Response to

Request for Additional Information No. 89 (1179, 1181), Revision 0

10/2/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.03 - Secondary Containment Functional Design
SRP Section: 06.04 - Control Room Habitability System
Application Section: FSAR Ch 6

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

Question 06.02.03-1:

AVS flow

Tech. Spec. SR 3.6.6.4 states: Verify the annulus can be maintained at a pressure ≥ 0.25 inches wg by one AVS train at a flow rate of ≤ 1295 cfm.

Tech. Spec. B3.6.6 Surveillance Requirements, SR 3.6.6.3 and 3.6.6.4 state: SR 3.6.6.4 demonstrates that the annulus can be maintained at a negative pressure ≥ 0.25 inches wg using one AVS train at a flow rate ≤ 1320 cfm.

As tabulated in Tier 2 FSAR Table 6.2.3-1, the maximum AVS fan flow rate is 1177 cfm.

Which AVS train flow rate is correct: 1295 cfm, 1320 cfm, or 1177 cfm?

Response to Question 06.02.03-1:

The AVS fan design air flow is 60–1177 cfm, as stated in U.S. EPR FSAR Tier 2, Table 6.2.3-1. U.S. EPR FSAR Tier 2, Chapter 16 Tech Spec SR 3.6.6.4 and Spec 5.5.10 are based on a nominal AVS fan flow of 1177 cfm. The values listed in TS 5.5.10 for AVS are ≥ 1060 and ≤ 1295 cfm which are ± 10% of the nominal AVS fan flow. The U.S. EPR FSAR Tier 2, Chapter 16 TS Bases for SR 3.6.6.3 and 3.6.6.4 will be changed from 1320 cfm to 1295 cfm.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16 TS Base SR 3.6.6.3 and TS Base 3.6.6.4 will be revised as described in the response and as indicated on the enclosed markup.

Question 06.02.03-2:

Condensation heat transfer correlation

Tier 2 FSAR Table 6.2.3-2, Secondary Containment Response Analysis, Notes 2 states: Heat transfer calculated by methods provided in BTP 6-2.

BTP 6-2 adopts a combination of Tagami correlation and Uchida correlation for the blowdown and post-blowdown phase heat transfer calculation.

Tier 2 FSAR Section 15.6.5.1.2, Method of Analysis and Assumptions states: As part of an EM requirement for containment modeling, the 1.7 Uchida heat transfer coefficient multiplier for application to containment heat structures is confirmed.

Which heat transfer model is used for Secondary Containment Response Analysis, 1.7 Uchida or BTP 6-2 model?

Provide a rational for its acceptability

Response to Question 06.02.03-2:

An analysis was performed to determine the thermal hydraulic response of the annulus between the reactor containment building and the reactor shield building following a design basis loss of coolant accident (LOCA). The analysis, described in U.S. EPR FSAR Tier 2, Section 6.2.3.3 and Table 6.2.3-2, covers the first 24 hours after the postulated accident. The evaluation used an infinite heat transfer coefficient such that the surface temperature of the primary containment wall is at the primary containment design temperature at the start of the transient. In addition, the primary containment design temperature was used as the primary containment LOCA temperature which bounds any expected post-LOCA temperature response.

U.S. EPR FSAR Tier 2, Section 15.6.5.1.2 describes the method of analysis and assumptions used for the primary containment following a postulated large break loss of coolant accident (LBLOCA). The Chapter 15 LBLOCA analyses are independent of the one performed for the annulus and described in Chapter 6.

The infinite heat transfer coefficient used in the annulus response analysis is acceptable because it conservatively bounds either the 1.7 Uchida or the BTP 6-2 recommended model.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 06.02.03-3:

Annulus temperature

Provide details of the thermal analysis that demonstrate the AVS will maintain acceptable annulus air temperature during accidents. Please include the key analysis assumptions, annulus in-leakage, heat loads, containment wall temperatures, and other calculation input parameters. Is heat conduction through metal penetrations considered?

Response to Question 06.02.03-3:

The annulus ventilation system (AVS) annulus air temperature response during accidents was calculated using the GOTHIC computer code. Heat loads in the annulus were not included in the analysis because the containment penetrations for high energy pipes are enclosed in guard pipe to minimize heat transfer between the piping and the annulus. Heat conduction through metal penetrations was not included in the analysis. It would take approximately 23 hours for the post-accident primary containment temperature to diffuse through the 1.3 m pipe penetration segment into the annulus using a conservative diffusivity value of 2×10^{-5} m^2/s for steel. This time is well beyond the calculated draw-down time of 305 seconds. The following assumptions were selected to maximize the annulus temperature response:

- Bounding inleakages from the primary containment and environment, into the annulus, were used.
- The primary containment design temperature was conservatively used for the primary containment loss of coolant accident (LOCA) temperature.
- Heat transfer from the primary containment to the primary containment wall was accounted for by using an infinite heat transfer coefficient.
- The primary containment wall consists of layers of various materials. The main portion of the containment in contact with the annulus is concrete and there is an air gap between the concrete and a painted stainless steel liner. In the analysis, the primary containment wall was considered to be made only of concrete. This is conservative because there is less resistance to heat transfer.
- The maximum ambient temperature was conservatively used for the environment temperature.

Initially, the annulus air temperature slightly increases prior to the AVS activation due to the conservative primary containment temperature, which results in a conservative air inleakage temperature and to the step reduction of the annulus volume as a result of the primary containment expansion post accident. Immediately after activation of the AVS, the temperature momentarily decreases due to the large draw-down rate. The annulus temperature then increases for the remainder of the transient. The calculated annulus temperature is conservatively high due to the use of bounding inleakage flow fluid conditions. Regardless, the annulus air temperature remains below the design temperature throughout the accident.

The actual primary containment temperature peaks before one hour into the accident and gradually decreases afterwards. Therefore, the primary containment inleakage temperature would be lower than that used in the analysis.

The results show that the AVS will maintain acceptable annulus air temperature during accidents.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 06.02.03-4:

Annulus pressure

Provide details of the pressure analysis that demonstrate the AVS will draw acceptable vacuum in annulus during accidents. Please include the key analysis assumptions, fan performance, annulus volume, and other calculation input parameters.

Response to Question 06.02.03-4:

The annulus pressure response during accidents was calculated using the GOTHIC computer code. The following assumptions were selected to maximize the pressure response:

- The annulus ventilation system (AVS) filters were considered fouled from the start of the analysis for conservatism.
- The AVS was not activated until 60 seconds after the start of the postulated loss of coolant accident (LOCA). This conservatively maximizes the annulus pressure response.
- The annulus volume decrease, due to thermal and mechanical expansion of the primary containment, was conservatively modeled by step-reducing the volume at the beginning of the transient. This results in the maximum increase in annulus pressure and temperature and, therefore, the maximum draw-down time for the AVS.
- The primary containment design pressure was conservatively used for the primary containment LOCA pressure.

The annulus pressure initially increases before the AVS is activated. After activation of the AVS, the pressure gradually decreases. The AVS draws down the annulus to -0.25 inch w.g in 305 seconds and to -2.5 inch w.g. in 565 seconds. The long-term results demonstrate the ability of the AVS to maintain the annulus at design subatmospheric conditions. The results show that the AVS will maintain acceptable annulus pressure during accidents.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 06.02.03-5:

Leak-off system

Please provide a description of the leak-off system and an explanation how it will capture bypass leakage.

Response to Question 06.02.03-5:

A response to this question will be provided by December 15, 2008.

Question 06.04-1:

Details of iodine protection factor (IPF) methodology used in the radiological dose analysis:

Areas of Review Section III of SRP Section 6.4, Revision 3, Review Procedure, Paragraph 3.D specifies a concern in the iodine protection factor (IPF) methodology used for transporting radioactive material into and through the control room. Per RG 1.183, Paragraph 4.2.3, the Murphy/Campe methodology may not be adequately conservative. FSAR Tier 2, Section 15.0.3.3.5, paragraph “Finite-Cloud Correction” references the Murphy/ Campe model for the LOCA. The EPR references the RADTRAD[1] computer code, which RG 1.183 states incorporates suitable methodologies. There is insufficient information to determine if RADTRAD was used for the IPF methodology, if another model was used, or if Murphy/Campe IPF methodology was used with proper rigor as specified in SRP Section 6.4, Review Procedure, Paragraph 3.D and RG 1.183, paragraph 4.2.3. Provide information to demonstrate the IPF methodology used in the radiological dose analysis is sufficiently conservative.

Response to Question 06.04-1:

The loss of coolant accident (LOCA) control room dose calculation was performed using the Polestar Applied Technology, Inc. proprietary STARDOSE computer code. With respect to the control room dose modeling, STARDOSE and RADTRAD are similar. In fact, comparative calculations were done with RADTRAD to confirm the STARDOSE control room dose results.

Although both STARDOSE and RADTRAD employ the Murphy-Campe finite-cloud correction endorsed by RG 1.183, Paragraph 4.2.7, neither code makes use of the Murphy-Campe IPF methodology discouraged by RG 1.183, Paragraph 4.2.3. A rigorous alternative methodology is employed by both STARDOSE and RADTRAD to integrate the rate of change of activity in the control room over time.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

1 RADTRAD is referenced in U.S. EPR FSAR Tier 2, Section 15.0.3.11.2 and Tables 15.0-50 and 15.0-52, but is used for Natural Deposition Decontamination Coefficients in the primary containment leakage pathway only.

Question 06.04-2:

CR air quality testing

Tier 2 FSAR Section 6.4.5: …..Air quality testing is performed in accordance with ASRAE 62 (Reference 4). Where in the Tech. Spec. or any document the air quality testing is described or performed? Is there any application document committing to the ASHRAE testing? ASHRAE 62 is a standard to specify outdoor air flow rates, not a testing procedure. Explain which portion of ASHRAE 62 is intended to be tested and how to achieve it.

Response to Question 06.04-2:

A response to this question will be provided by December 15, 2008.

Question 06.04-3:

Maintain positive pressure of 0.125 inches during normal condition

Tier 2 FSAR Section 6.4.2.2: ……The ventilation system maintains a positive pressure of 0.125 inches water gauge as a minimum within the CRE areas with respect to adjacent environmental zones to prevent uncontrolled, unfiltered in-leakage during normal and accident conditions. Tier 2, FSAR, 9.4.1.1 has similar statement on positive pressure of 0.125 inches water gauge.

Tier 2 FSAR Section 9.4.1.2.3, Normal Plant Operation: …….Exhaust air from the kitchen and sanitary rooms is not recirculated. The exhaust air is directed by a separate exhaust duct and exhaust fans to the SBVSE air outlet.

Explain how a positive pressure of 0.125 inches is maintained within the CRE areas during normal conditions given that the exhaust air from the kitchen and sanitary rooms is not recirculated?

Response to Question 06.04-3:

A response to this question will be provided by December 15, 2008.

Question 06.04-4:

CR conceptual design

The use of conceptual design information for the control room design basis is not appropriate. Remove the conceptual design basis information from the control room description (FSAR Chapter 6.4). Interface requirements like toxic gas evaluations should be identified as specific COL information items rather than be designated as conceptual.

Response to Question 06.04-4:

The designation of the toxic gas detectors as conceptual was meant originally to reflect the possibility that some COL sites may not need toxic gas detectors. The evaluation of potential toxic chemical accidents is addressed in U.S. EPR FSAR Tier 2, Section 2.2.3. As described in COL Item 2.2-1, "A COL applicant that references the U.S. EPR design certification will provide site-specific information related to the identification of potential hazards stemming from nearby industrial, transportation, and military facilities within the site vicinity, including an evaluation of potential accidents (such as explosions, toxic chemicals, and fires)." Though this evaluation is site-specific, AREVA agrees that in order to meet GDC 19 and the corresponding SRP acceptance criteria for control room habitability in U.S. EPR FSAR Tier 2, Sections 6.4 and 9.4.1, the main control room (MCR) design must include protection of MCR personnel from releases of chlorine or other toxic gases under accident conditions. Therefore, the U.S. EPR FSAR will be revised as indicated below to delete the conceptual design information from the MCR design basis. The COL applicant will evaluate the toxic gas hazards and determine the types of sensors required. COL Item 6.4-1 will be revised to state:

> "A COL applicant that references the U.S. EPR design certification will identify the type(s) of Seismic Category I Class IE toxic gas sensors (i.e., the toxic chemical(s) of concern) necessary for control room operator protection."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 1.8, Section 6.4, Section 9.4.1, Section 14.2, and Chapter 16 will be revised as described in the response and as indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

- The Access Building, Turbine Building, and the Fire Protection Storage Tanks and Pump Building. Conceptual design information for these structures is included, delineated by double brackets ([[ ]]), in Section 1.2 and Section 3.7.2.

- The Switchgear Building. Conceptual design information for this structure is included, delineated by double brackets ([[ ]]), in Section 1.2, Section 8.3, and Section 8.4.

- The auxiliary power and generator transformer areas. Conceptual design information for these components is included, delineated by double brackets ([[ ]]), in Section 8.2.

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- Buried conduit duct banks, pipe ducts, and piping. Conceptual design information for these components is included, delineated by double brackets ([[ ]]), in Section 3.8.

- ~~Toxic gas detectors for main control room. Conceptual design information that includes protection from hazardous chemicals and toxic gases is included, delineated by double brackets ([[ ]]), in Section 6.4, Section 9.4.1, and Section 16.0 – Technical Specifications 3.7.10, 5.5.17, and corresponding bases for 3.7.10 and 3.7.12.~~

- The portions of the circulating water supply system outside the Turbine Building. Conceptual design information for this system is presented, delineated by double brackets ([[ ]]), in Section 10.4.5, based upon a cooling tower approach.

- Security structures, systems, and components outside the U.S. EPR buildings listed above. Conceptual design information for these structures, systems, and components is included, delineated by double brackets ([[ ]]), in Section 13.6.

- The offsite power transmission system including the main switchyard area. Conceptual design information for this system is included, delineated by double brackets ([[ ]]), in Section 8.2.

- The lightning protection and grounding system grid. Conceptual design information for this system is included, delineated by double brackets ([[ ]]), in Section 8.3.

Table 1.8-1—Summary of U.S. EPR Plant Interfaces with Remainder of Plant, identifies the interfaces between the U.S. EPR standard design and the remainder of the plant. The safety-related interface requirements in Table 1.8-1 have been selected based on a review of interfaces between the U.S. EPR standard design and other COL applicant or site-specific items. The interface types are classified as follows:

- U.S. EPR interface: Assumptions made for the U.S. EPR design that must be verified during the coordination effort between the designer of the U.S. EPR and the COL applicant.

- Site Parameters: Site-related parameters upon which the U.S. EPR design is based.

Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section	Action Required by COL Applicant	Action Required by COL Holder
6.1-2	If components cannot be procured with DBA-qualified coatings applied by the component manufacturer, a COL applicant that references the U.S. EPR design certification must do one of the following: procure the component as uncoated and apply a DBA-qualified coating system in accordance with 10 CFR 50 Appendix B, Criterion IX; confirm that the DBA-unqualified coating is removed and the component is recoated with DBA-qualified coatings in accordance with 10 CFR 50 Appendix B, Criterion IX; or add the quantity of DBA-unqualified coatings to a list that documents those DBA-unqualified coatings already existing within containment.	6.1.2.3.2	Y	
6.2-1	A COL applicant that references the U.S. EPR design certification will identify the implementation milestones for the CLRT program described under 10 CFR 50, Appendix J.	6.2.6	Y	
6.3-1	A COL applicant that references the U.S. EPR design certification will describe the containment cleanliness program which limits debris within containment.	6.3.2.2.2	Y	
6.4-1	A COL applicant that references the U.S. EPR design certification will identify ~~any~~the type(s) of Seismic Category I Class IE toxic gas sensors (i.e., the toxic chemical(s) of concern) necessary for control room operator protection.	6.4.~~2.4~~.6	Y	
6.4-2	A COL applicant that references the U.S. EPR design certification will provide written emergency planning and procedures in the event of a radiological or a hazardous chemical release within or near the plant, and will provide training of control room personnel.	6.4.3.~~2~~		Y
6.4-3	A COL applicant that references the U.S. EPR design certification will evaluate the results of the toxic chemical accidents from Section 2.2.3 and address their impact on control room habitability in accordance with RG 1.78.	6.4.4	Y	

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Table 1.8-1—Summary of U.S. EPR Plant Interfaces with Remainder of Plant
Sheet 1 of 2

Item No.	Interface	Interface Type	Section
1-1	Switchgear Building	U.S. EPR Interface	1.2, 8.3, 8.4
1-2	Access Building	U.S. EPR Interface	1.2, 3.7.2
1-3	Turbine Building	U.S. EPR Interface	1.2, 3.7.2
1-4	Fire Protection Storage Tanks and Building	U.S. EPR Interface	1.2, 3.7.2
2-1	Envelope of U.S. EPR site related design	Site Parameter	2.0, Table 2.1-1
2-2	Consequences of potential hazards from nearby industrial, transportation and military facilities	Site Parameter	2.2
2-3	Site-specific χ/Q values based on site-specific meteorological data at the exclusion area boundary (EAB), low population zone (LPZ), and control room	Site Parameter	2.3
2-4	Site-specific seismic parameters	Site Parameter	2.5, 3.7
2-5	Soil conditions and profiles	Site Parameter	2.5, 3.7
2-6	Bearing pressure of soil beneath the nuclear island basemat	Site Parameter	2.5
2-7	Foundation settlements	Site Parameter	2.5
3-1	Missiles generated from nearby facilities	Site Parameter	3.5
3-2	Missiles generated by tornadoes or extreme winds	Site Parameter	3.5
3-3	Aircraft hazards	Site Parameter	3.5
3-4	Site-specific loads that lie within the standard plant design envelope for Seismic Category I structures	Site Parameter	3.8
3-5	Buried conduit duct banks, pipe ducts, and piping	U.S. EPR Interface	3.8
~~6-1~~	~~Toxic gas detectors for the main control room~~	~~U.S. EPR Interface~~	~~6.4, 9.4.1, 16 – TS&B – 3.7.10, TS – 5.5.17, B 3.7.12~~
8-1	Off-site ac power transmission system connections to the switchyard and the connection to the plant power distribution system	U.S. EPR Interface	8.2
8-2	On-site ac power transmission system connections to the switchyard and the connection to the plant power distribution system	U.S. EPR Interface	8.3
8-3	Auxiliary power and generator transformer areas	U.S. EPR Interface	8.2
8-4	Lightning protection and grounding system grid	U.S. EPR Interface	8.3.1

06.04-4

6.4 Habitability Systems

The main control room (MCR) habitability systems are designed to allow control room operators to remain in the MCR to operate the plant safely under normal conditions and to maintain the plant in a safe state under accident conditions.

The habitability systems protect the plant operators from the effects of accidental releases of [[toxic and]] radioactive gases. The systems also provide the necessary support for the Technical Support Center (TSC) personnel in case of an accident or abnormal event. The TSC is contained within the control room envelope (CRE).

06.04-4

The term "habitability systems" refers to equipment, supplies, and procedures. The habitability equipment is defined in Section 6.4.2.1.

Control room habitability system objectives include:

- Missile protection and radiation shielding (Section 3.8).
- Air filtration (Section 6.5.1, Section 9.4.1).
- Pressurization and air conditioning (Section 9.4.1).
- Fire protection (Section 9.5.1).
- Radiation monitoring (Section 12.3.4).
- [[Detection of and protection from toxic gases and hazardous chemicals.]]
- Lighting (Section 9.5.3).
- Personnel support.

06.04-4

6.4.1 Design Basis

Control room habitability is provided, so that the plant can be operated safely under normal conditions, and maintained safely under accident conditions or abnormal events. These design bases relate to MCR habitability:

- Habitability systems are designed to accommodate the effects of environmental conditions associated with normal operation, maintenance, testing, and postulated accidents and are protected against dynamic effects that may result from equipment failures and from events and conditions outside the nuclear power unit (GDC 4).
- The MCR habitability systems are not shared among multiple nuclear power units (GDC 5).

- The CRE is protected from radiological releases to permit access and occupancy of the MCR under accident conditions (GDC 19).
- [[The CRE is protected from hazardous chemical releases to permit access and occupancy of the MCR.]]

06.04-4

- The MCR air conditioning system (CRACS) provides the capability to isolate the CRE from the surrounding areas, pressurize the CRE to prevent in-leakage, and filter supply air to remove radioactive halogens (10 CFR 50.34(f)(2)(xxviii)).
- The air intake structures are physically separated and located away from potential radiological sources, (10 CFR 50.34(f) (2) (xxviii)).
- The CRE design permits periodic testing and in-service inspection to confirm integrity.

The CRACS design bases are presented in Section 9.4.1.

6.4.2 System Design

6.4.2.1 Definition of Control Room Envelope

The MCR contains the equipment necessary to monitor and control the plant during all operating conditions and to bring the plant to a safe shutdown state.

The CRE comprises these areas:

- Main control room.
- Shift supervisor's office.
- Integrated operations area including:
  - Technical support center.
  - NRC office area.
  - Break area.
- Sanitary facilities.
- Instrumentation and controls (I&C) service center.
- Service corridors.
- Computer rooms.
- Equipment rooms that contain MCR ventilation supply, filtration, and air conditioning systems.

The CRE is housed within Safeguard Buildings 2 and 3. The CRE is shown in Figure 6.4-1—Control Room Envelope Plan View 1, Figure 6.4-2—Control Room Envelope Plan View 2, and Figure 6.4-3—Control Room Envelope Elevation View. The total free-air volume of the CRE is approximately 200,000 ft^3.

These personnel support items are maintained within the confines of CRE in sufficient quantities for required operational personnel:

06.04-4

- Non-perishable food supply and drinking water.
- Emergency medical supply kits.
- SCBA units, air supply equipment and protective clothing for protection from smoke{{, and toxic or noxious gases}}.
  - SCBA units contain a minimum of six hours of air supply capacity{{, as specified by RG 1.78}}.

Food, water, and medical needs of the control room personnel are met using the site emergency preparedness process for providing these services to emergency centers, following the guidance of NUREG-0654 (Reference 1). Emergency planning is addressed in Section 13.3.

6.4.2.2 Ventilation System Design

The CRACS design is described in Section 9.4.1, which identifies and describes major components, design parameters and classifications, instrumentation and controls, and provides a system schematic. Figure 15.0-4 presents airflows through the system for post-accident filtration. Section 6.5.1 describes the engineered safety features (ESF) filter systems and fission product removal capability for the CRACS.

Section 3.8.4 contains elevation and plan views of the Safeguard Buildings. Figure 2.3-1 provides the relative locations of potential radiological release points and the CRACS air intakes. The evaluation of potential toxic chemical accidents is addressed in Section 2.2.3. Figure 6.4-1 through Figure 6.4-3 illustrate the CRE layout, including surrounding corridors, doors, stairwells and shielded walls.

The CRACS intakes are located on the roof of Safeguard Buildings 2 and 3, to prevent {{intrusion of toxic gases or }}radiological contamination. The two intakes are physically separated and are removed from potential radiological release points, including the main steam relief exhaust, the Safeguard Building depressurization shafts, and the stack, in both lateral and vertical directions. Section 15.0.3 identifies the bounding atmospheric release point used in the radiological analyses.

06.04-4

Radiation monitors in the CRACS supply air duct continuously measure the concentration of radioactive materials in the supply air. The control room airborne radioactivity monitoring system is addressed in Section 12.3.4.

The main features related to control room habitability of the CRACS design are:

- Under normal operating conditions:
  - The ventilation system operates in the recycling mode with fresh air makeup.
  - The air makeup rate corresponds to the exhausts from the kitchen and sanitary rooms and leakage out of the area due to the controlled overpressure.
- The ventilation system maintains an ambient condition for comfort and safety of control room occupants and to support operability of the MCR components during normal operation, anticipated operational occurrences (AOO), and design baseds accidents (DBA).
- The ventilation system maintains a positive pressure of 0.125 inches water gauge as a minimum within the CRE areas with respect to adjacent environmental zones to prevent uncontrolled, unfiltered in-leakage during normal and accident conditions. The filtered outside air supply rate during accident conditions corresponds to 0.3 volume changes per hour.
- During a site radiological contamination event, the air intake is redirected through the ESF filter system trains.
- 06.04-4 [[Control room operators are protected from chlorine releases and other toxic gases in accordance with RG 1.52, RG 1.78, and ASME AG-1 (Reference 2).]]
- The ventilation system can be operated in full recirculation mode without outside air makeup during DBAs [[or events involving toxic gas releases]]. The recirculated airflow rate is 17,000 cfm.
- 06.04-4 The ventilation system provides adequate capacity for proper temperature and humidity within the CRE.
  - Redundancy for air cooling, filtration, and toxic gas protection is provided by having two independent trains for critical functions.
  - Redundancy is provided for proper operation of the system when one active component is out of service.
  - Power supplies of the active components are backed up with emergency power so that they function in case of a loss of offsite power.

6.4.2.3 Leak-tightness

The CRACS is maintained in a manner that minimizes the unfiltered in-leakage across the CRE boundary. Adequate leak-tightness for air sealing components supports operator habitability within the CRE boundary during normal operation, AOOs and DBAs.

Leak-tightness provisions for pressure boundary components are:

- Pipe penetrations are sealed and tested for air leakage after initial construction.
- Cable penetrations are sealed and tested for air leakage after initial construction.
- Doors used for personnel or equipment access are sealed and remain substantially air-tight to maintain pressurization of the CRE area. Doors are arranged to allow access by necessary operational personnel and maintain pressurization of the CRE area. Two access doors are arranged in series to form a configuration similar to an air lock, minimizing in-leakage from surrounding areas.
- Open ended drain lines are provided with water seals.
- All building joints within the CRE boundary are sealed.

The CRACS maintains a positive pressure of 0.125 inches water gauge as a minimum within the CRE boundary, which limits unfiltered in-leakage through walls, ceiling, doors, pipes and cable penetrations.

The CRE boundary limits leakage from adjacent environmental zones to a maximum of 50 cfm unfiltered in-leakage. The system design requirements are provided in Section 9.4.1 and testing requirements are specified in the control room envelope habitability program in the Technical Specifications Section 5.5.17.

6.4.2.4 Interaction with Other Zones and Pressure-Containing Equipment

The CRACS does not supply air to areas other than the CRE. The air supply filtration and air conditioning systems are within the pressure boundary, thus minimizing the potential in-leakage of contaminated air into the MCR through fan shafts or ductwork connections.

06.04-4

The CRE area is isolated ~~and pressurized~~ in the event of an outside fire, external toxic gas release, smoke, and excessive concentrations of carbon monoxide or carbon dioxide. During these events, outside air is automatically isolated and CRACS operates in full recirculation mode. Upon detection of toxic gas or smoke, audible or visual alarms are actuated in the MCR. The CRACS and filter systems can be manually aligned from the MCR.

06.04-4

Fire barriers with a three hour fire rating enclose the MCR. Openings penetrating the fire barrier are furnished with both fire doors and fire dampers or approved fire rate seals meeting the associated barrier fire duration rating. In case of a fire within the CRE area, the room supply and exhaust are isolated by fire dampers and monitoring and control of the plant can be performed from the remote shutdown station (RSS).

The RSS is located in a different fire zone and is on a different elevation than the MCR, and is not contained within the CRE boundary. The RSS is described in Section 7.4.

The CRACS does not interact with air conditioning equipment serving adjacent zones, minimizing the possibility of transferring [[toxic or]]radioactive gases into the CRE. Piping not connected or related to the equipment within the CRE boundary is routed outside the pressurized boundary of the CRE.

06.04-4

The MCR is not located near pressure-containing tanks, equipment, or piping, such as CO_2 tanks or steam lines, which upon failure could transfer dangerous or hazardous material to the CRE. However, portable self-contained breathing apparatus (SCBA) are available for use by the control room operators.

6.4.2.5 Shielding Design

Massive concrete structures separate the MCR from the reactor containment atmosphere and the external environment, as described in Section 3.8. The thick concrete walls prevent any significant direct radiation shine from outside the Safeguard Buildings. The MCR is protected against direct shine from the MCR charcoal filtration system by a 19 inch concrete floor. Radiation sources and shielding requirements are identified in Section 12.2 and Section 15.0.3. The MCR dose calculations that are presented in these sections identify the contribution from direct radiation shine and demonstrate that the total MCR dose under accident conditions is within regulatory limits.

6.4.3 System Operational Procedures

During normal plant operation, the CRACS maintains acceptable environmental conditions within the CRE boundary. Upon receipt of a high radiation signal in the air intakes or a primary containment isolation signal, the system is automatically switched so that the intake is routed through the emergency filtration system. The operating modes of the CRACS are described in Section 9.4.1.

06.04-4

[[Upon detection of any hazardous chemicals in the environment which have a potential for infiltration within the CRE boundary, the control room operator will take protective measures within a short period of time from the initiation of the toxic gas sensors and alarms. The operators are not subjected to prolonged exposures during this time.]] Storage provisions for SCBAs and procedures for their use allow operators to begin using the SCBAs within a short period of time after detection of a radiological event[[or a hazardous release]].

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A COL applicant that references the U.S. EPR design certification will provide written emergency planning and procedures in the event of a radiological or a hazardous chemical release within or near the plant, and will provide training of control room personnel.

6.4.4 Design Evaluations

Section 9.4.1 contains the design evaluation of the CRACS. Fire protection inside and outside the CRE boundary is addressed in Section 9.5.1.

The total effective dose equivalent (TEDE) for the MCR occupants throughout the duration of any postulated DBA does not exceed the limits of GDC 19. The evaluation of radiological exposure to control room operators and the dose calculation model for the MCR is described in Section 15.0.3.

The CRE is designed, maintained and tested in accordance with RG 1.196 and RG 1.197. Habitability systems provide the capability to detect and protect personnel within the CRE boundaries from external fires, smoke, ~~[[~~toxic gases ~~]]~~and airborne radioactivity.

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A COL applicant that references the U.S. EPR design certification will confirm that the radiation exposure of MCR occupants resulting from a DBA at a nearby unit on a multi-unit site is bounded by the radiation exposure from the postulated design basis accidents analyzed for the U.S. EPR; or confirm that the limits of GDC 19 are met.

The evaluation of potential toxic chemical accidents is addressed by the applicant in Section 2.2.3 and includes the identification of toxic chemicals. A COL applicant that references the U.S. EPR design certification will evaluate the results of the toxic chemical accidents from Section 2.2.3 and address their impact on control room habitability in accordance with RG 1.78.

6.4.5 Testing and Inspection

Testing and inspection of the CRACS are described in Section 9.4.1. Refer to Section 14.2 (test abstract #082) for initial plant testing.

Periodic testing to confirm CRE integrity is performed using testing methods and at testing frequencies consistent with RG 1.197. The air in-leakage test (tracer gas test) of the CRE boundary is performed in accordance with ASTM E741 (Reference 3). Air quality testing is performed in accordance with ASHRAE 62 (Reference 4).

The control room envelope habitability program in ~~the~~ Technical Specification~~s~~ ~~Section~~ 5.5.17 defines testing requirements.

6.4.6 Instrumentation Requirements

The instrumentation and control features of the CRACS are described in Section 9.4.1. Radiation monitoring equipment for the CRE is described in Section 12.3.4.

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~~[[~~Toxic chemicals whose release has the potential to affect control room operators are monitored by toxic gas sensors. A list of chemicals and their locations is provided in

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Section 2.2.]] A COL applicant that references the U.S. EPR design certification will identify anythe type(s) of Seismic Category I Class IE toxic gas sensors (i.e., the toxic chemical(s) of concern) necessary for control room operator protection.

6.4.7 References

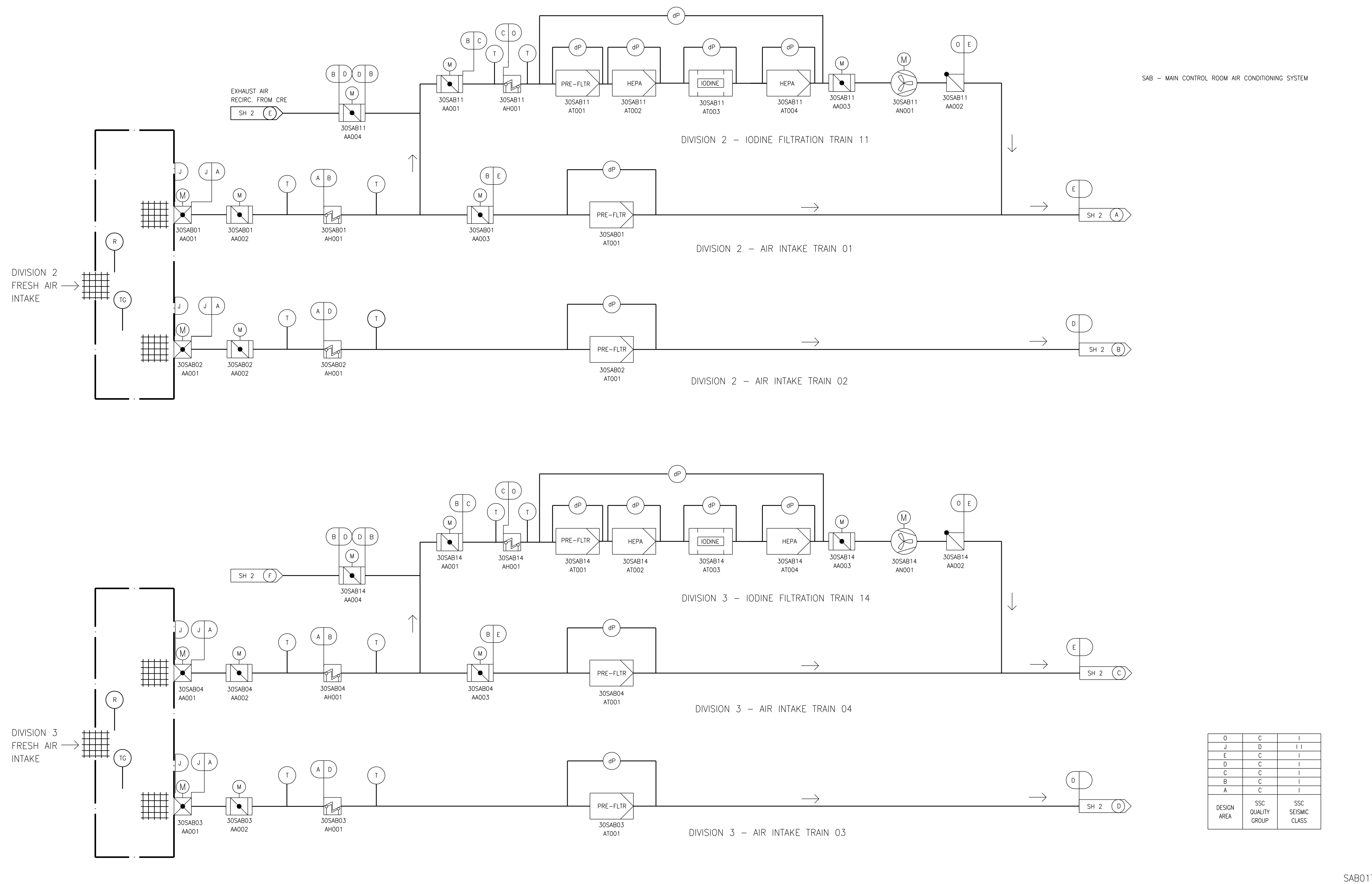
1. NUREG-0654/FEMA-REP-1 Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," U.S. Nuclear Regulatory Commission, November 1980.

2. ASME AG-1–2003, "Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 2003.

3. ASTM E741–2000, "Standard Test Methods for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution," American Society for Testing and Materials, 2000.

4. ASHRAE 62–1989, "Ventilation for Acceptable Indoor Air Quality," American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1989.

Figure 9.4.1-2—Control Room Recirculation Air Handling Subsystem



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TG-Toxic Gas Sensors

renewal rate, equipment and personnel heat loads and heat balance between the rooms.

Heating of air streams is provided by electric heaters located in the supply air ducts. The operation of heaters is automatically controlled by the temperature sensors located in the corresponding rooms.

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The CRE area is maintained at a pressure above atmospheric pressure to provide habitability in the event of radioactive ~~or toxic~~ contamination of the environment.

Both iodine filtration trains are secured and fully bypassed with the motorized inlet dampers in the auto-closed position during normal plant operation.

The air conditioning system for the CRE area operates in the recirculation mode with fresh air makeup. During the recirculation mode, the fresh air supply rate is equal to the rate of exhaust air from the kitchens and sanitary rooms plus accounting for the leakage rate in the area due to controlled overpressure. The four fresh air intake trains are not cross-connected; therefore, the air intake in operation corresponds to the recirculation train in operation.

Exhaust air from the kitchen and sanitary rooms is not recirculated. The exhaust air is directed by a separate exhaust duct and exhaust fans to the SBVSE air outlet duct.

Abnormal Operating Conditions

Redundancy of air supply and air conditioning trains is provided. A loss of function or power to any single train or component does not affect overall system operation. The train separation and independent power source limit common mode failure of active multiple trains and abnormal operating conditions.

Loss of a single cooling train will not result in a loss of system functional capability because four cooling trains are provided. The iodine filtration trains do not operate during normal plant operation, but loss of a single iodine filtration train during any design basis accident will not result in a loss of iodine filtration capability because two iodine filtration trains are provided.

During a toxic gas accident event, the CRACS is placed in full recirculation mode without any outside air makeup (refer to Section 6.4.2.2).

Loss of Offsite Power

During loss of offsite power (LOOP), the air intake and recirculation air handling electrical components located inside SB division two receive power for one train from the emergency diesel generators (EDG) of division two, and for the other train from the EDGs of division one. The electrical components located inside the SB division

5.2 The FBVS responds as designed to radiation monitor signals described in Section 9.4.2.

14.2.12.8.10 Main Control Room Air Conditioning System (Test #082)

1.0 OBJECTIVE

1.1 To verify that operation of the main control air conditioning (CRACS) system establishes that a proper environment for personnel and equipment under postulated conditions in the following areas:

1.1.1 MCR.

1.1.2 Technical Support Center.

1.1.3 Other offices and equipment areas of the control room envelope (CRE).

2.0 PREREQUISITES

2.1 Construction activities in the MCR complex have been completed and penetrations sealed.

2.2 Construction activities on the CRACS have been completed.

2.3 The CRACS system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the CRACS are complete and functional.

2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify that operation, stroke speed and position indication of dampers meet design requirements.

3.3 Verify in manual operating mode that system rated air flow and air balance meet design requirements.

3.4 Demonstrate in automatic mode the transfer to emergency-operations as a result of the following:

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3.4.1 Radiation detection.

3.4.2 Smoke detection.

3.4.3 Toxic chemical detection~~, if applicable~~.

3.4.4 Safety injection actuation signals (SIAS).

3.5 Verify the HEPA filter efficiency, carbon absorber efficiency, and filter bank air flow capacity.

3.6 Verify that operation of protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs meets design requirements.

3.7 Verify that the system maintains the CRE at the required positive pressure relative to the outside atmosphere during system operation. ~~in the pressurized mode as required by the Technical Specifications.~~

3.8 Verify the isolation capability of the CRE on detection of toxic gas at the intakes meets the requirements of RG ~~1.95~~1.78~~, if applicable~~.

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3.9 Demonstrate the operation of the battery room exhaust fans.

3.10 Verify the CRE air in-leakage rate when aligned in the emergency mode.

3.11 Verify that operation of CRACS in response to radiation monitors meets design requirements.

4.0 DATA REQUIRED

4.1 Air balancing verification.

4.2 Fan and damper operating data.

4.3 Temperature and humidity data in the CRE.

4.4 Response to radioactivity, toxic gas ~~(if applicable)~~, and products of combustion.

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4.5 Setpoints of alarms, interlocks, and controls.

4.6 Pressurization data for the CRE.

4.7 Filter and carbon absorber data.

4.8 CRE in-leakage rate when aligned in the emergency mode.

4.9 The CRACS response to radiation monitors.

5.0 ACCEPTANCE CRITERIA

5.1 The CRACS operates as described in Section 9.4.1.

5.2 The CRACS radiation monitors perform as described in Section 9.4.1.

14.2.12.8.11 Safeguard Building Controlled Area Ventilation System (Test #083)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the safeguard building controlled area ventilation system (SBVS):

1.1.1 Hot mechanical area serviced by the SBVS.

1.1.2 SBVS air supply subsystem.

1.1.3 SBVS air exhaust subsystem.

1.1.4 Electric air heating convectors (area heaters).

3.7 PLANT SYSTEMS

3.7.10 Control Room Emergency Filtration (CREF)

LCO 3.7.10 Two CREF trains shall be OPERABLE.

---NOTE---
The control room envelope (CRE) may be opened intermittently under administrative control.

APPLICABILITY: MODES 1, 2, 3, 4, 5, and 6,
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One CREF train inoperable for reasons other than Condition B.	A.1	Restore CREF train to OPERABLE status.	7 days
B. Two CREF trains inoperable due to inoperable CRE boundary in MODE 1, 2, 3, or 4	B.1	Initiate action to implement mitigating actions.	Immediately
	AND		
	B.2	Verify mitigating actions ensure CRE occupant exposures to radiological, [[chemical,]] and smoke hazards will not exceed limits.	24 hours
	AND		
	B.3	Restore CRE boundary to OPERABLE status.	90 days

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, 3, or 4.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours
D. Required Action and associated Completion Time of Condition A not met in MODE 5 or 6, or during movement of irradiated fuel assemblies.	---------REVIEWER'S NOTE--------- The need for the toxic gas isolation state will be determined by the COL Applicant. --- D.1 --------------NOTE-------------- Place CREF train in toxic gas isolation state if automatic transfer to toxic gas isolation state is inoperable. ------------------------------------- Place OPERABLE CREF train in emergency mode. OR D.2 Suspend movement of irradiated fuel assemblies.	06.04-4 Immediately Immediately
E. Two CREF trains inoperablein MODE 5 or 6, or during movement of irradiated fuel assemblies.	E.1 Suspend movement of irradiated fuel assemblies.	Immediately
F. Two CREF trains inoperable in MODE 1, 2, 3, or 4 for reasons other than Condition B.	F.1 Enter LCO 3.0.3.	Immediately

5.5 Programs and Manuals

5.5.15 Containment Leakage Rate Testing Program (continued)

e. The provisions of SR 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

---------------------------------------REVIEWER'S NOTE---------------------------------------
As discussed in FSAR Section 6.2.6, the U.S. EPR has no penetrations that are classified as bypass leakage paths.

5.5.16 Battery Monitoring and Maintenance Program

This Program provides for battery restoration and maintenance, based on the recommendations of IEEE Standard 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," or of the battery manufacturer including the following:

a. Actions to restore battery cells with float voltage < 2.13 V, and

b. Actions to equalize and test battery cells that had been discovered with electrolyte level below the top of the plate.

5.5.17 Control Room Envelope Habitability Program

A Control Room Envelope (CRE) Habitability Program shall be established and implemented to ensure that CRE habitability is maintained such that, with an OPERABLE Control Room Emergency Filtration System (CREFS), CRE occupants can control the reactor safely under normal conditions and maintain it in a safe condition following a radiological event, ~~[[~~hazardous chemical release,~~]]~~ or a smoke challenge. The program shall ensure that adequate radiation protection is provided to permit access and occupancy of the CRE under design basis accident (DBA) conditions without personnel receiving radiation exposures in excess of 5 rem total effective dose equivalent (TEDE) for the duration of the accident. The program shall include the following elements:

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a. The definition of the CRE and the CRE boundary;

b. Requirements for maintaining CRE boundary in its design condition including configuration control and preventive maintenance;

5.5 Programs and Manuals

5.5.17 Control Room Envelope Habitability Program (continued)

c. Requirements for (i) determining the unfiltered air inleakage past the CRE boundary into the CRE in accordance with the testing methods and at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors," Revision 0, May 2003, and (ii) assessing CRE habitability at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0;

d. Measurement, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization MODE of operation by one train of the CREFS, operating at the flow rate required by the VFTP, at a Frequency of 24 months on a STAGGERED TEST BASIS. The results shall be trended and used as part of the 24 month assessment of the CRE boundary;

e. The quantitative limits on unfiltered air inleakage into the CRE. These limits shall be stated in a manner to allow direct comparison to the unfiltered air inleakage measured by the testing described in Specification 5.5.17.c. The unfiltered air inleakage limit for radiological challenges is the inleakage flow rate assumed in the licensing basis analyses of DBA consequences. Unfiltered air inleakage limits for ~~[[~~hazardous chemicals or~~]]~~ smoke must ensure that exposure of CRE occupants to these hazards will be within the assumptions in the licensing basis; and

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f. The provisions of SR 3.0.2 are applicable to the Frequencies for assessing CRE habitability, determining CRE unfiltered inleakage, and measuring CRE pressure and assessing the CRE boundary as required by Specifications 5.5.17.c and 5.5.17.d, respectively.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.6.2

Maintaining shield building OPERABILITY requires verifying each access opening door is closed. However, all shield building access doors are normally kept closed, except when the access opening is being used for entry and exit or when maintenance is being performed on an access opening. The 31 day Frequency of this SR is based on engineering judgment and is considered adequate in view of the other indications of door status that are available to the operator.

SR 3.6.6.3 and 3.6.6.4

06.02.03-1

The Annulus Ventilation System (AVS) exhausts the annulus atmosphere to the environment through appropriate treatment equipment. Each safety AVS train is designed to draw down the annulus to a negative pressure of ≥ 0.25 inches of water gauge (wg) in ≤ 305 seconds and maintain the annulus at a negative pressure ≥ 0.25 inches wg. To ensure that all fission products released to the annulus are treated, SR 3.6.6.3 and SR 3.6.6.4 verify that a pressure in the annulus that is less than the lowest postulated pressure external to the shield building boundary can be established and maintained. When the AVS System is operating as designed, the establishment and maintenance of annulus pressure cannot be accomplished if the shield building boundary is not intact. Establishment of this pressure is confirmed by SR 3.6.6.3, which demonstrates that the annulus can be drawn down to a negative pressure ≥ 0.25 inches wg using one AVS train. SR 3.6.6.4 demonstrates that the annulus can be maintained at a negative pressure ≥ 0.25 inches wg using one AVS train at a flow rate ≤ ~~1320~~1295 cfm. The primary purpose of these SRs is to ensure annulus boundary integrity. The secondary purpose of these SRs is to ensure that the AVS train being tested functions as designed. There is a separate LCO with Surveillance Requirements which serves the primary purpose of ensuring OPERABILITY of the AVS System. These SRs need not be performed with each safety AVS train. The AVS train used for these Surveillances is staggered to ensure that in addition to the requirements of LCO 3.6.7, either safety AVS train will perform this test. The inoperability of the AVS System does not necessarily constitute a failure of these Surveillances relative to the shield building OPERABILITY. Operating experience has shown the shield building boundary usually passes these Surveillances when performed at the 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES None.

B 3.7 PLANT SYSTEMS

B 3.7.10 Control Room Emergency Filtration (CREF)

BASES

BACKGROUND

The CREF provides a protected environment from which occupants can control the unit following an uncontrolled release of radioactivity, [[hazardous chemicals,]] or smoke.

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The CREF consists of two 100% capacity iodine filtration trains which operate when radioactive contamination is detected at the site or inside the control room envelope (CRE) area. The iodine filtration train is a bypass path of the fresh air intake train for the Control Room Air Conditioning System (CRACS) normal air supply. The air from CRE can also be recirculated through the CREF Iodine Filtration trains. The iodine filtration trains are provided as bypass lines on two of the four normal CRACS air intake trains; other two CRACS intake trains do not have the bypass iodine filtration trains. During an emergency, the fresh outside air and recirculated air are directed through air intake motorized damper and electric heater through the CREF Iodine Filtration train. Each iodine filtration train consists of motorized damper, electric heater, prefilter, upstream HEPA filter, an activated carbon iodine filter, downstream HEPA filter, booster fan, and manual isolation damper. The filtered and clean air is then directed through one or both CRACS normal 75% capacity air conditioning train. Each air conditioning train consists of volume control manual damper, cooling coil, moisture separator, fan suction and discharge silencers, supply air fan, HEPA filter, steam humidifier, non-return damper, volume control electric damper, and fire dampers. The conditioned and clean air is then supplied to the CRE areas. Electric heaters are installed in the CRE supply air ducts to maintain individual room temperatures and relative humidity. The exhaust air from the CRE areas is directed through the recirculation air shaft and then recycled either through the iodine filtration trains or CRACS air conditioning trains. The exhaust from kitchen and sanitary areas is separated from the recycle return air and processed separately.

The prefilters remove any large particles in the air, and any entrained water droplets present, to prevent excessive loading of the HEPA filters and carbon adsorbers. The HEPA filter bank downstream of the carbon iodine filter collects carbon fines and provides backup in case of failure of the upstream HEPA filter bank. Continuous operation of each train for at least 10 hours per month, with the heaters on, reduces moisture buildup on the HEPA filters and carbon adsorbers.

BASES

BACKGROUND (continued)

The CRE is the area within the confines of the CRE boundary that contains the spaces that control room occupants inhabit to control the unit during normal and accident conditions. This area encompasses the control room, and may encompass other non-critical areas to which frequent personnel access or continuous occupancy is not necessary in the event of an accident. The CRE is protected during normal operation, natural events, and accident conditions. The CRE boundary is the combination of walls, floor, roof, ducting, doors, penetrations and equipment that physically form the CRE. The OPERABILITY of the CRE boundary must be maintained to ensure that the inleakage of unfiltered air into the CRE will not exceed the inleakage assumed in the licensing basis analysis of design basis accident (DBA) consequences to CRE occupants. The CRE and its boundary are defined in the Control Room Envelope Habitability Program.

The CREF train is an emergency system, which may also operate during normal unit operations in the standby mode of operation. Upon receipt of the actuating signal(s), the outside fresh air supply to the CRE is isolated, and the outside air is directed through the CREF train. The CRE ventilation air is recycled through the air conditioning filter trains and/or CREF train.

Actuation of the CREF places the system in either of two separate states (emergency radiation state or toxic gas isolation state) of the emergency mode of operation, depending on the initiation signal. Actuation of the system to the emergency radiation state of the emergency mode of operation, closes the unfiltered outside air intake and unfiltered exhaust dampers, and aligns the system for recirculation of the air within the CRE through the CREF trains. The emergency radiation state also maintains control room pressurization and filtered ventilation of the air supply to the CRE.

Outside makeup air is supplied through the iodine filtration train and added to the air being recirculated from the CRE. Pressurization of the CRE minimizes infiltration of unfiltered air through the CRE boundary from all the surrounding areas adjacent to the CRE boundary. The actions taken in the toxic gas isolation state are the same, except that the signal switches the CREF to an isolation alignment to minimize any outside air from entering the CRE through the CRE boundary.

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The outside air entering the CRE is continuously monitored by radiation ~~[[~~and toxic gas~~]]~~ detectors. One detector output above the setpoint will cause actuation of the emergency radiation state or toxic gas isolation state, as required. The actions of the toxic gas isolation state are more restrictive, and will override the actions of the emergency radiation state.

BASES

BACKGROUND (continued)

One CREF operating at a flow rate of < 4000 cfm will pressurize the CRE to ≥ 0.125 inches water gauge relative to all external areas adjacent to the CRE boundary. The CREF operation in maintaining the CRE habitability is discussed in FSAR Section 9.4.1 (Ref. 1).

Redundant supply and recirculation trains provide the required filtration should an excessive pressure drop develop across one of the other filter trains. Normally open isolation dampers are arranged in series so the failure of one damper to shut will not result in a breach of isolation. The CREF train components are designed in accordance with Seismic Category I requirements.

The CREF is designed to maintain a habitable environment in the CRE for 30 days of continuous occupancy after a postulated accident without exceeding a 5 rem whole body dose or its equivalent to any part of the body 5 rem total effective dose equivalent (TEDE).

APPLICABLE SAFETY ANALYSES

The CREF components are arranged in redundant, safety related ventilation trains. The location of components and ducting within the CRE ensures an adequate supply of filtered air to all areas requiring access. The CREF provides airborne radiological protection for the CRE occupants, as demonstrated by the CRE occupant dose analyses for the most limiting design basis loss of coolant accident, fission product release presented in Chapter 15 (Ref. 2).

The CREF consists of two 100% capacity iodine filtration trains. Each iodine filtration train can be aligned with one of the two 75% capacity air conditioning trains. There are only two iodine filtration trains since only slow failure modes are assumed and filtration efficiency is checked periodically. Both CREF trains with the associated air conditioning trains are required to be OPERABLE. One CREF train is assumed to be lost to a single failure. The other train provides 100% of the ventilation to the CRE.

The CREF provides protection from smoke ~~[[~~and hazardous chemicals to the CRE occupants. Reference 3 discusses protection of CRE occupants following a hazardous chemical release~~]]~~. Reference 4 discusses protection of the CRE occupants and their ability to control the reactor from the control room or from the remote shutdown panels in the event of a smoke challenge.

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BASES

APPLICABLE SAFETY ANALYSES (continued)

The worst case single active failure of a component of the CREF, assuming a loss of offsite power, does not impair the ability of the system to perform its design function.

The CREF satisfies Criterion 3 of 10 CFR 50.36(~~d~~c)(2)(ii).

LCO

In the event of a postulated accident, one iodine filtration train is required to provide an adequate supply of filtered air to the CRE. To ensure that this requirement is met, both CREF trains must be OPERABLE. The basis for this approach is that two trains are required to satisfy all design requirements (i.e., one train is needed to mitigate the event and other train is assumed to have a single active failure). The failure of both iodine filtration trains could result in exceeding a dose of 5 rem whole body or its equivalent to any part of the body 5 rem TEDE in the event of a large radioactive release.

Each CREF train is considered OPERABLE when the individual components necessary to limit CRE occupant exposure are OPERABLE. A CREF train is OPERABLE when the associated:

a. Fan is OPERABLE;

b. Prefilters, HEPA filters, and carbon adsorbers are not excessively restricting flow, and are capable of performing their filtration functions; and

c. Heater, ductwork, and dampers are OPERABLE, and air circulation can be maintained.

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In order for the CREF trains to be considered OPERABLE, the CRE boundary must be maintained such that the CRE occupant dose from a large radioactive release does not exceed the calculated dose in the licensing basis consequence analyses for postulated accidents, and that CRE occupants are protected from ~~[[~~hazardous chemicals and~~]]~~ smoke.

The LCO is modified by a Note allowing the CRE boundary to be opened intermittently under administrative controls. This Note only applies to openings in the CRE boundary that can be rapidly restored to the design conditions, such as doors, hatches, floor plugs, and access panels. For entry and exit through doors, the administrative control of the opening is performed by the person(s) entering or exiting the area. For other openings, these controls should be procedurelized, and consist of

.

BASES

LCO (continued)

stationing a dedicated individual at the opening who is in continuous communication with the operators in the CRE. This individual will have a method to rapidly close the opening and to restore the CRE boundary to a condition equivalent to the design condition when a need for CRE isolation is indicated.

APPLICABILITY

In MODES 1, 2, 3, and 4, and during movement of irradiated fuel assemblies, the CREF trains must be OPERABLE to ensure that the CRE will remain habitable during and following a postulated accident (i.e., LOCA, main steam line break, rod ejection, and fuel handling accident).

In MODE 5 or 6, the CREF is also required to cope with a failure of the Gaseous Waste Processing System.

ACTIONS

A.1

With one CREF train inoperable, for reasons other than an inoperable CRE boundary, action must be taken to restore OPERABLE status within 7 days. In this Condition, the OPERABLE CREF train is adequate to perform the CRE occupant protection function. However, the overall system reliability is reduced. The 7 day Completion Time is based on the low probability of a postulated accident occurring during this time period, and ability of the remaining trains to provide the required capability.

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B.1, B.2, and B.3

If the unfiltered inleakage of potentially contaminated air past the CRE boundary and into the CRE can result in CRE occupant radiological dose greater than the calculated dose of the licensing basis analyses of postulated accident consequences (allowed to be up to 5 rem whole body or its equivalent to any part of the body 5 rem TEDE), or inadequate protection of CRE occupants from ~~[[~~hazardous chemicals or~~]]~~ smoke, the CRE boundary is inoperable. Actions must be taken to restore an OPERABLE CRE boundary within 90 days

During the period that the CRE boundary is considered inoperable, action must be initiated to implement mitigating actions to lessen the effect on CRE occupants from the potential hazards of a radiological ~~[[~~or chemical~~]]~~ event or a challenge from smoke. Actions must be taken within 24 hours to verify that in the event of a postulated accident, the mitigating actions will ensure that CRE occupant radiological exposures will not exceed the calculated dose of the licensing basis analyses of postulated accident

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BASES

ACTIONS (continued)

06.04-4

consequences, and that CRE occupants are protected from [[hazardous chemicals and]]smoke. These mitigating actions (i.e., actions that are taken to offset the consequences of the inoperable CRE boundary) should be preplanned for implementation upon entry into the condition, regardless of whether entry is intentional or unintentional. The 24 hour Completion Time is reasonable based on the low probability of a postulated accident occurring during this time period, and the use of mitigating actions. The 90 day Completion Time is reasonable based on the determination that the mitigating actions will ensure protection of CRE occupants within analyzed limits while limiting the probability that CRE occupants will have to implement protective measures that may adversely affect their ability to control the reactor and maintain it in a safe shutdown condition in the event of a postulated accident. In addition, the 90 day Completion Time is a reasonable time to diagnose, plan and possibly repair, and test most problems with the CRE boundary.

C.1 and C.2

In MODE 1, 2, 3, or 4, if any Required Action and Completion Time of Condition A or B cannot be met, the unit must be placed in a MODE that minimizes accident risk. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner.

D.1 and D.2

In MODE 5 or 6, or during movement of irradiated fuel assemblies, if the inoperable CREF train cannot be restored to OPERABLE status within the required Completion Time, action must be taken to immediately place the OPERABLE CREF train in the emergency mode. This action ensures that the other train is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure would be readily detected.

An alternative to Required Action D.1 is to immediately suspend activities that could result in a release of radioactivity that might require isolation of the CRE. This places the unit in a condition that minimizes risk. This does not preclude the movement of fuel to a safe position.

Required Action D.1 is modified by a Note indicating to place the system in the toxic gas isolation state with outside air isolated.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.10.3

This SR verifies that each CREF train starts and operates on an actual or simulated actuation signal. The Frequency of 24 months is based on industry operating experience and is consistent with the typical refueling cycle.

SR 3.7.10.4

This SR verifies the OPERABILITY of the CRE boundary by testing for unfiltered air inleakage past the CRE boundary and into the CRE. The details of the testing are specified in the Control Room Envelope Habitability Program. 06.04-4

The CRE is considered habitable when the radiological dose to CRE occupants calculated in the licensing basis analyses of postulated accident consequences is no more than 5 rem whole body or its equivalent to any part of the body 5 rem TEDE and the CRE occupants are protected from ~~[[~~hazardous chemicals and ~~]]~~smoke. This SR verifies that the unfiltered air inleakage into the CRE is no greater than the flow rate assumed in the licensing basis analyses of postulated accident consequences. When unfiltered air inleakage is greater than the assumed flow rate, Condition B must be entered. Required Action B.3 allows time to restore the CRE boundary to OPERABLE status provided mitigating actions can ensure that the CRE remains within the licensing basis habitability limits for the occupants following an accident. Mitigating actions, or compensatory measures, are discussed in Regulatory Guide 1.196, Section 2.7.3, (Ref. 5) which endorses, with exceptions, NEI 99-03, Section 8.4 and Appendix F (Ref. 6). These compensatory measures may also be used as mitigating measures as required by Required Action B.2. Temporary analytical methods may also be used as compensatory measures (Ref. 7). Options for restoring the CRE boundary to OPERABLE status include changing the licensing basis postulated accident consequence analysis, repairing the CRE boundary, or a combination of these actions. Depending upon the nature of the problem and the corrective action, a full scope inleakage test may not be necessary to establish that the CRE boundary has been restored to OPERABLE status.

BASES

ACTIONS (continued)

B.1

--------------------------------------REVIEWER'S NOTE-------------------------------
Adoption of Condition B is dependent on a commitment from the licensee to have guidance available describing compensatory measures to be taken in the event of an intentional and unintentional entry into Condition B.

If the safeguard buildings or fuel building boundary is inoperable in MODE 1, 2, 3, or 4, the SBVS trains may not be able to perform their intended functions. Actions must be taken to restore an OPERABLE safeguard buildings and fuel building boundaries within 24 hours. During the period that the safeguard buildings or fuel building boundary is inoperable, appropriate compensatory measures consistent with the intent, as applicable, of GDC 19 and 10 CFR Part 100 should be utilized to protect plant personnel from potential hazards such as radioactive contamination, [[toxic chemicals,]] smoke, temperature and relative humidity, and physical security. Preplanned measures should be available to address these concerns for intentional and unintentional entry into the condition. The 24 hour Completion Time is reasonable based on the low probability of a postulated accident occurring during this time period, and the use of compensatory measures. The 24 hour Completion Time is a typically reasonable time to diagnose, plan and possibly repair, and test most problems with the safeguard buildings or fuel building boundary.

06.04-4

C.1 and C.2

In MODE 1, 2, 3, or 4, when Required Action A.1 or B.1 cannot be completed within the associated Completion Time, or when both SBVS Accident Exhaust Filtration trains are inoperable for reasons other than an inoperable safeguard building or fuel building boundary (i.e., Condition B), the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in MODE 3 within 6 hours and in MODE 5 within 36 hours. The Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.