time period. (ref.: 6.2.3.8)

- Whole body and skin doses are considered negligible for a MSLB Accident (ref.: 6.6.1.1)

The assumptions used in the MSLB calculation are:

- Control Room fails to isolate automatically, manual isolation takes place after 10 minutes, initial unfiltered inleakage is 5000 scfm.

- After isolation, unfiltered inleakage is 3000 scfm.

3.6.8.3.3 **Refueling Accident**

The calculated doses received by the Control Room operators from a Refueling Accident are: (ref.: 6.1.1.2, Sections M14.1 and M14.4)

- whole body: 2.95×10^{-1} rem
- beta skin: 7.24×10^{-4} rem
- thyroid: 5.6×10^{-1} rem

These analyses assume 25 scfm unfiltered inleakage, since the control room was to be maintained at 1/4 in w.g. positive pressure.

3.6.8.3.4 **Control Rod Drop Accident**

The calculated doses received by the Control Room operators from a Control Rod Drop Accident are: (ref.: 6.1.1.2, Sections M14.1 and M14.4)

- thyroid: 8.64×10^{-4} rem
- whole body and skin doses have not been retrieved for this accident

These analyses assume 25 scfm unfiltered inleakage, since the control room was to be maintained at 1/4 in w.g. positive pressure.

3.6.8.4 The largest expected doses to equipment would occur from a release of fission products during a design-basis accident. The release would produce a mild radiation environment and no equipment functional degradation is expected. (ref.: 6.1.1.13, p. A-28)

3.6.9 *TEMPERATURE\HUMIDITY*

3.6.9.1 The outdoor design temperature range for BSEP is 15 °F to 93 °F. Outdoor design humidity is 10 to 100% (ref.: 6.1.1.2, Fig. M 7.9-1)

3.6.9.1.1 The 93 degree summer design temperature is consistent with the ASHRAE 99% summer design temperature for Wilmington (see Reference 6.3.14 for current standard). The 99% temperature coincides with the temperature that will be reached or exceeded for 1% of the hours in the summer months (June through September), or approximately 30 hours per year. Elevated temperatures are typically used for aging calculations and assume that the components are at the design temperature for their entire life. Actual temperatures are below this limit 99% of the time, balancing the 1% of a typical year in which the components are at or above the design temperature. The 99% summer wet bulb temperature listed in ASHRAE is 81 °F. This number was adjusted upward to 82 °F for BNP based on actual data.

3.6.9.1.2 The 99% winter temperature is based on the hours in December, January and February. Temperature will be at or below this limit for only 22 hours in a typical year (1% of the hours in December, January and February). ASHRAE lists a 99% winter design temperature of 23 °F. BNP design temperature is 15 °F for most applications, including the CBHVAC System. The additional 8 °F is for conservatism.

3.6.9.2 The design temperature of the Control Room is 75°F at 50 percent relative humidity with only two air conditioning units in operation. If one unit should fail, the identical spare unit would be placed into service. These units are powered from emergency buses and will function on loss of offsite power when the Emergency Diesel Generators are supplying power to the emergency buses. (ref.: 6.1.1.13, p. A-17)

3.6.10 *CHLORINE TANK CAR RUPTURE ANALYSIS*

3.6.10.1 An analysis of the severity of a postulated rupture of the 55-ton chlorine rail car was conducted using the assumptions listed in Reference 6.1.1.1, Table 6.4.4-2 and Reference 6.1.1.2 Section M14.5. The results may also be found in References 6.1.1.2 Sections M14.5, 6.1.1.1 Section 6.4.4.2, and 6.2.8.5. This analysis demonstrates that a rupture of the chlorine tank car will not impair Control Room habitability. (ref.: 6.1.1.13, p. A-8, 6.1.1.1, p. 6.4.4-1)

3.6.10.2 *Analysis Assumptions*

- Normal air exchange rate is 0.46 air volume exchanges per hour. (ref.: 6.1.1.13, p. 6-7)
- Chlorine Isolation mode air exchange rate is 0.28 air volume exchanges per hour. (ref.: 6.1.1.13, p. 6-7)
- Tank car is located 450 feet (137.2 meters) from the Control Room intake on grade. The Control Room intake is 82 feet (25 meters) above grade. (ref.: 6.1.1.13, p. 6-1, A-7)
- Chlorine is the only hazardous material stored on-site in significant quantities. (ref.: 6.1.1.13, p. B-4)
- The volume of the Control Room is 298,650 cubic feet. (ref.: 6.1.1.13, p. B-1)

3.6.10.3 Toxic gas levels shall be kept below the toxicity limit for two minutes after alarm. (ref.: 6.5.16, p. 6.4-5; 6.5.11)

3.6.10.4 Two minutes is considered sufficient time for a trained operator to put a self-contained breathing apparatus in operation. (ref.: 6.5.11, p. 2)

3.6.10.5 Allowable limits of toxic gas concentration should be established on the basis that the operators should be capable of carrying out their duties with a minimum of interference caused by the gas and subsequent protective measures. The limits for chlorine gas for the three categories are:

- Long term limit (1 hour or greater): the limit assigned for occupational exposure (40 Hour week) - 1 ppm by volume
- Short-term Limit (2 minutes to 1 hour): A limit that will assure that the operator will not suffer incapacitating effects after a 1-hour exposure - 4 ppm

- Protective Action Limit (2 minutes os less): A limit that will assure that the operator will quickly recover after breathing apparatus is in place. In determining this limit, it should be assumed that the concentration increases linearly with time from zero to two minutes and that the limit is attained at two minutes - 15 ppm (45mg/m^3). This limit is also termed the protective action limit in reference 6.5.10.

Reference: 6.5.16, p. 6.4-4,5 These limits are found in NUREG-75/087 (ref.: 6.5.16), Section 6.4, page 6.

3.6.10.6 An additional analysis has been performed using more state of the art modeling techniques. This analysis is not the basis for our SER, but does provide additional insight into the affect of changing certain parameters on Control Room habitability. This analysis is contained in Reference 6.2.3.22.

4.0 COMPONENT DESIGN REQUIREMENTS

This section describes the design requirements for key components within the CBHVAC.

The information in this section represents calculation outputs, methods used, and design parameters that support the design basis on the key component level. This information is considered useful both to the designer and the plant engineer, but should not be considered design basis unless it is underlined.

4.1 CONTROLS COMPONENTS

4.1.1 Automatic controls components should be in accordance with Specification 252-22 (ref.: 6.2.7.18). This specification governs the pneumatic portion of the control system, as well as the electronic thermostats.

4.1.2 Air piping for automatic controls should be ASTM B88 type K copper per Specifications 252-22, (ref.: 6.2.7.18) and 248-51 (ref.: 6.2.7.12). Installation should be per Specification 248-53 (ref.: 6.2.7.13). (ref.: 6.2.7.18).

4.1.3 Controls components required to ensure operability of critical equipment (see following Sections 4.2, 4.3) are included in the Quality Assurance Program. See EDBS screen 404 for specific instruments.

4.1.4 The seismic test report for various HVAC instruments may be found in Reference 6.2.8.8.

4.2 DUCTWORK AND ACCESSORIES

Ductwork and accessories should be provided and installed in accordance with the requirements of Specifications 226-001 (ref.: 6.2.7.9) for the Computer Room Duct work and 226-002 (ref.: 6.2.7.10) for the balance of the system. These components are included in the Quality Assurance program if they are required to operate to ensure that the function of the CBHVAC as defined in Section 1.1 is met. See EDBS screen 404 for information on specific components.

4.2.1 *SHEET METAL*

4.2.1.1 Sixteen (16) gauge and lighter sheet metal should conform to ASTM A527. Fourteen (14) gauge and heavier sheet metal should conform to ASTM A526. (ref.: 6.2.7.9) This is in accordance with standard engineering practice.

4.2.1.2 Sheet metal should have a galvanized coating with a total weight of 2.5 oz per ft^2 (total both sides). (ref.: 6.2.7.9) Angles and reinforcing steel should be hot-dipped galvanized. (ref.: 6.2.7.9) This is to minimize corrosion and maximize equipment life.

4.2.1.3 Ductwork should be airtight. Ducts should be leak tested for audible leakage to 4 in. W.G. (ref.: 6.2.7.9). This guideline is to ensure that adequate air quantities are delivered to the spaces and equipment requiring the ventilation. In addition, duct leakage is factored into the unfiltered inleakage for habitability analyses. See Section 3.6.3.7 for specific values used.

4.2.1.4 Ductwork for the Battery Room Supply and Exhaust, Cable Spreading Room Supply and Exhaust, Control Room Emergency Ventilation, and Mechanical Equipment Room shall be Seismic Category I and shall meet the requirements of 10 CFR 50 Appendix B to meet the requirements of Sections 2.1.1 and 2.1.2.

4.2.1.5 Ductwork for the Control Room Normal Ventilation Supply and Exhaust installed outside the Control Room Emergency Zone shall be Seismic Category I and Shall meet the requirements of 10 CFR 50 Appendix B to meet the requirements of Sections 2.1.1 and 2.1.2.

4.2.1.6 Ductwork for the Control Room Supply and Exhaust installed inside the Control Room Emergency Zone shall be Seismic Category I to the extent that its failure shall not damage safety related equipment to meet the requirements of Section 3.4.3.4.

4.2.1.7 Ductwork for the Control Building Supply and Exhaust Ventilation Subsystem inside the Mechanical Equipment Room shall be Seismic Category I and shall meet the requirements of 10 CFR 50 Appendix B to meet the requirements of Sections 2.1.1 and 2.1.2.

4.2.1.8 Ductwork for the Computer Room Supply and Exhaust installed inside the Control Room Emergency Zone shall be Seismically Supported to the extent that its failure shall not damage safety related equipment to meet the requirements of Section 3.4.3.4. The requirements of 10 CFR 50 Appendix B (ref.: 6.4.3) do not apply to the Computer Room Ductwork.

4.2.2 *MISCELLANEOUS ACCESSORIES*

4.2.2.1 *Turning Vanes*

4.2.2.1.1 Turning vanes are provided to minimize the pressure drop through the ductwork. This is in accordance with good engineering practice.

4.2.2.1.2 Turning vanes should be provided in elbows whose centerline radius is less than 150% of duct width. Turning vanes should be in accordance with Specification 226-02, III.C.1.b. (ref.: 6.2.7.10)

4.2.2.1.3 Turning vanes, where provided, shall not compromise the requirements of Sections 2.1.1 and 2.1.2 as applies to the ductwork in which they are installed. (See Section 4.2.1.4 for ductwork requirements.)

4.2.2.2 *Access Doors*

4.2.2.2.1 Access doors should be provided in ducts for access to automatic controls, automatic dampers, backdraft dampers, and fire dampers. (ref.: 6.2.7.9) The access doors were originally provided for ease of maintenance, but are now used for access to fire dampers in order to perform the required surveillance. (ref.: 6.1.1.3, Section 4.7.8)

4.2.2.2.2 Access doors, where provided, shall not compromise the requirements of Sections 2.1.1 and 2.1.2 as applied to the ductwork in which they are installed. (See Section 4.2.1.4 for ductwork requirements.)

4.2.2.3 *Flexible Connectors*

4.2.2.3.1 Flexible connectors are non-asbestos rubberized cloth or glass fabric double coated with neoprene. It should be noncombustible and able to withstand 250 °F (ref.: 6.2.7.9). This requirement minimizes the fixed combustible load in each fire area and allows a standardization of components thereby minimizing the different types of flex to be stocked.

4.2.2.3.2 Flexible connectors shall meet the requirements of Sections 2.1.1 and 2.1.2 and are subject to the requirements of 10 CFR 50 App. B (ref.: 6.4.3) if the ductwork system and fan they are associated with are required to meet these requirements. (See Section 4.2.?.4 for ductwork requirements and Section 4.3 for fan requirements.)

4.3 FANS

4.3.1 *GENERAL*

Fans in the CB (excluding Condenser Area Booster Fans) were purchased per Specification 45-8. The following are requirements of that specification:

4.3.1.1 Fan motors are in accordance with Specification 128-1, 1970. (ref.: 6.2.7.8)

4.3.1.2 Fans are qualified to operate in a service environment having a normal ambient temperature of 148 °F. (ref.: 6.2.7.3) This requirement is standard for the fan motors provided via Specification 45-8, and does not imply that ambient temperatures in the CB will reach 148 °F.

4.3.1.3 Fan motors are heavy-duty, totally enclosed air over construction, designed and built to move air to pass directly over the motor frame (ref.: 6.2.7.3)

4.3.1.4 Fan housings were tested in accordance with ASME Boiler & Pressure Vessel Code, Section V, 1971. (ref.: 6.2.7.3)

4.3.1.5 Fans are manufactured in accordance with the quality standards and special requirement of Specification 9527-01-4224.

4.3.1.6 The emergency filter fans are seismically mounted and located in a tornado-proof Seismic Category I structure. (ref.: 6.1.1.13, p. A-25)

4.3.1.7 The fans and motors are designed to permit easy removal from the duct system for maintenance.

4.3.1.8 The following fans in the CBHVAC System shall be Seismic Category I and shall meet the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3) to meet the requirements of Sections 2.1.1 and 2.1.2: Control Room Supply Fans (3 fans), Battery Room Supply and Exhaust Fans (total of 8 fans for the two units), Cable Spread Supply and Exhaust Fans (total of 4 for the two units), Mechanical Equipment Room Supply and Exhaust fans (two fans), Control Room Emergency Ventilation Fans (2 fans), and Control Room (washroom) Exhaust fan (one fan).

4.3.1.9 The following fans are required to be Seismic Category I to meet the requirements of Section 2.1.2, but not meet the requirements of 10 CFR 50 Appendix B: Condenser Area Booster Fans and the Air Cooled Condenser fans. (See Reference 6.2.8.14 for quality class information.)

4.3.1.10 Fans in the Computer Room Air Conditioning Units are not required to be safety related or Seismic Category I.

4.4 CHLORINE DETECTORS

4.4.1 Chlorine Protection is provided by six chlorine detectors: two detectors are mounted at the Control Room air intakes, two detectors are attached to the wall of the service water intake structure, and two are located inside the Chlorination Building. (refs.: 6.1.1.13, p. 4-5, B-3; 6.1.1.1, Section 6.4.4.2; and 6.1.1.2, Section M14.5)

4.4.2 The first locations (air intake and service water intake) are inside, or on the outer wall of, Class I structures and are therefore seismically protected. (ref.: 6.1.1.2, Section M14.5)

Chlorine detectors in the Control Building and the Service Water Intake Building shall be Seismic Category I, but not safety related. The seismic classification is in accordance with R.G. 1.95, Reference 6.1.1.2, page M14.5-4, and Reference 6.6.1.1, page 6-3. The detectors are not classified as Safety Related in accordance with the definition in 10 CFR 50 Appendix B (ref.: 6.4.3) since they do not prevent or mitigate the consequences of a postulated accident that could cause undue risk to the health and safety of the public. See Reference 6.2.2.2 for determination of safety classification .

4.4.3 Detectors should be able to detect and signal a chlorine concentration of 5 ppm. (ref.: 6.5.11, p. 3)

4.4.4 The detectors have a sensitivity of 1 part per million or better and a response time of less than five seconds. (ref.: 6.2.1.17 and 6.1.1.1, Section M14.5).

4.5 DAMPERS

4.5.1 Ventilation dampers in the CBHVAC System shall be Seismic Category I and shall meet the requirements of 10 CFR 50 Appendix B to meet the requirements of Sections 2.1.1 and 2.1.2. Fire dampers installed in ductwork in the CBHVAC System shall be seismically qualified to the extent that they shall not compromise the operation of the System during or after a seismic event to meet the requirements of Section 3.4.3.4.

4.5.2 Safety related dampers shall fail to their safe position. (ref.: 6.2.2.9) All motor operated dampers and piston type air operators can be manually operated. Diaphragm type operators fail-safe in the proper orientation. All valves requiring manual manipulation for safe shutdown are accessible via presently installed ladders and platforms. (ref.: 6.1.1.9, request #27)

4.5.2.1 Failure positions for Control Building dampers may be found in EER 91-0091 (ref.: 6.2.2.9). Selected damper failure positions will be listed here due to their importance to system operation. Failure on loss of air is not considered since safety-related compressed air is provided from the Control Room HVAC Air Compressors.

4.5.2.1.1 The normal intake damper (2L-D-CB) fails closed on loss of power to prevent introduction of contaminants (smoke, radiation or chlorine) to the Control Room. This failure position is taken credit for in the single failure analysis. See Section 3.1.6. If the damper should fail closed during normal operation, the CO_2 concentration in the Control Room would not exceed acceptable levels for several days and, if necessary the Emergency Ventilation Subsystem could be operated to introduce fresh air.

4.5.2.1.2 The Emergency Recirculation Damper (2J-D-CB) fails closed on loss of power to prevent introduction of chlorine to the control room. During a radiation or smoke event, the desirable position is open. However, failure of the damper in the closed position for a radiation event has been analyzed and found to be acceptable (ref.: 6.2.3.16). Failure of the damper in the closed position during a smoke event may be mitigated by alternate procedure for the removal of smoke (ref.: 6.2.6.4).

4.5.2.1.3 The Control Room (Washroom) Exhaust Damper (2H-D-CB) fails closed on loss of power to prevent the introduction of contaminants (smoke, radiation, or chlorine) into the control room. See Section 3.1.6 for additional information on failure requirements.

4.5.2.1.4 The Emergency Air Filtration Train isolation dampers (2A, 2B, 2C, and 2D-EAD-CB) fail closed on loss of power to prevent introduction of chlorine into the Control Room. During smoke and radiation events, it is preferable for these dampers to be open. However, failure of one set (the inlet and outlet dampers associated with one train) of dampers during a smoke or radiation event is acceptable since the other train would be available.

4.5.2.1.5 The Battery Room Inlet and Outlet dampers fail closed on loss of power or air to allow the Fire dampers to function. During normal operation, the preferred position is open to cool and ventilate the Battery Rooms. However, since the batteries are redundant, failure of a damper or pair of dampers (inlet and outlet for one room) in the closed position will not cause a loss of a safety function.

4.5.3 Isolation dampers should be leak tight. (ref.: 6.5.16, p. 6.4-3) The isolation dampers for habitability purposes are the CBEAF inlet and outlet dampers, the Normal Inlet Damper, the Emergency Recirculation Damper, and the Control Room (washroom) Exhaust Damper.

4.5.4 Dampers may be manually operated or repaired following an accident/event as allowed by NUREG-75/87 (ref.: 6.5.16), Section 6.4, Appendix A. See Section 2.2.2.6 for commitment to NUREG-75/087. Briefly, the requirements are (see the reference for a more detailed explanation):

- Internal components should not require repair. Component design details should be such that internal components are of a simplicity, ruggedness, and suspectibility to failure mechanisms as to render them reliable. Welded or keyed shafts are considered reliable. Multi-element linkages or pneumatic components internal to the ducts are viewed as subject to failure.

- External valve components must be designed to ensure that the failed component may be bypassed easily and safely and that the valve can be manipulated to an acceptable position.
- The location and positioning of the valves or damper must permit easy access from the Control Room, especially under DBA conditions.
- Appropriate Control Room instrumentation should be provided for a clear indication and annunciation of valve or damper malfunction.
- Periodic manipulation of the valve or damper by operators should be performed for training purposes.
- The need for manual manipulation should not occur more than once during the accident.
- The time for repair used in the computation of Control Room exposures should be taken as the time necessary to repair the valve plus a one-half hour margin.

4.5.5 *INTAKE AND EXHAUST ISOLATION DAMPERS*

4.5.5.1 Intake and exhaust isolation dampers are of standard HVAC design and quality. Leakage requirements are 1% of full-flow, which is 2000 scfm. (ref.: 6.1.1.13, A-4, A-14)

4.5.5.2 Failure of various dampers to operate due to mechanical failure of some internal component of the valve is remote because of the design of these dampers. In addition, periodic testing requires functional testing of the system every 31 days. (ref.: 6.1.1.13, p. A-12)

4.5.5.3 Dampers can be manually operated by disconnecting the actuator and shifting the damper blade manually, then locking it in place. (ref.: 6.1.1.13, p. A-12)

4.5.5.4 The normal ventilation intake dampers will close within five seconds. This prevents the introduction of radioactive contaminants and smoke to the central Control Room area without first being filtered by the Emergency Filtration Subsystem. (ref.: 6.1.1.2, Section M14.5; 6.1.1.1, Section 6.4.4.2: 6.5.10, p. 6.4.1; and 6.2.1.14)

4.5.5.5 Damper operators for the normal air intake and exhaust for the Control Room HVAC Subsystem are sized, by design, to shut the dampers within three seconds. (ref.: 6.2.7.18)

4.5.6 *OPPOSED BLADE DAMPERS*

Opposed blade dampers in the CBHVAC System are provided for general air control on the Supply Fan discharge. The dampers are in accordance with Specification 226-002 (ref.: 6.2.7.10).

4.5.7 *EMERGENCY AIR FILTRATION TRAIN ISOLATION DAMPERS*

4.5.7.1 The emergency filter isolation valves are heavy-duty, low-leakage, single-blade dampers which have provisions for hand operation. The valve seals are designed for no leakage. (ref.: 6.1.1.13, p. A-3 and 6.2.7.11)

4.5.7.2 The dampers are designed for open/ close operation and fail as-is upon loss of air. (ref.: 6.1.1.13, p. A-3 and 6.2.7.11) The dampers fail close on loss of power. (ref.: 6.2.1.21)

4.5.7.3 The dampers are rated for 10 in. w.g. differential pressure at a 2000 fpm maximum face velocity. (ref.: 6.1.1.13, A-4 and 6.2.7.11)

4.5.8 *Fire dampers*

4.5.8.1 Fire dampers should be U.L. labeled and meet the requirements of NFPA Standard 90A. For dampers which are exceptions to NFPA 90A see Reference 6.2.3.18. Selection and installation should be in accordance with Specification 118-003 (ref.: 6.2.7.7).

4.5.8.2 Fire doors and fire dampers installed in ventilation ducts penetrating fire barriers in vital areas are 3-hour fire rated. (ref.: 6.1.1.36)

4.5.8.3 Ventilation ducts penetrating fire barriers shall have fire dampers installed. (ref.: 6.1.1.9, 6.1.1.7, Section IV.C.2.a.29 & 30, IV.C.2.d.14 & 17, 6.1.3.8, 6.1.3.9)

4.5.9 *TORNADO CHECK DAMPERS*

4.5.9.1 Tornado check dampers are designed to close against a pressure drop of 3 psi in 3 seconds for 20 seconds. (ref.: 6.1.2.6)

4.5.9.2 Tornado check valves shall meet the requirements of Sections 2.1.1 and 2.1.2. They shall be Seismic Category 1 and are subject to the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3)

4.5.9.3 The seismic analysis report for the tornado check valves may be found in Reference 6.2.8.4.

4.5.9.4 The tornado check valves were designed in accordance with ASME Boiler and Pressure Vessel Code, Section VIII.

4.5.9.5 The inlet tornado check valves are installed in the normal flow direction. They are designed to close during a tornado and to restore following a tornado with no operator intervention. (ref.: 6.2.8.4 and 6.7.7)

4.5.9.6 The discharge tornado check valves are installed with flow opposite to the normal direction and are provided with a counter weight system to hold them open during normal operation. The discharge checks are equipped with pneumatic cylinders to allow removal of the counter weight for testing of the valves. (ref.: 6.7.7)

4.5.9.7 The discharge tornado check valves are designed to close during a tornado without operator intervention. Restoring the valves after a tornado is accomplished by shutting down the exhaust fans and allowing the counter weight to operate. (ref.: 6.2.8.4)

4.5.10 *VORTEX TYPE FLOW CONTROL DAMPERS*

4.5.10.1 Vortex type flow control dampers are used to control the quantity of air supplied to and exhausted from each Battery Room. The supply vortex dampers are used to control temperature, while the exhaust vortex dampers are used to control negative pressure.

4.5.10.2 Vortex type flow control dampers are necessary for control of temperature and negative pressure, therefore, they shall meet the requirements of Sections 2.1.1 and 2.1.2 . The dampers shall be Seismic Category I and be subject to the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3) to meet the requirements of Sections 2.1.1 and 2.1.2.

4.6 FILTERS

4.6.1 *HEPA AND CHARCOAL FILTER TRAINS (EMERGENCY FILTERS)*

4.6.1.1 *General*

4.6.1.1.1 Each emergency filter train contains a charcoal filter bank and a HEPA filter upstream of the charcoal. (ref.: 6.1.1.13, pp. A-24 and A-30).

4.6.1.1.2 The redundant emergency filter trains shall be constructed to Seismic Category I requirements. (ref.: 6.1.1.13, p. A-24) These filter trains shall be in accordance with 10 CFR 50 Appendix B to meet the requirements of Section 2.1.1.

4.6.1.1.3 For the radiological analyses of the Control Room, the following ventilation system filter efficiencies for iodine were assumed: (refs.: 6.1.1.2, Section 9.4.1.2; 6.1.1.13, p. 5-5; 6.1.1.27, p. 1-5, and 6.1.1.1, Section 9.4.1.2)

- Elemental = 95 percent
- Organic = 90 percent
- Particulate = 95 percent

4.6.1.1.4 The combined pressure drop across the HEPA filters and adsorber banks is less than 8.5 inches water gauge. (ref.: 6.1.1.13, p. A-28)

4.6.1.1.5 There are no water drains used in the emergency recirculation filtration system. (ref.: 6.1.1.13, p. A-32) Water drains are not required since build-up of moisture is not a concern. See Section 4.6.1.3.5 for additional discussion of entrained moisture.

4.6.1.1.6 The filter efficiencies for iodine meet ANSI N509-1976 guidelines for iodine removal efficiency. (ref.: 6.1.1.13, p. A-32)

4.6.1.1.7 The filter system is designed to withstand the anticipated fission product heat loading from a TID-14844 release without reaching the desorption temperature of the charcoal filters. (ref.: 6.1.1.13, p. A-33)

4.6.1.1.8 Components should be provided with a minimum of 3 linear feet from mounting frame to mounting frame between banks of components. (ref.: 6.1.1.13, p. A-35)

4.6.1.1.9 Conformance to design parameters is demonstrated by verifying a system flow rate of 2000 scfm +/- 10 % during system operation when tested in accordance with ANSI N510-1975. (refs.: 6.1.1.13, p. A-36 and 6.1.1.3, 4.7.2.b.3)

4.6.1.1.10 Each emergency filter unit housing is provided with access doors (approximately 20 x 50 inches in size) to give complete accessibility to components for servicing. (ref.: 6.2.7.11)

4.6.1.1.11 The housing for each filter train is designed to withstand a pressure differential range from minus 15 inches of water to 1.5 psi positive, applied to the inside, with no permanent deformation or damage. (ref.: 6.2.7.11, p. 16)

4.6.1.1.12 The seismic evaluation of the Emergency Filters may be found in reference 6.2.8.6.

4.6.1.2 *HEPA Filters*

4.6.1.2.1 HEPA filters, filter and adsorber mounting frames, and filter housings meet the recommendations of ANSI N509-1976. (ref.: 6.1.1.13, p. A-31,32)

4.6.1.2.2 HEPA filters are tested for an efficiency of 99% for particulate iodine. (ref.: 6.1.1.13, p. B-1) Specified HEPA filter efficiency is 99.97% at 0.3 μ particulate size. (ref.: 6.2.7.11) This is also in accordance with the definition of a HEPA provided in Reference 6.2.8.3.

4.6.1.2.3 HEPA filter pressure drops are as follows:

- clean filter: 1.0 in. W.G.
- dirty filter pressure drop (normal change-out point): 3.0 in. W.G.
- Emergency operation allowable pressure drop: 8.0 in. W.G.

(ref.: 6.2.7.11)

4.6.1.2.4 HEPA Filters should be in accordance with UL-586 (ref.: 6.3.41) (ref.: 6.2.7.11)

4.6.1.2.5 The HEPA filters included with the filter train should have an efficiency of not less than 99.97% through the complete filter (medium, frame, and gasket) when operated at rated capacity and tested with thermally generated Dioctylphthalate (DOP) of uniform 0.3 micron droplet size in accordance with the Edgewood Arsenal Manual. (ref.: 6.2.7.11, p. 8)

4.6.1.3 *Charcoal Adsorbers*

4.6.1.3.1 If a high temperature condition is detected, the filtering train automatically shuts down to limit desorption of the charcoal. The desorption temperature of the charcoal is greater than 302°F. (ref.: 6.1.1.13, p. A-33)

4.6.1.3.2 Provisions should be made for obtaining representative adsorbent samples in order to estimate the amount of penetration of the system. (ref.: 6.1.1.13, p. A-38)

4.6.1.3.3 Adsorbent samples are obtained after every 720 hours of operation. (ref.: 6.1.1.13, p. A-39)

4.6.1.3.4 The practical limit of the testing system and instrumentation for charcoal bed leakage is 0.01% (99.99% efficient). This is the limiting factor for charcoal beds, since the charcoal is tested to 99.999% efficiency. (ref.: 6.1.2.7)

4.6.1.3.5 Under dry conditions, charcoal removes iodine materials well; but under 100% humidity conditions the efficiency drops sharply. Efficiency for methyl iodine form is satisfactory at relative humidities less than 70%, but at over 80% humidity is significantly reduced. Heaters are recommended for installations encountering over 70 % humidity air. (ref.: 6.1.2.5) The filter trains do not require a moisture separator because of the mixing of 50 percent outdoor air and recirculation air ensures that the relative humidity will be maintained below the critical conditions. (ref.: 6.1.1.13, pp. A-24 and A-30)

4.6.1.3.6 Charcoal ignition temperature should not be less than 340 °F. (ref.: 6.2.7.11)

4.6.2 *ROLL-TYPE FILTERS*

4.6.2.1 Analysis has shown that without the use of the recirculation roll filter, radiological limits inside the Control Room area will not be exceeded due to charcoal dust from the emergency filter system. (ref.: 6.1.1.13, p. A-24 and 6.2.3.17) Therefore, the recirculation roll filters are not required to meet the requirements of 10 CFR 50 Appendix B. <u>These filters are required to be seismically qualified to the extent that their failure shall not compromise the operation of the CBHVAC System during or after a seismic event to meet the requirements of Section 3.4.3.4.</u>

4.6.2.2 The supply roll filters are provided for increased reliability and reduced maintenance for components inside the CB, however, they are not required for any of the criteria listed in Section 2.1.2 or Reference 6.4.3. Therefore, the supply roll filters are not required to be Safety Related. <u>These filters are required to be seismically qualified to the extent that their failure shall not compromise the operation of the CBHVAC System during or after a seismic event to meet the requirements of Section 3.4.3.4.</u>

4.6.2.3 The filters for the intake plenum and the Control Room Normal Ventilation subsystem (recirculation plenum) have an efficiency of 80 to 85% when tested by the Air Filter Institute weight method. (ref.: 6.1.1.2, Section 10.10.5.4)

4.7 AIR CONDITIONING UNITS

4.7.1 *CONTROL ROOM AIR CONDITIONING UNITS*

4.7.1.1 The air cooled condensing units were specified in accordance with UE&C Specification 45-6 (ref.: 6.2.7.2) and UL Standard 465 (ref.: 6.3.40).

4.7.1.2 Under the worst anticipated degraded CBHVAC performance (see Section 3.1.6.2), the administratively controlled doors for the affected areas of the Control Room could be opened to help keep those Rooms cooler. No equipment failures are expected if two of the three air-conditioning units fail. (ref.: 6.1.1.13, p. A-21)

4.7.1.3 Humidity of the Control Room area is maintained by the air conditioning equipment and use of cooling coils. Incoming air is mixed with recirculated air to ensure the incoming atmosphere is maintained at a nominal 50 percent relative humidity. (ref.: 6.1.1.13, p. A-30)

4.7.1.4 Cooling coils are direct expansion evaporator coils and are each connected to its compressor-condenser unit with a closed refrigerant piping system. The condenser coils are cooled by fans utilizing outside air. (ref.: 6.1.1.2, Section 10.10.5.4)

4.7.1.5 The Control Room Air Conditioning Units are not required to be operable to meet the requirements of Section 1.1.2 and therefore are not required to meet 10 CFR 50 Appendix B. These units are required to be Seismic Category I. (ref.: 6.2.2.3)

4.7.1.6 Motors in the Control Room Air Conditioning Units should be in accordance with Reference 6.3.40 (UL 465). (ref.: 6.2.7.2)

4.7.2 *COMPUTER ROOM AIR CONDITIONING UNITS*

4.7.2.1 The Computer Room Air Conditioning Units are not required to meet the requirements of Sections 2.1.1 or 2.1.2. These units are not designated as Safety related nor are they required to be seismically qualified.

4.8 COMPRESSED AIR SYSTEM COMPONENTS

4.8.1 *RECEIVER TANKS*

4.8.1.1 For all tanks outside primary containment the stored energy and plant arrangement with respect to potential missiles and possible missile trajectory have been evaluated using the Modified Petry Formula. Where required, missile barriers were installed. These analyses and corrective actions are adequate for providing protection from a tank rupture. (ref.: 6.1.1.2, Section M10.24 and 6.6.1.1 pp. 3-3 and 3-8 and 6.1.2.16, # 46)

4.8.1.2 The Control Room HVAC Air receivers shall meet the requirements of Sections 2.1.1 and 2.1.2 . The receivers shall be Seismic Category I and be subject to the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3).

4.8.1.3 The seismic test report for these tanks may be found in Reference 6.2.8.7.

4.8.2 *AIR COMPRESSORS*

4.8.2.1 The Control Room Air Compressors are the sole source of air for the CBHVAC System. Compressed air is required for operation of the CBHVAC system. These units and supporting components (pressure regulators, etc.) shall be seismically qualified and shall meet the requirements of 10 CFR 50, Appendix B.

4.8.2.2 Two 100% redundant air compressors are provided. Each air compressor, driven by a 2 hp motor, discharges to a dedicated 60-gallon air receiver. (refs.: 6.2.4.1 and 6.2.7.18) The air compressors are automatically controlled to maintain, within instrument tolerances, each air receiver pressurized between 78 psig and 92 psig. (ref.: 6.2.4.1)

4.8.2.3 The seismic test report for these compressors may be found in Reference 6.2.8.9.

4.8.3 *AIR DRYER*

4.8.3.1 The Control Room HVAC Air Dryer shall meet the requirements of Sections 2.1.1 and 2.1.2 . The dryer shall be Seismic Category I and be subject to the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3).

4.8.3.2 The compressed air is dried and cooled by a refrigerant type air dryer. The air dryer is designed to maintain a dewpoint less than 0 °F at 20 psig. (ref.: 6.2.7.18)

4.8.3.3 The seismic test report for the air dryer and accessories may be found in Reference 6.2.8.10.

4.8.4 *AIR PRESSURE REDUCING VALVES*

4.8.4.1 The Air Pressure Reducing Valves shall meet the requirements of Sections 2.1.1 and 2.1.2 . The valves shall be Seismic Category I and be subject to the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3).

4.8.4.2 Pressure reducers are provided to maintain a constant pressure of 20 psig on the Control system (ref.: 6.2.7.18) and 60 to 90 psig for operation of the exhaust tornado valve test function. (refs.: 6.1.2.10 and 6.7.7)

4.8.4.3 The seismic test report for the air pressure reducing valves may be found in Reference 6.2.8.8.

4.8.5 *AUTOMATIC DRAIN VALVES*

4.8.5.1 Automatic drain traps are provided in the CBHVAC Instrument Air Subsystem to prevent the buildup on condensation in the air receivers and to allow drainage of condensation from the air dryer.

4.8.5.2 The automatic drain traps in the CBHVAC Instrument Air Subsystem shall meet the requirements of Sections 2.1.1 and 2.1.2 . The traps shall be Seismic Category I and be subject to the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3).

4.8.5.3 The seismic test report for the automatic drain valves may be found in Reference 6.2.8.8.

4.9 ELECTRIC HEATERS

4.9.1 *BATTERY ROOM DUCT HEATERS*

4.9.1.1 The Battery Room Duct heaters are provided for reliability and availability of the batteries. They are provided based on the economic advantage of avoiding entering LCO's and possible subsequent plant shutdown, but are not required to function during or after an accident, nor are they required to prevent an accident. Therefore, the Battery Room Duct Heaters are not required to meet the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3). Since the heaters are mounted inside the duct, the Battery Room Heaters are required to be Seismically Qualified to the extent that their failure during or after a seismic event shall not affect the functioning of the Battery Room Ventilation System to meet the requirements of Section 3.4.3.4.

4.9.1.2 The Battery Room Duct Heaters are sized to maintain a temperature of at least 77 °F assuming a 0 °F outdoor air temperature with flow reduced to the winter minimum. (ref.: 6.2.3.26) See Section 3.6.5.1 for minimum air flow rates.

4.9.2 *CONTROL ROOM DUCT HEATERS*

4.9.2.1 The Control Room Duct Heaters are provided for personnel comfort during original plant start-up and extended dual unit outages during the winter, but are not required to function during or after an accident, nor are they required to prevent an accident. Therefore, the Control Room Duct Heaters are not required to meet the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3).

4.9.2.2 The heaters are mounted inside the duct, the Control Room Duct Heaters are required to be Seismically Qualified to the extent that their failure during or after a seismic event shall not affect the functioning of the Control Room Normal Ventilation System to meet the requirements of Section 3.4.3.4.

4.9.2.3 The heaters were sized to conservatively account for the minimum expected heat load of a dual unit shutdown. The assumptions were 30% of equipment heat load, 50% of the lights and 2000 scfm of make-up air. Without the make-up air, the listed equipment and lighting load is adequate to maintain the Control Room above 65 °F on a 15 °F day. (refs.: 6.1.2.2, 6.2.3.36, and 6.2.3.38)

4.9.3 *MECHANICAL EQUIPMENT ROOM HEATERS*

4.9.3.1 The Mechanical Equipment Room Heaters (2 15 KW each) are provided to maintain the Mechanical Equipment Room above 55°F based on an outdoor air temperature of 15°F. Per calculation 9527-6-VAC-4-F (ref.: 6.2.3.38), only 21 KW is required to meet these listed criteria.

4.9.3.2 The Mechanical Equipment Room heaters are not required to function during or after an accident, nor are they required to prevent an accident. Therefore, the Mechanical Equipment Room Electric Heaters are not required to meet the requirements of 10 CFR 50 Appendix B (ref.: 6.4.3). The Mechanical Equipment Room heaters are required to be seismically qualified to the extent that their failure shall not compromise the operation of the CBHVAC System as required by Section 3.4.3.4.

5.0 DESIGN MARGIN

This section discusses and identifies known margin in the CBHVAC design, assuring the system's ability to fulfill its safety function. Design Margin is the difference between the minimum acceptable criteria and the system capability. This should not be confused with the Margin of Safety, which is the area above the acceptance limit (i.e., minimum acceptable criteria) that is in the control of the NRC. Refer to the Corporate 10 CFR 50.59 Program Manual for further clarification.

Quantifying margin with a view to reducing it is a complex and regulatory sensitive task that should be approached with caution.

5.1 LOCA AND MSLB DOSES

NRC acceptance limits: 5 rem whole body, 30 rem thyroid, 30 rem skin See Section 3.6.8 for results of analyzed conditions.

5.2 BATTERY HYDROGEN CONCENTRATION

The Battery Rooms are supplied with at least 1580 scfm of air. The minimum required air flow to maintain hydrogen concentrations below the explosive limit is 110 scfm. (ref.: 6.2.3.37) This does not account for pockets of hydrogen.

5.3 BATTERY ROOM TEMPERATURES

The Batteries are adequately sized to provide the required current at a temperature of 65 °F with a 10% design margin (ref.: 6.2.3.19). At a cell temperature of 60 °F, the design margin is 7% (ref.: 6.2.3.2) Note that this calculation has not received final approval. The Battery Room Heaters are sized to maintain the rooms at a temperature of 77 °F on a 0 °F day (outdoor ambient) (refs.: 6.2.1.11 and 6.2.1.12).

5.4 CHLORINE CONCENTRATION

Per R.G. 1.95, the two minute concentration limit for chlorine is 15 ppm (45mg/ml). The calculated worst case chlorine concentrations in the control room are 10 ppm at 156 minutes (ref.: 6.2.8.5).

6.0 DESIGN BASIS DOCUMENT REFERENCES

This section provides a listing of documents used as references in this DBD and other major documents important to system design. These listings are not intended to be all encompassing in order to minimize the revisions to the DBD. EDBS and NRCS can be utilized for detailed listings of the design output documents. The references have been categorized by type.

Not all reference documents were originally issued with a unique number. In such cases a "MISC" number has been assigned to identify the document in NED's DBD Reconstitution System Files.

6.1 GENERAL

6.1.1 *LICENSE BASIS DOCUMENTS*

6.1.1.1 Updated Final Safety Analysis Report, Brunswick Steam Electric Plant

6.1.1.2 Final Safety Analysis Report, Brunswick Steam Electric Plant Through Amendment 31 (date: 11/26/75)

6.1.1.3 Appendix A to License No's. DPR-62 & 71, BSEP Technical Specifications, Unit 1 and Unit 2

6.1.1.4 Appendix B to License No's. DPR-62 & 71, BSEP Environmental Technical Specifications, Unit 1 and Unit 2

6.1.1.5 NG-75-300, 02/27/75, Quality Assurance Program (contains original commitments to QA Reg. Guides, etc.)

6.1.1.6 NG-75-1278, 08/26/75, Quality Assurance Program (revisions and clarification to NG-75-300)

6.1.1.7 BTP APCSB 9.5-1, 1/1/77, Fire Protection Program Review

6.1.1.8 NG-77-705, 6/23/77, Administrative Controls for Fire Protection

6.1.1.9 NG-77-706, 6/23/77, Fire Protection Program Evaluation

6.1.1.10 GD-79-3307, 12/31/79, Lessons Learned Short Term Requirements

6.1.1.11 MISC-05508, 03/02/83, NUREG-0737 Item III.D.3.4, Control Room Habitability (From CP&L to NRC Transmitting NUS-3697, Rev 2)

6.1.1.12 OQA-81-026, 03/18/81, Quality Assurance Program

6.1.1.13 NUS-3697, Rev 2, 3/2/83, Control Room Habitability Evaluation

6.1.1.14 LAP-83-128, 04/15/83, Generic Letter 82-33 Response

6.1.1.15 LAP-83-434, 10/14/83, Supplement to Generic Letter 82-33 Response

6.1.1.16 LAP-83-408, 09/30/83, Emergency Response Capability - Regulatory Guide 1.97 (Submits Revision 0 of position paper ans supp)

6.1.1.17 NLS-84-025, 02/01/84, BSEP Emergency Response Capability - Regulatory Guide 1.97 - Revision 1 (Submits Revision 1 of position paper and supp)

6.1.1.18 ASCA, April 1984, Alternative Shutdown Capability Assessment Report, BSEP Units 1&2

6.1.1.19 NLS-84-202, 05/08/84, Response to Generic Letter 82-33, Supplement 1 to NUREG-0737, Requirements for Emergency Response Capability - Regulatory Guide 1.97 (Submits Revision 2 of position paper and supp)

6.1.1.20 NLS-84-345, 10/03/84, Control Room Habitability - Inability to Maintain 1/8th inch positive pressure

6.1.1.21 NLS-85-009, 01/22/85, BSEP - Emergency Response Capability - Conformance with Regulatory Guide 1.97, Revision 2

6.1.1.22 NLS-85-054, 2/21/85, Control Room Habitability

6.1.1.23 NLS-85-125, 4/15/85, Control Room Habitability (commits to making transport time greater than isolation time for chlorine events)

6.1.1.24 NLS-85-365, 6/07/85, Control Room Habitability (reiterates prior commitments on installation of hold-up line)

6.1.1.25 NLS-85-275, 8/5/85, Control Room Habitability

6.1.1.26 NLS-85-311, 8/30/85, Control Room Habitability (transmittal letter for NUS-4758)

6.1.1.27 NUS-4758, 8/85, Control Room Radiological Reanalysis Brunswick Steam Electric Plant

6.1.1.28 NLS-86-015, 3/5/86, Request for License Amendment, Chlorine Detection System

6.1.1.29 NLS-86-094, 3/28/86, Supplement Request for License Amendment, Chlorine Detection System

6.1.1.30 NLS-87-101, 05/19/87, Appendix R Safety Evaluation Report Comments

6.1.1.31 NLS-87-123, Control Room Design Review-Final Summary Report, Revision 1, June 23, 1987.

6.1.1.32 NLS-89-020, 02/03/89, Response to NRC Generic Letter 88-14, Instrument Air Supply System Problems Affecting Safety-related Equipment

6.1.1.33 NLS-90-231, 11/15/90, Response to NRC Station Blackout Safety Evaluation

6.1.1.34 NLS-91-323, 12/18/91, Response to NRC Supplemental Safety Evaluation of CP&L Response to Station Blackout Rule

6.1.1.35 Brunswick Physical Security Plan, current amendment

6.1.1.36 SSAR, Rev. 0, 10/01/90, 10CFR50 APP. R Safe Shutdown Analysis Report, Brunswick Nuclear Project

6.1.2 *CORRESPONDENCE*

6.1.2.1 MISC-00223, 09/30/71, Control Building HVAC (comments on drawings)

6.1.2.2 MISC-00229, 11/17/71, Control Building HVAC (resolutions to comments)

6.1.2.3 MISC-00230, 01/20/72, Control Building HVAC - Heating for the Battery Rooms

6.1.2.4 MISC-00224, 01/26/72, Control Building HVAC - Control Room Heating

6.1.2.5 MISC-00293, 02/14/72, Standby Gas Treatment System - Charcoal bed Heaters

6.1.2.6 MISC-0231, 03/13/72, Control Building HVAC - Drawings

6.1.2.7 MISC-00296, 09/20/72, Charcoal Bed Depth versus Efficiency - Farr Company

6.1.2.8 UC-07712, 04/23/73, Air Conditioning Equipment for the Control Building

6.1.2.9 UC-09818, 07/17/73, Plant Batteries

6.1.2.10 UC-11087, 09/17/73, Control Building Ventilation Check Valve Solenoid Operation

6.1.2.11 UC-11173, 9/20/73, Instrument Air Compressors: Missiles due to tank rupture

6.1.2.12 CU-04071, 9/24/73, Proposed Regulatory Guide (Chlorine Detection - draft of R.G. 1.95 is attached)

6.1.2.13 CU-04090, 9/28/73, Compressor Tank Rupture

6.1.2.14 UC-14334, 03/15/74, BSEP Computer Room A.C. System (recommends addition of a package A/C unit)

6.1.2.15 CU-05355, 04/24/74, Computer Room Air Conditioning (accepts recommendation of package A/C unit

6.1.2.16 MISC-00489, 08/02/74, Commitments Made Concerning Brunswick Steam Electric Plant

6.1.2.17 B-3513, 12/03/74, Telephone Conversation Memorandum on Outstanding AEC Concerns, between R.G. Black (CP&L) and Ray Powell (AEC)

6.1.2.18 MISC-04912, 01/24/75, Trip Report for Brunswick Site Visit January 21 through January 22, 1975

6.1.2.19 BSEP/75-373, 04/30/75, Additional Railcar Storage on the BSEP Site

6.1.2.20 UC-24285, 08/11/76, Battery Chargers

6.1.2.21 UC-30556, 4/24/81, Control Room Ductwork - Seismic Qualification

6.1.2.22 NLS-84-054, 02/02/84, Battery Capacity Testing

6.1.2.23 NSSS-85-316, 04/16/85, BSEP Control Room Positive Pressurization Analysis and Action Plan

6.1.2.24 UC-35292, 01/27/87, Control Room Habitability - Comparison of FSAR and UFSAR Analyses for an MSLB

6.1.2.25 BSEP/87-1051, 09/18/87, HPCI, RHR, and Battery Room Temperature Limits

6.1.2.26 MISC-04948, 11/23/91, Rain Build-up in CBHVAC Intakes

6.1.2.27 MISC-5404, 12/04/91, Oxygen Concentrations in the Control Room

6.1.2.28 UC-35669, 09/17/92, Control Room Doses Following A Main Steam Line Break

6.1.3 *VIOLATION RESPONSES / LERS / SPECIAL REPORTS*

6.1.3.1 LER 1-84-33, 12/19/84, Failure of Units 1 and 2 common CL Detection System to meet FSAR/T.S. Design Criteria

6.1.3.2 LER 1-85-040, 08/22/85, Automatic Starting of Control Building Emergency Air Filtration trains 2A and 2B

6.1.3.3 LER 1-85-048, 10/02/85, Automatic Start Signals to Control Building Emergency Air Filtration System

6.1.3.4 LER 1-86-007, 03/21/86, Automatic Starting of Control Building Emergency Air Filtration Train 2A

6.1.3.5 LER 1-90-007, Rev 1, 8/10/90, Failure of CBEAF System to meet Design Basis for Toxic Gases (Chlorine)

6.1.3.6 LER 1-91-003, Rev. 2, 09/30/91, Fail as-is Position of CBEAF System Inlet and Outlet Dampers not Evaluated with Respect to a Chlorine Event

6.1.3.7 BSEP/82-819, 01/15/82, Special Report per Technical Specification 3.7.8a

6.1.3.8 BSEP/82-2259, 10/15/82, Special Report per Technical Specification 3.7.8a

6.1.3.9 BSEP/82-1073, 05/18/82, Special Report per Technical Specification 3.7.8a

6.1.3.10 BSEP/85-0143, 1/30/85, Response to Infractions of NRC requirements

6.1.4 *PROCEDURES AND NON-TECHNICAL MANUALS*

6.1.4.1 PAM, current revision, Carolina Power and Light Company, Nuclear Generation, Procedures Administration Manual

6.1.4.2 CQAM, current revision, Carolina Power and Light Company, Corporate Quality Assurance Manual

6.1.4.3 SD-37, Rev. 5, 1/31/89, System Description: Control Building Heating, Ventilation, and Air Conditioning System

6.1.4.4 PO-55, 03/18/75, Unit 2 Preoperational Test Procedure for Control Building Heating, Ventilation, and Air Conditioning System

6.1.4.5 PO-55, 08/07/76, Unit 1 Preoperational Test Procedure for Control Building Heating, Ventilation, and Air Conditioning System

6.2 DESIGN DOCUMENTS

6.2.1 *PLANT MODIFICATIONS*

6.2.1.1 PM 75-096, 02/14/75, CB Air Intake FECP-1066 - Separated CB Intake From Condenser Area

6.2.1.2 PM 75-321, 05/16/75, CB HVAC ECP 0133 - CB Exhaust fans. Added Condenser Area Booster Fans and Switches to Enhance Condenser Performance

6.2.1.3 PM-75-385, 06/12/75, CB HVAC FECP 1138 - Chlorine Isol Stopped 2A & 2B-ERF-CB on Receipt of a Chlorine Signal & Closed Normal Make-up

6.2.1.4 PM 76-019, 01/22/76, Wiring For CR Air Intake High CL to Annunciator

6.2.1.5 PM 77-215, 08/17/77, CR Area High Radiation Alarm - Reconnection of Auto Isolation Relays From CR Radiation Monitors that were disconnected via an earlier mod

6.2.1.6 PM 77-358, 8/2/78, Replace Existing Fire Dampers with 3 Hr Rated Ones, Add Cowl on CB Exhaust Air Outlets, Add Ventilation and Smoke Removal Fans for Diesel Generator Oil Storage Tank Rooms

6.2.1.7 PM 79-308, 12/18/79, CB Charcoal Filter - Adds Detectors and Isolation Circuit

6.2.1.8 PM 81-181, 6/19/81, Installation of Temporary Boiler Package

6.2.1.9 PM 81-266, 11/18/81, Aux Boiler Removal

6.2.1.10 PM 81-272A, 2/26/82, Aux Steam System Upgrade

6.2.1.11 PM 84-336, 9/20/84, HVAC - Battery Room, Unit 1

6.2.1.12 PM 84-337, 9/21/84, HVAC - Battery Room, Unit 2

6.2.1.13 PM 85-042, 10/07/85, Automatic Actuation of CB EAFS

6.2.1.14 PM 85-057, 08/01/85, Control Room Habitability/Chlorine Detection System

6.2.1.15 PM 85-124, 09/15/86, Fire Seal Damper Modifications

6.2.1.16 PM 86-016, 04/23/86, CBEAFS Input Control Logic Change

6.2.1.17 PM 86-072, 12/01/86, Chlorine Detector Replacement

6.2.1.18 PM 87-125, 08/06/90, CR HVAC Upgrade

6.2.1.19 PM 87-269, 12/31/87, Replace/Modify 2L-D-CB Logic Upgrade

6.2.1.20 PM 90-036, 06/05/90, Damper 2L-D-CB Logic Upgrade

6.2.1.21 PM 91-055, 04/13/92, Correction of Control Room Emergency Air Damper Fail Safe Position

6.2.1.22 PM 92-108, In Progress, Control Building EAF Improvements

6.2.2 *ENGINEERING EVALUATIONS*

6.2.2.1 EER 84-0663, Rev. 0, 12/12/84, Document Identified Deficiencies in CR Habitability

6.2.2.2 EER 85-0208, Rev. 0, 8/29/85, Quality Class Determination for Chlorine Detection System

6.2.2.3 QLE 87-34, Rev. 0, 06/12/87, Q-list Evaluation for Control Building Air Conditioning

6.2.2.4 EER 87-0448, Rev. 0, 10/15/87, Repair of Vibration Isolation Assembly for 2A-ERF-CB

6.2.2.5 EER 87-0553, Rev. 0, 12/21/87, Evaluate Procurement of Rubber Seal for Control Room HVAC Damper 2-VA-2L-D-CB as OTS-Q

6.2.2.6 EER 88-0343, Rev. 0, 07/25/88, CB HVAC Air Compressor Relief Valve Setpoint

6.2.2.7 EER 89-0307, Rev. 0, 11/30/89, Short Term Evaluation for HVAC Supports (plant wide)

6.2.2.8 EER 91-0041, Rev. 0, 02/08/91, Control Building Emergency Filtration System Single Failures

6.2.2.9 EER 91-0091, Rev. 0, 05/30/91, Evaluation of Safety-related Damper Failure Positions

6.2.2.10 EER 92-0352, Rev. 0, 10/07/92, CBEAF Single Failure Operability Assessment

6.2.3 *CALCULATIONS*

6.2.3.1 BNP-E-6.004, Rev. 0, 08/15/89, Fault Current Calculation for 125/250 VDC Switchboards 1A, 1B, 2A, 2B and their Downstream MCCs and Distribution Panels

6.2.3.2 BNP-E-6.073, NOT APPROVED, Calculation for Sizing 125/250 V DC Lead-Acid Storage Batteries

6.2.3.3 BPE-2547, 02/17/84, Battery Room Heaters - Hydrogen Generation

6.2.3.4 G0077A-01, 10/17/89, Brunswick Control Room Emergency Filter System (CREFS) Differential Pressure Analysis

6.2.3.5 M-2635, Rev. 0, 11/24/87, Control Room Damper Isol Mode Leak Rate in Meeting Necessary Criteria During Hypothetical Chlorine Spill (transmittal is UC-35378)

6.2.3.6 M-90-0CB-0001, Rev. 0, 10/26/90, Flow velocity for Compressible Fluids that Results from a Small Pressure Differential

6.2.3.7 0VA-0008, Rev. 0, 02/01/91, Brunswick Control Room LOCA Integrated Dose Reanalysis with Damper Isolation at 24-hrs Post-LOCA

6.2.3.8 0VA-0009, Rev. 0, 02/07/91, Provide an Analysis of Inhalation (Thyroid) Doses to Control Room for a Steam Line Break Accident (assuming Failure of the Control Room to isolate for 10 minutes - this is UE&C calculation No. 9527-8-SS-112-F)

6.2.3.9 0VA-0010. Rev. 0, Validation Report on Chlorine Detection/Isolation system Functional Design Basis

6.2.3.10 0VA-0013, Rev. 0, 02/01/83, Prediction of Damage Caused by Fan Blade

6.2.3.11 0VA-0018-87125, Rev. 1, 10/28/91, Installation Tolerances for HVAC Control Panel 2-VA-M1-CB

6.2.3.12 0VA-0020, Rev. 0, Seismic Qualification of HVAC Systems
Note: As of issuance of revision 0 of this DBD, this calculation was not approved.

6.2.3.13 0VA-0041, Rev. 0, 10/07/92, Main Steam Line Break Doses in the Control Room

6.2.3.14 0FP-0001, Rev. 0, 06/12/89, Battery Room Hydrogen Generation

6.2.3.15 01534A-248, Rev. 0, 08/21/90, Control Room Radiation Monitor Setpoint Evaluation (NUS calc. # 3F74-M-01)

6.2.3.16 4019-RD-A1, Rev. 0, 02/10/83, Control Room Dose due to a LOCA, Considering Failure of Charcoal Filter and Clean-up System

6.2.3.17 4019-RD-A2, Rev. 0, 02/10/83, Control Room Thyroid Dose Due to Charcoal Filter Failure

6.2.3.18 704U-M-05/S3, Rev. 0, 08/20/87, Adequacy of Control Building HVAC Fire Dampers

6.2.3.19 7579-139-S-E-003, Rev. 2, 02/28/90, Battery Loading Study for Design Basis Accidents (includes calc. set 7537-139-3-EDOO-05-F)

6.2.3.20 7579-199-6-VAC-8-F, Rev 0, 6/29/84, Control Room Pressurization to 1/8th in. W.G.

6.2.3.21 7579-199-6-VAC-10-F, Rev 0, 5/30/85, Control Room Normal Make-up Damper 2L-D-CB Inlet/Outlet Pressures

6.2.3.22 7866.014-S-M-019, Rev 0, 5/21/85, Chlorine Spill Study Report

6.2.3.23 8S20-E-01, Rev. 1, 03/30/89, BSEP SBO Coping Study EDG Loads

6.2.3.24 8S42-M-08, Rev. 2, 12/05/91, Station Blackout - Control Room Loss of HVAC

6.2.3.25 8S42-P-101, Rev. 4, Station Blackout Coping Analysis Report

6.2.3.26 84-071-0-01-F, Rev. 0, 11/19/85, Analysis for Battery Room Heat Load

6.2.3.27 86-072-01, Rev. 0, 01/26/87, Seismic Qualification of Instrument and Electrical Equipment For Chlorine Detector Monitoring Mounting for 1/2X-AT-2977 and 1/2X-AT-2979

6.2.3.28 87-125-11, Rev. 0, 05/17/90, Brunswick Control Room HVAC Ducting Pressure Drop Calculation

6.2.3.29 87-125-20, Rev. 1, 02/20/91, Brunswick Control Room HVAC Upgrade Modification 87-125, Dynamic Analysis and Anchor Bolt Evaluation for Pneumatic Control Panel 2-VA-M1-CB

6.2.3.30 9527-0-C-1CLOR-1-0, Rev 0, 4/1/74, Seismic Analysis of Chlorine Gas Monitoring

6.2.3.31 9527-1-CB-DS-01-F, Rev 0, 5/1/84, AC and Vent Ducts in Control Building-Duct Supports

6.2.3.32 9527-1-CB-DS-02-F, Rev 0, 5/1/84, AC and Vent Ducts in Control Building-Duct Supports

6.2.3.33 9527-1-CB-DS-03-F, Rev 0, 10/29/84, Control Building HVAC - Air Supply to the Battery Rooms

6.2.3.34 9527-1-CB-SC-01, Rev. 0, 02/09/81, Control Building - Structural Calculation

6.2.3.35 9527-6-VAC-1-F, Rev 0, 6/1/71, Control Building Ventilation - Ventilation Requirements During a Tornado

6.2.3.36 9527-6-VAC-2-F, Rev 0, 4/20/71, Control Building Ventilation - Ventilation/ Air Conditioning Requirements

6.2.3.37 9527-6-VAC-3-F, Rev 0, 1/18/72, Control Building Ventilation - Ventilation Requirements for Safe H_2 Levels in Battery Rooms

6.2.3.38 9527-6-VAC-4-F, Rev 0, 5/26/71, Control Building Ventilation - Heating Requirements for the Winter Months

6.2.3.39 9527-6-VAC-5-F, Rev 0, 2/07/72, Control Building Ventilation - Static Pressure Losses for HVAC Ductwork

6.2.3.40 9527-6-VAC-6-F, Rev 0, 5/15/73, Control Building Ventilation - Analysis of Refrigerant Suction Piping

6.2.3.41 9527-6-VAC-7-F, Rev 0, 5/15/73, Control Building Ventilation - Analysis of Refrigerant Discharge Piping

6.2.3.42 9527-6-VAC-9-F, Rev 0, 5/22/85, Control Room Complex HVAC System Infiltration Analysis

6.2.4 *PROCUREMENT DOCUMENTATION*

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6.2.5 *DESIGN BASIS DOCUMENTS*

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6.2.5.2 DBD-50, current revision, Design Basis Document for AC Electrical System

6.2.5.3 DBD-51, current revision, Design Basis Document for DC Electrical System

6.2.5.4 DBD-58, current revision, Design Basis Document for Structures and Cranes System

6.2.5.5 DBD-101, current revision, Design Basis Document for Appendix R

6.2.5.6 DBD-102, current revision, Design Basis Document for Seismic Qualification

6.2.5.7 DBD-106, current revision, Design Basis Document for Hazards Analysis

6.2.5.8 DBD-107, current revision, Design Basis Document for Regulatory Guide 1.97

6.2.5.9 DBD-109, current revision, Design Basis Document for Human Factors

6.2.5.10 DBD-110, current revision, Design Basis Document for Single Failure Criteria

6.2.5.11 DBD-111, current revision, Design Basis Document for Station Blackout

6.2.5.12 DBD-112, current revision, Design Basis Document for Cable and Raceway

6.2.6 *DRAWINGS*

6.2.6.1 F-4080, current revision, Control Building Air Flow Diagram Units 1 & 2

6.2.6.2 FP-4321, shts 1 through 6, current revision, Control Building Units 1 & 2

6.2.6.3 F-4127, current revision, Control Building - Computer Room Air Conditioning System

6.2.6.4 F-04207, current revision, Fire Protection - Control Building, Diesel Generator Oil Tank Room Ventilation and Smoke Removal

6.2.7 *SPECIFICATIONS*

Specifications listed in this section are listed both with and without revision levels. For modifications or purchases, the current revision of the specification should be used (See NRCS for latest specification revisions). For information on existing equipment, the revision of the Specification in effect at the time of purchase of the particular component of interest must be used.

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6.2.7.2 45-6, Specification for Air Conditioning Equipment for the Control Building

6.2.7.3 45-8, Specification for In-Line Fans

6.2.7.4 45-10, Specification for Heating System Accessories

6.2.7.5 45-12, Specification for Coil Modules for the Control Building

6.2.7.6 45-019, Specification for Subcooling Refrigeration for the Control Room HVAC

6.2.7.7 118-003, Selection and Installation of Fire Barrier Penetration Seals

6.2.7.8 128-001, Specification for Non-special Alternating Current Induction Motors Less Than 100 HP

6.2.7.9 226-001, Specification for Sheet Metal and Accessories

6.2.7.10 226-002, Specification for Sheet Metal Work

6.2.7.11 236-11, Specification for Control Building Emergency Filters

6.2.7.12 248-051, Revision 13, Specification for Instrument Tubing and Tubing Fittings

6.2.7.13 248-053, Specification for Installation of Instruments for Piping Systems Classified as IB, II, IIA, IIB

6.2.7.14 248-57, Specification for Ventilation Check Valves for the Control Building

6.2.7.15 248-107, Specification for Seismic Pipe Supports and HVAC Supports and Miscellaneous Structural Steel

6.2.7.16 248-121, Specification for Non-safety Related Fire Protection and Radwaste Pipe

6.2.7.17 248-133, Specification for Q-list (safety-related) Instrument Tubing and Tube Fittings

6.2.7.18 252-22, Specification for Automatic Controls for Heating, Ventilating, and Air Conditioning Systems

6.2.7.19 252-091, Specification for Pressure Switches

6.2.8 *MISCELLANEOUS TECHNICAL REFERENCES/REPORTS*

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6.2.8.5 UC-07582, 4/2/73, Study of Accidental Chlorine Release

6.2.8.6 D-51843, 06/20/73, Seismic Evaluation of CB Emergency Filters

6.2.8.7 MISC-04990, 07/18/73, Seismic Vibration Test of one (1) Tank Outfit H71-60-T

6.2.8.8 TLP-774-468, 10/01/73, Johnson Service Company Test Report, Seismic Testing of Miscellaneous HVAC Instruments

6.2.8.9 MISC-01221, 03/17/75, Seismic Vibration Test on One Motor-Compressor Assembly, Gaynes Laboratories Job No. 75188

6.2.8.10 MISC-01223, 08/21/75, Seismic Vibration Test on One Refrigerated Aftercooler and Dryer for Compressed Air

6.2.8.11 UC-30556, 4/24/81, Control Room Ductwork - Seismic Qualification

6.2.8.12 NO-80-1924, 12/30/80, Control Room Habitability Requirements (transmittal of Rev. 0 of NUS 3697)

6.2.8.13 BPE-3346, 01/21/85, Chlorine Dispersion Calculations (ref: FSAR comment M14.5)

6.2.8.14 Q-list Evaluation 87-34, Control Building Air Conditioning, 6/12/87

6.2.8.15 NCR A-89-013, 03/01/89, HVAC Supports differ from as-built used for Seismic Calculations

6.2.8.16 27873-91N, 04/29/91, Test Report for Seismic Qualification of Johnson Controls Pneumatic Components for Johnson Yokogawa

6.2.8.17 Design Guide IV.8, latest revision, HVAC System Design

6.2.8.18 DG-VIII.53, current revision, BNP Human Factors Engineering

6.2.8.19 DG-VIII.58, current revision, Human Factors Evaluation of Plant Modifications

6.2.8.20 CP&L Corporate Welding Manual, latest revision

6.3 CODES AND STANDARDS

6.3.1 AISC 1963, Specification for Design Fabrication, and Erection of Structural Steel for Buildings

6.3.2 AISC, 8th Ed., Specification for Design Fabrication, and Erection of Structural Steel for Buildings

6.3.3 ANS-3.3-1982, Security For Nuclear Power Plants

6.3.4 ANSI B31.1.0-1967, Power Piping

6.3.5 ANSI N18.7-1976, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants

6.3.6 ANSI N45.2.4-1972, Installation, Inspection, and Testing Requirements for Instrumentation and Electrical Equipment During the Construction of Nuclear Generating Stations

6.3.7 ANSI N45.2.8-1975, Supplementary Quality Assurance Requirements for Installation, Inspections, and Testing of Mechanical Equipment and Systems for the Construction Phase of Nuclear Power Plants

6.3.8 ANSI N45.2.10-1973, Quality Assurance Terms and Definitions

6.3.9 ANSI N45.2.11-1974, Quality Assurance Requirements for the Design of Nuclear Power Plants

6.3.10 ANSI/ASME N-509, 1976, Nuclear Power Plant Air Cleaning Units and Components

6.3.11 ANSI/ASME N-510, 1975, Testing of Nuclear Air Cleaning Systems

6.3.12 ASHRAE Equipment Handbook, 1988

6.3.13 ASHRAE Fundamentals Handbook, 1972

6.3.14 ASHRAE Fundamentals Handbook (I-P or SI Edition), 1989

6. ASHRAE HVAC Systems and Applications Handbook, 1987

6.3 ASHRAE 41.1-1986, Standard Method for Temperature Measurement

6.3.17 ASHRAE 41.3-1989, Standard Method for Pressure Measurement

6.3.18 ASHRAE 41.7-1984, Standard Method for Measurement of Flow of Gas

6.3.19 ASHRAE 111-1988, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems

6.3.20 ASME Section VIII -1971, Boiler Pressure Vessel Code

6.3.21 AWS-D.1.1, revision is specified in Corporate Welding Manual (ref.: 6.2.8.20), Structural Welding Code - Steel

6.3.22 IEEE-279-1971, Criteria for Protection Systems for Nuclear Power Generating Systems

6.3.23 IEEE-308-1971, Class 1E Electrical Systems for Nuclear Power Generating Stations

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6.2.28 IEEE 379-1972, IEEE Trial-use Guide for the Application of the Single Failure Criterion to Nuclear Power Generating Station Protection Systems

6.3.29 IEEE-450-1980, Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations

6.3.30 IEEE-484-1975, IEEE recommended Practice for Installation Design and Installation of Large Lead Storage Batteries for Generating Station and Substations

6.3.31 IEEE-485-1983, Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations

6.3.32 ISA-S5.1-1973, Instrumentation Symbols and Identification

6.3.33 MIL-F-51068C, 06/08/70, Filter, Particulate, High Efficiency, Fire Resistant

6.3.34 SMACNA, 2nd Ed., 19??, High Velocity Duct Construction Manual

6.3.35 SMACNA, 1st Ed., 1985, HVAC Duct Construction Standards, Metal and Flexible

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6.3.39 SMACNA, 1975, Accepted Practice for Industrial Duct Construction

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6.4 REGULATIONS

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6.4.5 Code of Federal Regulations, Title 10, Part 73, (10 CFR 73), 1990, Physical Protection of Plants and Materials

6.4.6 Code of Federal Regulations, Title 10, Part 100, (10 CFR 100), 1989, Reactor Site Criteria

6.4.7 Code of Federal Regulations, Title 29, Part 1910, (29 CFR 1910), 1990, Occupational Safety and Health Act

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6.5.2 S. G. 5, Revision 0, 03/10/71, Assumptions for Evaluating the Potential Radiological Consequences of a Steam Line Break for Boiling Water Reactors

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6.5.6 R.G. 1.52, Revision 1, July 1976, Design, Testing and Maintenance Criteria for Engineered Safety Feature Atmosphere Clean-up System Air Filtration and Adsorption Units of Light-water-cooled Nuclear Power Plants

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6.5.13 NUREG-0660, May 1980, TMI Action Plan Requirements

6.5.14 NUREG-0700, September 1981, Guidelines for Control Room Design Reviews

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6.5.16 NUREG-75/087, Revision 1, USNRC Standard Review Plan

6.5.17 NUREG-0801, October 1981, Evaluation Criteria for Detailed Control Room Design Reviews

6.5.18 NUREG-0908, August 1982, Acceptance Criteria for the Evaluation of Nuclear Power Reactor Security Plans

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6.6.1.2 NLU-77-28, November 22, 1977, Fire Protection SER

6.6.1.3 NLU-83-673, 10/18/83, Resolution of TMI Action Item III.D.3.4 Control Room Habitability (SER)

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6.6.1.5 NLS-85-297, 04/14/85, Emergency Response Capability - Conformance to Regulatory Guide 1.97, Rev. 2 - BSEP, Units 1 & 2

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6.6.1.9 NRC-89-812, 12/06/89, Appendix R Safety Evaluation Clarification and Revision - BSEP

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6.6.5 *USNRC GENERIC LETTERS*

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6.6.5.3 GL-84-01, 01/05/84, NRC Use of Terms Important to Safety and Safety Related. CP&L reference NLU-84-31

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6.6.6 *USNRC INFORMATION NOTICES*

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6.7.2 FP-4465, current revision, Filter System, Control Building Emergency Air, Farr Company

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6.7.5 FP-4366, current revision, Fans, Axivane, Series 800, 1000, and 2000, Joy Manufacturing Co.

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7.0 APPENDICES

None