From:	WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent:	Thursday, February 14, 2013 4:35 PM
To:	Snyder, Amy
Cc:	Gleaves, Bill; DELANO Karen (AREVA); LEIGHLITER John (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); TOLLEY Tracey (AREVA); VANCE Brian (AREVA); WELLS Russell (AREVA); WILLS Tiffany (AREVA); KOWALSKI David (AREVA); BALLARD Bob (AREVA)
Subject:	Advanced Response to U.S. EPR Design Certification Application RAI No. 511 (6019,6020,6012), FSAR Ch. 6, Questions 06.02.02-125 and -126 and 06.04-9, -10 and -11
Attachments:	RAI 511 Advanced Response US EPR DC.pdf
Importance:	High

Amy,

Attached is an Advanced Response to RAI 511, Questions 06.02.02-125 and -126 and 06.04-9, -10 and -11, in advance of the final response date of March 29, 2013.

To keep our commitment to send a final response to these questions by the commitment date, we need to receive all NRC staff feedback and comments no later than **March 15, 2013**.

Please let me know if NRC staff has any questions or if these responses can be sent as final.

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, February 24, 2012 5:12 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 511 (6019,6020,6012), FSAR Ch. 6, Supplement 4
Importance: High

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the six questions of RAI No. 511 on October 21, 2011. Supplement 1 response was sent on November 11, 2011 to provide a response to one (Question 06.02.02-124) of the six questions.
Supplement 2 and Supplement 3 responses to RAI No. 511 were sent on December 13, 2011 and January 20, 2012, respectively, to provide a revised schedule for the remaining five questions.

The schedule for technically correct and complete responses to the five questions has been changed as provided below. This schedule was transmitted to the NRC in AREVA NP letter NRC:12:008 dated February 21, 2012.

Question #	Response Date
RAI 511 — 06.02.02-125	**March 29, 2013**
RAI 511 — 06.02.02-126	**March 29, 2013**
RAI 511 — 06.04-9	**March 29, 2013**
RAI 511 — 06.04-10	**March 29, 2013**
RAI 511 — 06.04-11	**March 29, 2013**

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, January 20, 2012 2:31 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 511 (6019,6020,6012), FSAR Ch. 6, Supplement 3
Importance: High

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the six questions of RAI No. 511 on October 21, 2011. Supplement 1 response was sent on November 11, 2011 to provide a response to one (Question 06.02.02-124) of the six questions.
Supplement 2 response was sent on December 13, 2011 to provide a preliminary revised schedule for the remaining five questions.

The preliminary schedule for the response to the remaining five questions has been changed as provided below. This schedule is being reevaluated and a new supplement with a revised schedule will be transmitted by February 21, 2012.

Question #	Response Date
RAI 511 — 06.02.02-125	**February 21, 2012**
RAI 511 — 06.02.02-126	**February 21, 2012**
RAI 511 — 06.04-9	**February 21, 2012**
RAI 511 — 06.04-10	**February 21, 2012**
RAI 511 — 06.04-11	**February 21, 2012**

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager

AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Tuesday, December 13, 2011 4:26 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 511 (6019,6020,6012), FSAR Ch. 6, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the six questions of RAI No. 511 on October 21, 2011. Supplement 1 response to RAI No. 511 was sent on November 11, 2011 to provide a response to one (Question 06.02.02-124) of the six questions.

The preliminary schedule for the remaining five questions has changed from that provided in the November 11, 2011 response. The preliminary revised schedule is provided below. This schedule is being reevaluated and a new supplement with a revised schedule for the remaining five questions will be transmitted by January 25, 2012.

Question #	**Response Date**
RAI 511 — 06.02.02-125	**January 25, 2012**
RAI 511 — 06.02.02-126	**January 25, 2012**
RAI 511 — 06.04-9	**January 25, 2012**
RAI 511 — 06.04-10	**January 25, 2012**
RAI 511 — 06.04-11	**January 25, 2012**

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: RYAN Tom (RS/NB)
Sent: Friday, November 11, 2011 11:37 AM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); GUCWA Len (External RS/NB); WILLIFORD Dennis (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 511 (6019,6020,6012), FSAR Ch. 6, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the six questions of RAI No. 511 on October 21, 2011. The attached file, “RAI 511 Supplement 1 Response US EPR DC.pdf,” provides a technically correct and complete response to Question 06.02.02-124. The response references a revision to technical report, ANP-10293P, which is being provided by separate letter.

The following table indicates the respective pages in the response document, “RAI 511 Supplement 1 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 511 — 06.02.02-124	2	2

The preliminary schedule for the remaining 5 questions is unchanged from that provided in the October 21, 2011 response. A new supplement with a revised schedule for these 5 questions will be transmitted by December 14, 2011.

Question #	Response Date
RAI 511 — 06.02.02-125	December 14, 2011
RAI 511 — 06.02.02-126	December 14, 2011
RAI 511 — 06.04-9	December 14, 2011
RAI 511 — 06.04-10	December 14, 2011
RAI 511 — 06.04-11	December 14, 2011

Sincerely,

Tom Ryan for
Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, October 21, 2011 12:33 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 511 (6019,6020,6012), FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.’s response to the subject request for additional information (RAI). The attached file, “RAI 511 Response US EPR DC.pdf,” provides a schedule since technically correct and complete responses to the six questions cannot be provided at this time.

The following table indicates the respective pages in the response document, “RAI 511 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 511 — 06.02.02-124	2	2
RAI 511 — 06.02.02-125	3	3

RAI 511 — 06.02.02-126	4	4
RAI 511 — 06.04-9	5	6
RAI 511 — 06.04-10	7	8
RAI 511 — 06.04-11	9	9

The schedule for responding to Question 06.02.02-124 listed below is consistent with the commitment date for other GSI-191 questions that was provided in the GSI-191 Closure Plan letter (NRC:11:092) dated August 25, 2011. A preliminary schedule for technically correct and complete responses to the other 5 questions is provided below. This schedule is being reevaluated and a new supplement with a revised schedule for these 5 questions will be transmitted by December 14, 2011.

Question #	**Response Date**
RAI 511 — 06.02.02-124	November 18, 2011
RAI 511 — 06.02.02-125	December 14, 2011
RAI 511 — 06.02.02-126	December 14, 2011
RAI 511 — 06.04-9	December 14, 2011
RAI 511 — 06.04-10	December 14, 2011
RAI 511 — 06.04-11	December 14, 2011

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, September 21, 2011 5:20 PM
To: ZZ-DL-A-USEPR-DL
Cc: Ashley, Clinton; ODriscoll, James; Jackson, Christopher; McKirgan, John; Scarbrough, Thomas; Terao, David; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 511 (6019,6020,6012), FSAR Ch. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 31, 2011, and discussed with your staff on September 21, 2011.   Drat RAI Questions 06.04-9 was modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 4220

Mail Envelope Properties (554210743EFE354B8D5741BEB695E6560C801C)

Subject: Advanced Response to U.S. EPR Design Certification Application RAI No. 511 (6019,6020,6012), FSAR Ch. 6, Questions 06.02.02-125 and -126 and 06.04-9, -10 and -11
Sent Date: 2/14/2013 4:34:50 PM
Received Date: 2/14/2013 4:34:58 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

Recipients:
"Gleaves, Bill" <Bill.Gleaves@nrc.gov>
Tracking Status: None
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"LEIGHLITER John (AREVA)" <John.Leighliter@areva.com>
Tracking Status: None
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"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
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"VANCE Brian (AREVA)" <Brian.Vance@areva.com>
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Tracking Status: None
"KOWALSKI David (AREVA)" <David.Kowalski@areva.com>
Tracking Status: None
"BALLARD Bob (AREVA)" <Robert.Ballard@areva.com>
Tracking Status: None
"Snyder, Amy" <Amy.Snyder@nrc.gov>
Tracking Status: None

Post Office: FUSLYNCMX03.fdom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	10761	2/14/2013 4:34:58 PM
RAI 511 Advanced Response US EPR DC.pdf	289656	

Options
Priority: High
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Advanced Response to

Request for Additional Information No. 511

9/21/2011

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.02 - Containment Heat Removal Systems
SRP Section: 06.04 - Control Room Habitability System

Application Section: 6.3

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)
QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

Question 06.02.02-125:

In response to RAI 212, Question 06.02.02-27 that requested information on the motor-operated valves (MOVs) in the passive flooding lines, the U.S. EPR design certification applicant described a revised design for the Severe Accident Heat Removal System (SAHRS) for the U.S. EPR. For example, the applicant provided the following information on the SAHRS MOVs in the revised U.S. EPR design:

1. The SAHRS flooding line isolation motor-operated valve (MOV) identification numbers are 30JMQ42 AA004 and 30JMQ42 AA 006.

2. The MOVs are safety-related and Seismic Category I.

3. The MOVs are normally closed and support the safety-related function of the in-containment refueling water storage tank (IRWST) by protecting the water volume in the IRWST from inadvertent draining.

4. The MOVs are part of the U.S. EPR environmental qualification program for seismically and dynamically qualified mechanical equipment (U.S. EPR FSAR, Tier 2, Table 3.10-1) and part of the in-service testing program. Since the actuators are normally deactivated and not required to perform a safety function, they will not be listed in U.S. EPR FSAR Tier 2, Table 3.11-1.

5. The MOVs are normally closed and deactivated and do not have to be operated to perform their safety function. No operator action is required to perform their safety function in case of an inadvertent opening of the passive flooding devices. Manual operator action is only required in case of a severe accident, in which case the breaker will have to be reset and the valves activated to open.

The NRC staff considers the revised U.S. EPR design to resolve the initial question regarding the functional design, qualification, and testing of the SAHRS MOVs to be capable of closing to prevent draining the emergency core cooling water supply in the event of an inadvertent opening of the passive flooding valves. The new design requires the SAHRS MOVs to be normally closed such that these MOVs do not have an active safety-related function. However, these MOVs must open to perform their severe accident function. The NRC staff requests that the U.S. EPR design certification applicant specify these commitments in the U.S. EPR FSAR that provide confidence that the SAHRS MOVs will be capable of performing their severe accident design function to open to allow cooling water flow to mitigate a beyond design basis event. The staff requests that the applicant identify any necessary modifications to the U.S. EPR FSAR to support its RAI response.

Response to Question 06.02.02-125:

The MOVs in the passive flooding lines of the SAHRS are designed to perform their severe accident design function of opening to allow cooling water flow to mitigate a beyond design basis event.

U.S. EPR FSAR Tier 2, Section 6.3 will be revised to reflect that operator action to manually open the normally-closed, de-energized motor-operated isolation valves in the passive flooding lines is required when core outlet temperature reaches 1,200°F.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 6.3 will be revised as described in the response and indicated on the enclosed markup.

Question 06.02.02-126:

In RAI 212, Question 06.02.02-28, the NRC staff requested information regarding the passive flooding valves in the Severe Accident Heat Removal System (SAHRS) for the U.S. EPR design including: (1) identification numbers; (2) safety classification; (3) design and operating mechanism; (4) normal and safety functions; (5) functional design, qualification and inservice testing; and (6) position indication system, and provisions to alert the reactor operators to an incorrect valve position. In response to RAI 212, Question 06.02.02-28, the applicant noted that the design of the passive flooding lines had been revised and provided the following information on the SAHRS passive flooding valves in the revised U.S. EPR design:

1. The SAHRS passive flooding valve identification numbers are 30JMQ42 AA003 and 30JMQ42 AA005.

2. The passive flooding valves are non-safety augmented quality and Seismic Category II.

3. The passive flooding valve design is described in U.S. EPR FSAR Tier 2, Section 19.2.3.3.3.1, “Core Melt Stabilization System.” The spring-loaded valve is held closed by a cable and pulley system. The cable is attached to the thermal actuator in the sacrificial concrete of the spreading compartment. The tension in the cable offsets the force of the spring and keeps the valve from opening. In case of a core melt with subsequent corium spreading, the thermal actuator is destroyed, releasing tension in the cable. The spring then opens the valve and allows water to flow from the IRWST to the spreading compartment.

4. The passive flooding valves are normally closed and do not perform a safety-related function. The valves are only used in case of a severe accident.

5. The passive flooding valves will be part of the U.S. EPR environmental qualification program for seismically and dynamically qualified mechanical equipment (U.S. EPR FSAR Tier 2, Table 3.10-1). However, since these valves are used only to mitigate beyond design basis accidents, they do not have to meet the stringent requirements for quality assurance requirements of 10 CFR Part 50, Appendix B, or the redundancy/diversity requirements of 10 CFR Part 50, Appendix A.

6. Position indication will be provided for each passive flooding valve providing Open/Close indication in the control room. In addition, flow measurements will be provided downstream of the passive flooding valves to further assist the operator in determining an opening of the passive flooding valves.

The NRC staff requests that the U.S. EPR design certification applicant specify these commitments in the U.S. EPR FSAR that provide confidence that the SAHRS passive flooding valves will be capable of performing their severe accident design function to open to allow cooling water flow to mitigate a beyond design basis event. The staff requests that the applicant identify any necessary modifications to the U.S. EPR FSAR to support its RAI response.

Response to Question 06.02.02-126:

The passive flooding valves in the Severe Accident Heat Removal System (SAHRS) are designed to perform their severe accident design function to open to allow cooling water flow to mitigate a beyond design basis event.

U.S. EPR FSAR Tier 2, Section 19.2 will be revised to reflect that operator action is required to open the normally-closed, de-energized motor-operated isolation valves in the SAHRS passive flooding line, upstream of the normally-closed, passive flooding devices.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 19.2 will be revised as described in the response and indicated on the enclosed markup.

Question 06.04-9:

Clarify how primary containment bypass leakage that is not captured by the AVS or the leakoff system is captured by the secondary containment.

Based on the staff's review of your responses and proposed Tier 1 and Tier 2 markups to questions in RAI 277 (Supplement 18 response) and RAI 462 (Supplement 4 response), the staff requests the following information with regard to FSAR Section 6.2.3 "Secondary Containment":

The staff understands that the containment leakoff system functions with the AVS to provide assurance that some but not all primary containment leakage is directed back to the AVS filtration trains. Details of the system will be documented in the FSAR per your response to RAI 462 Question 06.02.03-8. The staff understands that there remain other bypass leakage pathways including hatches and isolation valves that terminate in the fuel building and the Safeguard buildings. In several locations in the FSAR you credit the existence of a .25 inch water gauge negative pressure in these buildings as the means to assure that any leakage of potentially contaminated air to the outside environment is prevented.

In accordance with SRP 6.2.3, since you assume zero bypass leakage ($0.00L_a$) of secondary containment in section 6.2.6.5, of the FSAR and in the FSAR chapter 15 radiological analyses, the staff considers the Fuel Building and the Safeguard Building Controlled Areas along with the Shield Building as containment structures that are part of the secondary containment. The staff understands that, it is the intent of the design that in a DBA, 100% of containment leakage is filtered at 99% efficiency 305 seconds after ESF system actuation. It is the function of the secondary containment to capture any primary containment leakage, and provide 100% filtration of L_a in order to meet assumptions used in the radiological analyses.

Since the SBVS is the ESF system that establishes the negative pressure in the Safeguard Building and the Fuel building, and the SBVS is credited to establish a negative pressure in the Fuel Building and the Controlled Area of the Safeguard Buildings for the purpose of capturing this primary containment bypass leakage, the staff requests the following clarifications in the US EPR FSAR:

a. Clarify The Tier 2 and Tier 1 safety- related functions of the Fuel Building, Safeguard Building, and the SBVS to state that they provide the safety-related function of capturing the primary containment bypass leakage that is not captured by the leak-off system. Clarify the discussion on secondary containment in 6.2.6.5 to clarify that the secondary containment encompasses all SSCs that are credited with secondary containment functions (i.e., those SSC's relied upon to ensure that zero bypass leakage is zero ($0.00L_a$)).

b. In order to verify the FSAR Chapter 15 accident analyses assumptions, add Tier 1 ITAAC to verify that the Fuel Building and the Safeguard Building Controlled Areas are capable of being drawn down to a negative pressure of .25 inches of water gauge in 305 seconds.

c. Clarify the scope of Technical specification 3.6.6 to cover the functions of the entire secondary containment as opposed to just the shield building (only a portion of the secondary containment). Specifically,

   I. Include similar operability requirements and required actions for the Safeguard Building Controlled Areas and the Fuel Building as that in LCO 3.6.6.

   II. Add similar surveillance requirements for the Fuel Building and the Safeguard Building Controlled Area as those for the Shield Building specifically, expand the scope of SR 3.6.6.5, inspection requirements to include the Safeguard Building Controlled Area and the Fuel Building)

   III. Clarify the Shield Building Technical Specification Bases 3.6.6 discussion to indicate that the Shield Building functions in conjunction with the Safeguard Building Controlled Areas and the Fuel Building to ensure that the release of radioactive materials from the primary containment atmosphere is restricted to those leakage paths and associated leakage rates assumed in the accident analyses.

   IV. Clarify the SBVS Technical Specification Bases 3.7.12 to clarify that the SBVS design basis addresses the capture of the primary containment bypass leakage, that is described in Tier 2 paragraph 6.2.6.5, (i.e. that bypass leakage that is not captured by the AVS or the leak-off system.)

d. Re- address RAI 233 Question 06.05.03-1 which requested the scope of the secondary containment review to include the Safeguard Buildings and the Fuel building, and questioned the effect of wind on the outside walls of these buildings, on the capability of the SBVS to maintain the credited negative pressure within. In your response to this RAI, please assume the SBVS flow rate stated in SR 3.7.12.7 in your analysis.

e. Revise the analysis that supports the functional capability of the EPR secondary containment design in response to a LOCA, to include the Safeguard Building Controlled Area and the Fuel Building along with the Shield Building Annulus. Address SRP Section 6.2.3 Acceptance Criteria 1A through 1H with this scope.

Response to Question 06.04-9:

Item a:

The following U.S. EPR FSAR Tier 1 and Tier 2 sections will be revised to clarify the safety-related functions of the Fuel Building (FB), Safeguard Buildings (SB) and the safeguards building controlled area ventilation system (SBVS) to capture the primary containment bypass leakage that is not captured by the leak-off system:

- U.S. EPR FSAR Tier 1, Sections 2.6.4 and 2.6.6.
- U.S. EPR FSAR Tier 2, Sections 9.4.2.1, 9.4.5.1 and 9.4.5.3.

U.S. EPR FSAR Tier 2, Section 6.2.6.5 will be revised to clarify that structures, systems and components (SSCs) that are credited with secondary containment functions are located within the filtered areas.

Item b:

Existing ITAAC, which test for a negative pressure of 0.25 inches water gauge in the SB and FB relative to adjacent areas, will be revised to correct the ITAAC. The following U.S. EPR FSAR Tier 1 sections will be revised:

- U.S. EPR FSAR Tier 1, Table 2.6.4-3—Fuel Building Ventilation System ITAAC, Item 7.1
- U.S. EPR FSAR Tier 1, Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC, Items 7.1 and 7.4

Item c:

As described in U.S. EPR FSAR Tier 2, Section 6.2.6.5, the Annulus, SB and FB, perform a similar function in capturing and processing post-accident leakage through engineered safety features (ESF) filter systems. Upon receipt of a Containment Isolation Phase 1 signal, the fuel building ventilation system (FBVS) is isolated from the nuclear auxiliary building ventilation system (NABVS) and flow is directed to the SBVS.

Since the annulus ventilation system (AVS) and SBVS provide comparable leakage processing functions, the surveillance requirements (SRs) for these systems were compared and an SR will be added to the U.S. EPR FSAR Tier 2, Chapter 16 Technical Specifications, SR Section 3.7.12 to require visual inspection of the exposed interior and exterior portions of the SB and FB. The Background sections of the Bases for U.S. EPR FSAR Tier 2 Chapter 16 Technical Specifications 3.6.6 and 3.7.12 will be revised to note the shared mission of processing containment and penetration leakage.

Item d:

Refer to the response to RAI 233, Supplement 2, Question 06.05.03-1, Parts a through d, which is being submitted through a separate transmittal.

Item e:

A separate GOTHIC analysis has been performed to evaluate the drawdown of the FB and SB by the SBVS on receipt of a containment isolation signal (CIS). The analysis used a time period of 305 seconds, determined in the AVS analysis to calculate the required capacity of the SBVS fans needed to draw down the FB and SB to a negative pressure of 0.25 inches water gauge. Since the Annulus is between the primary containment and the SB and FB, not all requirements of General Design Criteria 16 are applicable to this analysis. Compliance with Standard Review Plan Section 6.2.3 Acceptance Criteria is summarized as follows:

1.A. Heat transfer from the primary containment to the FB and SB is not considered as the buildings are not adjacent to each other.

1.B. Adiabatic boundary conditions are assumed for the surface of the FB and SB exposed to the outside environment.

1.C. The compressive effect of primary containment expansion on the FB and SB atmosphere is not considered since the annulus is between the primary containment and the FB and SB.

1.D. In-leakage from the primary containment (by-pass leakage) and the outside environment into the SB and FB is considered.

1.E. No credit is taken for out-leakage from the FB and SB.

1.F. By design, both SBVS accident fans start upon receipt of a CIS. This analysis assumes the failure of one fan to start.

1.G. Heat loads are included for both the FB and SB.

1.H. To account for potential degradation such as clogged filter, the SBVS design capacity was degraded by increasing the system resistance and decreasing the fan performance.

FSAR Impact:

U.S. EPR FSAR Tier 1, Sections 2.6.4 and 2.6.6, and Tables 2.6.4-3 and 2.6.6-3 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Sections 6.2.6.5, 9.4.2.1, 9.4.5.1 and 9.4.5.3, and Chapter 16, B3.6.6, B3.7.12 and SR3.7.12.10 will be revised as described in the response and indicated on the enclosed markup.

Question 06.04-10:

Clarify the CRE ITAAC described in Tier 1 and CRACS Toxic Gas Design Features described in Tier 2.

Based on the staff's review of your responses and proposed Tier 1 and Tier 2 Markups to questions in RAI 277 (Supplement 18 response) and RAI 462 (Supplement 4 response), the staff requests the following information with regard to FSAR Section 6.4 Control Room Habitability:

a. The staff remains unclear on the method of testing that will be used to perform ITAAC item 6.4 in Tier 1 Table 2.6.1.3. The staff understands that periodic verification of the CRE unfiltered air in-leakage is as per the Control Room Habitability Program, as described in FSAR Tier 2 Chapter 16, section 5.5.17, "Control Room Envelope Habitability Program" and will be performed in accordance with the testing methods described in Section C.1 and C.2 of RG 1.197, "Demonstrating Control Room Envelope Integrity and Nuclear Power Reactors," Revision 0, May 2003. The staff needs assurance that the method of testing for the ITAAC will be the same as that used after the 10 CFR 52.103 (g) finding is made by the Commission. Therefore the staff requests AREVA to clarify the "Inspections Test, Analyses" section of ITAAC item 6.4 in Tier 1 Table 2.6.1.3, to indicate that tracer gas testing in accordance with ASTM E741 will be performed to measure the unfiltered air in-leakage into the CRE area with the CREF operating.

b. The staff noted that the FSAR Tier 2 mark-ups related to your response to RAI 462, Question 06.04-7 clarify the FSAR to leave the description of the sensors and features of the habitability systems required to mitigate a toxic gas event to the COL applicant that references the U.S. EPR standard design. The staff noted that several proposed FSAR mark ups seem inconsistent with the intent of the RAI response specifically:

    I. The staff noted that the Tier 1 description of the CRACS continues to describe functions for the CRACS to maintain CRE habitability in case of a toxic gas event. The staff requests you clarify Tier 1 Paragraph 2.6.1, (third subparagraph) to delete references to toxic gas.

    II. The staff noted that Tier 2 chapter 16 section B 3.7.10, describe actions to be taken for toxic gas isolation: "[The actions taken in the toxic gas isolation state are the same, except that the control room operator switches the CREF to a filtration alignment to minimize any outside air from entering the CRE though the CRE boundary.]" This description details the response of the CREF to a toxic gas event in the standard design description that appears to be inconsistent with the RG 1.78 guidance quoted in RAI 462, Question 06.04-7. The staff believes it should be revised to be consistent with the reviewer's note that was added to the same paragraph: "The need for toxic gas isolation state will be determined by the COL applicant".

c. The staff noted that the FSAR Tier 2 mark-up related to your response to RAI 462, Question 06.04-7 include a change the capacity of the CRACS cooling unit cooling capacity that affect a previous RAI responses on this subject. Specifically, Tier 2, Chapter 16 section B 3.7.11 now states the following:

> *"During normal* and *emergency operation each CRACS cooling unit provides 50% of the normal and emergency cooling load to allow two CRACS air handling units to cool the CRE rooms during a station blackout (SBO) event. During an SBO event, the CRACS air handling units will prevent the CRE room temperature from exceeding 78°F."*

This markup text conflicts with the February 27, 2009 Supplement 1 response to RAI 135 Question 09.04.05-1 (#2 Item 3). The mark-up also conflicts with FSAR changes made to paragraph 9.4.2.1.1 (General Description- Recirculation Air Handling Subsystem).

I. Please provide more information as to why the CRACS cooling unit capacity is reduced. Specifically, please re-address your response to RAI 135 Question 09.04.05-1 (#2 Item 3)

II. The LCO to restore a single inoperable CRACS train to service is proposed to be 120 days. Include a discussion on the specific case of an SBO that occurs while one of the two AAC-Backed CRACS trains is out for maintenance, and the probability of an SBO event that occurs while this LCO applies. Provide further justification for the duration of this LCO period.

III. Clarify the FSAR as needed.

Response to Question 06.04-10:

Item a

The method of testing used to satisfy ITAAC Commitment Item 6.4 in U.S. EPR FSAR Tier 1, Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC is described in U.S. EPR FSAR Tier 2, Section 6.4.5. The tracer gas testing is performed in accordance with ASTM E741 and is used to measure the unfiltered air in-leakage into the control room envelope (CRE) area with the control room emergency filtration operating. No changes to the U.S. EPR FSAR are required.

Item b

I. The intent of the response to RAI 462, Supplement 4, Question 06.04-7, was to revise the U.S. EPR FSAR to reflect that a toxic gas event is a site-specific event. The equipment used for the detection, measurement, and isolation associated with a toxic gas release is the responsibility of the COL applicant. The specific toxic gas design, which had been part of the design of the control room air conditioning system (CRACS) in the U.S. EPR standard design, was removed from the CRACS. In the response to RAI 462, Supplement 4, Question 06.04-7, applicable U.S. EPR FSAR Tier 1 and Tier 2 sections were revised to reflect this change.

To be consistent with the response to RAI 462, Supplement 4, Question 06.04-7, U.S. EPR FSAR Tier 1, Section 2.6.1 and U.S. EPR FSAR Tier 2, Section 7.3.1.3.3 will be revised to delete references to a toxic gas event.

II. In the generic Technical Specifications, text in brackets represents content that individual applicants will use as is, modify or delete. These references to toxic gas should remain in the U.S. EPR FSAR.

Item c

I. In the original CRACS design of the U.S. EPR standard design, the CRACS cooling coils for Division 1 and 4 were sized for 75 percent capacity. In this design configuration, only Division 1 and 4 fans were powered by the two station blackout (SBO) diesels. In the event of an SBO diesel generator (DG) failure, the 75 percent capacity accommodated the SBO load using one set of fan and cooling coils. During normal or emergency operation (excluding SBO), any combination of two CRACS cooling units could be used. The 75 percent capacity units were over-sized and there was the potential for unbalanced air flow and cooling when a 75percent unit was operating with a 50 percent unit.

A design change has been implemented to reduce the size of the Division 1 and 4 CRACS cooling coils to 50 percent capacity, which is equivalent to the Division 2 and 3 CRACS cooling coils. Power for the Division 2 and 3 CRACS supply fans has been moved to new buses, which can receive alternate power and are backed by SBO DGs. If a loss of a single SBO DG occurs, an operator can utilize a second CRACS supply fan and associated cooling coil using power from the remaining operating SBO DG to provide additional cooling to the main control room (MCR), if needed. An SBO event is mitigated by operator actions from the MCR and the additional CRACS supply fan will only be loaded on the remaining SBO DG if the SBO DG has adequate load margin at the time in the SBO event the additional CRACS supply fan is needed. During an SBO event, two 50 percent CRACS cooling units are available to maintain the MCR temperature below 104°F.

II. The 120-day completion time specified in U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B3.7.11, Action A.1, is based on the assumption that one CRACS train is out of service for maintenance, leaving three trains available. The Technical Specifications limiting conditions for operation (LCOs) address and are consistent with assumptions in the U.S. EPR FSAR Tier 2, Chapter 15 safety analyses. CRACS is included in the Technical Specifications and satisfies the requirements of 10 CFR 50.36(c)(2)(ii). The Technical Specifications are not intended to address beyond design basis events.

III. U.S. EPR FSAR Tier 1, Table 2.6.1-2—CRACS Equipment I&C and Electrical Design, and Tier 2, Sections 9.4.1.2.1 and 9.4.1.2.3 will be revised to reflect the change to 50 percent capacity cooling coils and the new power source for operation during an SBO event.

U.S. EPR FSAR Tier 2 Chapter 16, Section B3.7.11 will be revised to reflect the removal of station blackout from the scope of Technical Specifications.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.6.1 and Table 2.6.1-2 and U.S. EPR FSAR Tier 2, Section 7.3.1.3.3, Section 9.4.1.2.1, Section 9.4.1.2.3 and Section 16 B3.7.11 will be revised as described in the response and indicated on the enclosed markup.

Question 06.04-11:

Clarify the startup testing requirements of the CRACS with regard to CRE positive pressure.

Based on the staff's review of your responses and proposed Tier 1 and Tier 2 mark-ups to questions in RAI 277 (Supplement 18 response) and RAI 462 (Supplement 4 response), the staff requests the following information with regard to FSAR Section 14.2, "Initial Test Program":

The staff noted that the FSAR Tier 2 markup on page 14.2-150, related to your response to RAI 462, Question 06.04-7 does not modify the Main Control Room Air Conditioning System Test (#082), Item 3.7: "Verify that the system maintains the CRE at the required positive pressure relative to the outside atmosphere during system operation" The staff understands that it is the intent of the design to maintain a positive pressure relative to adjacent areas of at least 1/8 inches of water gauge inside the CRE area while the system is operating in design basis accident alignment relative to outside and adjacent areas, and the design maintains a slightly positive pressure inside the CRE area while operating in normal alignment Please clarify Test #082, Item 3.7 (or add an additional item) to specify that the system positive pressure is tested in both operating modes, and the positive pressure in the CRE is measured relative to both outside and adjacent areas when the system is tested in accident alignment.

Response to Question 06.04-11:

Testing of the main control room air conditioning system (CRACS) positive pressure will be performed with the system in both the normal and operating alignment, and also, in the design basis accident alignment.

U.S. EPR FSAR Tier 2, Section 14.2.12.8.10—Main Control Room Air Conditioning System (Test #082) will be revised to specify that the system is tested in the two different alignments to verify that the system maintains the required positive pressure relative to external areas adjacent to the control room envelope boundary. The required positive pressures are given in U.S. EPR FSAR Tier 2, Section 9.4.1.1.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2.12.8.10 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

2.6 HVAC Systems

2.6.1 Main Control Room Air Conditioning System

Design Description

1.0 System Description

The main control room air conditioning system (CRACS) supplies air to the control room envelope (CRE) area which includes the main control room (MCR) and associated rooms.

The CRACS controls the CRE area temperature and air change rate for personnel comfort, personnel safety, and equipment protection during normal plant operation. The CRACS provides cooling, heating, and ventilation for the CRE area to remove equipment heat, and heat generated from other sources. The CRACS also provides heat to maintain a minimum temperature in the CRE area. The CRACS provides a minimal air change rate for the CRE area and controls building pressurization to reduce spreading of contamination.

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The CRACS maintains habitability of the CRE area in case of radioactive ~~or toxic gas~~ contamination of the environment. The CRACS also maintains a positive pressure in the CRE area to prevent infiltration of contaminated outside air. The CRACS operates in recirculation mode with fresh air makeup.

The CRACS provides the following safety-related functions:

- Maintains ambient temperature conditions inside the CRE area.
- Provides ~~carbon~~ filtration of outside air and recirculated air from within the CRE area.
- Maintains a positive pressure in the CRE area relative to the adjacent areas to prevent unfiltered in-leakage, upon receipt of a containment isolation signal (CIS) or high radiation alarm signal in the air intake ducts.

2.0 Arrangement

2.1 The functional arrangement of the CRACS is as described in the Design Description of Section 2.6.1, Tables 2.6.1-1—Main Control Room Air Conditioning System Equipment Mechanical Design and 2.6.1-2—Main Control Room Air Conditioning System Equipment I&C and Electrical Design, and as shown on Figures 2.6.1-1—Control Room Air Intake and CREF (Iodine Filtration) Train Subsystem Functional Arrangement, 2.6.1-2—Control Room Air Conditioning and Recirculation Air Handling Subsystem Functional Arrangement, and 2.6.1-3—CRE Air Supply and Recirculation Subsystem Functional Arrangement.

2.2 Deleted.

Table 2.6.1-2—CRACS Equipment I&C and Electrical Design
Sheet 3 of 5

06.04-10

Description	Tag Number(1)	Location	IEEE Class 1E (2)	PACS	MCR / RSS Displays	MCR / RSS Controls
Motor Operated Damper	30SAB14AA003	Safeguard Building 2	Division 4^N Division 3^A	Yes	Position / Position	Open-Close / Open-Close
Supply Air Fan	30SAB14AN001	Safeguard Building 3	Division 4^N Division 3^A	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Recirculation and Air Conditioning Train 30SAB01						
Supply Air Fan	30SAB01AN001	Safeguard Building 2	Division 1^N Division 2^A	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Recirculation and Air Conditioning Train 30SAB02						
Supply Air Fan	30SAB02AN001	Safeguard Building 2	Division 2^N Division 1^A	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Recirculation and Air Conditioning Train 30SAB03						
Supply Air Fan	30SAB03AN001	Safeguard Building 3	Division 3^N Division 4^A	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Recirculation and Air Conditioning Train 30SAB04						
Supply Air Fan	30SAB04AN001	Safeguard Building 3	Division 4^N Division 3^A	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Kitchen and Sanitary Exhaust 30SAB45						

2.6.4 Fuel Building Ventilation System

Design Description

1.0 System Description

The fuel building ventilation system (FBVS) receives the conditioned air supply from the nuclear auxiliary building ventilation system (NABVS). The exhaust from the FBVS is processed by the NABVS through a filtration train, and the exhaust air is directed to the vent stack.

The FBVS controls the Fuel Building temperature, humidity and air change rate for personnel comfort, personnel safety, and equipment protection during normal plant operation. The FBVS provides cooling, heating, and ventilation for the Fuel Building (FB) to remove equipment heat and heat generated from other sources. The FBVS also provides heat to maintain a minimum temperature in the building. The FBVS provides a minimal air change rate for the building and controls the building pressurization to reduce spreading of contamination.

The FBVS provides the following safety-related functions:

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- Isolation of the FB from NABVS supply and exhaust on receipt of containment isolation signal. Bypass leakage from primary containment is captured and filtered by the safeguard building controlled area ventilation system (SBVS) iodine filtration trains before being released into the environment.~~The FB atmosphere is then processed through iodine filtration trains of the safeguard building controlled area ventilation system (SBVS).~~
- Heating of the rooms which have safety-related systems, structures, or equipment containing borated fluid and the rooms surrounding the extra borating system tanks to maintain minimum ambient room temperatures.
- Cooling of rooms which have the extra borating system pumps and the fuel pool cooling system pumps to maintain ambient conditions.

The FBVS provides the following non-safety related functions:

- Diverts the ventilation air flow to the NABVS iodine filter train on high radioactivity in the Fuel Building.
- Isolates the fuel handling area ventilation on high activity in the Fuel Building exhaust.~~Maintains the room ambient conditions for operation of equipment and to allow personnel access during normal operation.~~
- ~~Reduces spread of contamination from the contaminated rooms to less contaminated rooms during normal operation.~~
- ~~Reduces concentration of aerosols and radioactive gases from the room air.~~

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.4-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.6.4-2 is powered from the Class 1E division as listed in Table 2.6.4-2 in a normal or alternate feed condition.

5.2 Deleted.

6.0 Environmental Qualifications

6.1 Equipment designated as harsh environment in Table 2.6.4-2 will perform the function listed in Table 2.6.4-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.

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7.0 Equipment and System Performance

7.1 Deleted. ~~Upon receipt of a containment isolation signal (CIS), the FBVS maintains a negative pressure in the Fuel Building relative to the outside environment.~~

7.2 Upon receipt of a containment isolation signal (CIS), the FBVS isolation dampers identified in Table 2.6.4-1 realign to exhaust air to the SBVS iodine filtration exhaust to the plant vent stack.

7.3 The FBVS provides cooling to maintain design temperatures in the pump rooms in the Fuel Building, while operating in a design basis accident alignment.

7.4 The FBVS provides heating to maintain design temperatures in the rooms with systems containing borated fluid in the Fuel Building, while operating in a design basis accident alignment.

7.5 Upon receipt of a high radioactivity signal in the FBVS, the FBVS diverts the ventilation air flow to the Nuclear Auxiliary Building Ventilation System (NABVS) iodine filter train.

7.6 Upon receipt of a high activity signal in the Fuel Building exhaust, the FBVS isolates the fuel handling area ventilation.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.6.4-3 lists the FBVS ITAAC.

Table 2.6.4-3—Fuel Building Ventilation System ITAAC
Sheet 4 of 5

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
6.1	Equipment designated as harsh environment in Table 2.6.4-2 will perform the function listed in Table 2.6.4-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.	a. Type tests or type tests and analysis will be performed to demonstrate the ability of the equipment designated as harsh environment in Table 2.6.4-2 to perform the function listed in Table 2.6.4-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. b. An inspection will be performed of the as-built equipment designated as harsh environment in Table 2.6.4-2 to verify that the equipment, including anchorage, are installed per the approved design requirements.	a. EQDPs conclude that the equipment designated as harsh environment in Table 2.6.4-2 can perform the function listed in Table 2.6.4-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions, including the time required to perform the listed function. b. Inspection reports conclude that the equipment designated as harsh environment in Table 2.6.4-2, including anchorage, are installed per the approved design requirements.
7.1	Deleted. ~~Upon receipt of a containment isolation signal, the FBVS maintains a negative pressure in the Fuel Building relative to the outside environment.~~	Deleted. ~~A test will be performed using test input signals to verify that upon receipt of a containment isolation test input signal, the FBVS maintains a negative pressure in the Fuel Building relative to the outside environment.~~	Deleted. ~~Upon receipt of a containment isolation test input signal, the FBVS maintains a negative pressure of less than or equal to 0.25 inches water gauge in the Fuel Building relative to the outside environment.~~
7.2	Upon receipt of a containment isolation signal, the FBVS isolation dampers identified in Table 2.6.4-1 realign to exhaust air to the SBVS iodine filtration exhaust to the plant vent stack.	A test will be performed using test input signals to verify that upon receipt of a containment isolation test input signal, the FBVS isolation dampers realign to exhaust air to the SBVS iodine filtration exhaust to the plant vent stack.	Within 60 seconds after receipt of a containment isolation test input signal from the PACS module the FBVS isolation dampers identified in Table 2.6.4_1 realign to exhaust air to the SBVS iodine filtration exhaust to the plant vent stack.

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2.6.6 Safeguard Building Controlled-Area Ventilation System

Design Description

1.0 System Description

The safeguard building controlled-area ventilation system (SBVS) provides cooling, heating, and ventilation for the hot areas of the four divisions of the Safeguard Buildings to remove equipment heat and heat generated from other sources. The SBVS also provides heat to maintain a minimum temperature in areas of the Safeguard Buildings. The SBVS provides a minimal air change rate for the buildings and controls the building pressurization to reduce spreading of contamination.

The SBVS provides the following safety-related functions:

- Isolates the volume of the hot mechanical area of the Safeguard Buildings and confines this volume by maintaining a negative pressure and removing the iodine that might be released due to post-accident operation of the safety injection system (SIS).

- Removes heat generated by equipment of the safety injection / residual heat removal systems in the hot mechanical rooms to maintain ambient temperatures during accident conditions.

- Removes heat generated by piping and equipment of the component cooling water and emergency feedwater systems in the valve rooms to maintain ambient temperatures during accident conditions.

- Removes heat generated by equipment of the hydrogen monitoring and post accident atmosphere sampling systems to maintain ambient temperatures during accident conditions.

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- Maintains a negative pressure in the Fuel Building (FB) and Safeguard Building (SB) mechanical areas to capture bypass leakage from the primary containment upon receipt of a containment isolation signal. The exhaust air is directed to the SBVS iodine filtration trains before being released into the environment. ~~to direct the air from the FB to the SBVS iodine filtration trains when the FB is isolated from the nuclear auxiliary building ventilation system (NABVS) on receipt of a containment isolation signal.~~

The SBVS provides the following non-safety-related functions:

- Diverts the ventilation air flow to the NABVS iodine filter train on high radioactivity in the Safeguard Buildings.~~Ventilates the hot mechanical areas of the Safeguard Buildings and provides a minimum required air change rate during normal operation.~~

- ~~Maintains acceptable ambient conditions in the hot mechanical areas of the Safeguard Buildings during normal operation.~~

4.2 Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.6.6-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.6-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.6.6-2 are powered from the Class 1E division as listed in Table 2.6.6-2 in a normal or alternate feed condition.

5.2 Deleted.

6.0 Environmental Qualifications

6.1 Equipment designated as harsh environment in Table 2.6.6-2 will perform the function listed in Table 2.6.6-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.

6.2 Deleted.

7.0 Equipment and System Performance

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7.1 Upon receipt of a containment isolation signal, the SBVS maintains a negative pressure in the Fuel Building and the hot mechanical rooms of the Safeguard Buildings relative to the outside environment.~~adjacent areas.~~

7.2 Deleted.

7.3 Upon receipt of a high radiation signal in the Fuel Building or Reactor Building, both SBVS iodine filtration trains start automatically, the FB isolation dampers open, the SBVS isolation dampers close, iodine filtration banks isolation dampers open, and the accident air is directed through the SBVS iodine filtration trains.

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7.4 Deleted.~~Upon receipt of a containment isolation signal, the SBVS maintains a negative pressure in the FB and SB relative to the outside environment.~~

7.5 The SBVS provides cooling to maintain design temperatures in the hot mechanical rooms in the Safeguard Buildings, while operating in a design basis accident alignment.

7.6 Upon receipt of a high radioactivity signal in the SBVS, the SBVS diverts the ventilation air flow to the Nuclear Auxiliary Building Ventilation System (NABVS) iodine filter train.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.6.6-3 lists the SBVS ITAAC.

Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC
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	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
7.1	Upon receipt of a containment isolation signal, the SBVS maintains a negative pressure in the Fuel Building and the hot mechanical rooms of the Safeguard Buildings relative to the outside environment. ~~adjacent areas.~~	A test will be performed to verify that upon receipt of a containment isolation test input signal, the SBVS maintains a negative pressure in the Fuel Building and the hot mechanical rooms of the Safeguard Buildings relative to the outside environment.~~adjacent areas.~~	The SBVS maintains a negative pressure of less than or equal to 0.25 inches water gauge within 305 seconds in the Fuel Building and the hot mechanical rooms of the Safeguard Buildings relative to the outside environment after receipt of a containment isolation test input signal from the PACS module. ~~Upon receipt of a containment isolation test input signal from the PACS module, the SBVS maintains a negative pressure of less than or equal to 0.25 inches water gauge in the hot mechanical rooms of the Safeguard Buildings relative to the adjacent areas.~~
7.2	Deleted.	Deleted.	Deleted.
7.3	Upon receipt of a high radiation signal in the Fuel Building or Reactor Building, both SBVS iodine filtration trains start automatically, the FB isolation dampers open, the SBVS isolation dampers close, iodine filtration banks isolation dampers open, and the accident air is directed through the SBVS iodine filtration trains.	A test will be performed separately for each iodine filtration train to verify that upon receipt of a high radiation test input signal in the Fuel Building or Reactor Building, both SBVS iodine filtration trains start automatically, the FB isolation dampers, the SBVS isolation dampers close, iodine filtration banks isolation dampers open, and the accident air is directed through the SBVS iodine filtration trains.	Upon receipt of a high radiation test input signal from the PACS module, both SBVS iodine filtration trains start automatically, the FB isolation dampers open, the SBVS isolation dampers close, iodine filtration banks isolation dampers open, and the accident air is directed through the SBVS iodine filtration trains. The isolation dampers close or open within 60 seconds after receipt of a test input signal from the PACS module.

Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC
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Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
7.4	Deleted. ~~Upon receipt of a containment isolation signal, the SBVS maintains a negative pressure in the FB and SB relative to the outside environment.~~	Deleted. ~~A test will be performed to verify that upon receipt of a containment isolation test input signal, the SBVS maintains a negative pressure inside the FB and SB relative to the outside environment.~~	Deleted. ~~Upon receipt of a containment isolation test input signal from the PACS module, the SBVS maintains a negative pressure of less than or equal to -0.25 inches water gauge in the FB and SB relative to the outside environment.~~
7.5	The SBVS provides cooling to maintain design temperatures in the hot mechanical rooms in the Safeguard Buildings, while operating in a design basis accident alignment.	a. Tests and analysis will be performed to verify the SBVS provides cooling to maintain design temperatures in the hot mechanical rooms in the Safeguard Buildings, while operating in a design basis accident alignment. b. A test of the SBVS fans will be performed to verify that the design air flow is greater than the approved design requirement.	a. Each SBVS cooling coil is capable of providing design cooling capacity, while operating in a design basis accident alignment. b. Each SBVS fan is capable of meeting the design air flow requirements, while operating in a design basis accident alignment.
7.6	Upon receipt of a high radioactivity signal in the SBVS, the SBVS diverts the ventilation air flow to the NABVS iodine filter train.	A test will be performed to verify that upon receipt of a high radioactivity test input signal in the SBVS, the SBVS diverts the ventilation air flow to the NABVS iodine filter train.	Upon receipt of a high radioactivity signal in the SBVS, the SBVS diverts the ventilation air flow to the NABVS iodine filter train.

The second category of leakage is considered bypass leakage and is evaluated by examining the potential bypass of the secondary containment. Penetrations and seals that terminate outside the secondary containment (outside the annulus) exit the Reactor Shield Building structure into either the Fuel Building or one of the four Safeguard Buildings. The ventilation systems for the Fuel Building and Safeguard Buildings are provided with filtering systems to capture radiological contaminants that may occur from a DBA. The ESF filters and ducts that capture bypass leakage are located in the Fuel Building, Safeguard Buildings and Annulus. Therefore, any bypass leakage is processed by engineered safety features (ESF) filter systems before release. The ESF filters are described in Section 6.5.1. The fuel building ventilation system and the safeguard building controlled-area ventilation system are described in Section 9.4.2 and Section 9.4.5, respectively.

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All penetrations that are welded or have mechanical connections are tested using methods that conform to regulatory requirements and guidance for measuring the leakage rate of potential bypass leakage paths in dual containment plant designs.

Containment penetrations identified as potential bypass leakage paths are listed in Table 6.2.4-1. The table provides a brief description of each penetration and provides a determination of potential bypass leakage path.

U.S. EPR design has no primary containment penetrations or seals that terminate outside the secondary containment to the general environment. Leakage through penetrations and seals that terminate in the secondary containment do not become bypass leakage during normal or accident operation modes. Therefore, the maximum combined leakage rate for all bypass penetrations is assumed to be zero (0.00 L_a) at a primary containment pressure of $P_{a.}$

6.2.7 Fracture Prevention of Containment Pressure Vessel

Section 3.8.2 identifies the ferritic steel parts of the reactor containment pressure boundary and specifies how they meet the requirements of GDC 1 and GDC 16. The selected materials provide sufficient margin to assure that under operating, maintenance, testing, and postulated accident conditions:

- Ferritic materials behave in a nonbrittle manner.
- Probability of rapidly propagating fracture of the pressure boundary is minimized (GDC 51).

The materials of the carbon steel liner plate and carbon steel and low alloy steel attachments and appurtenances subject to ASME Section III (Reference 14), Division 2 requirements meet the fracture toughness requirements of ASME Section III, Division 2, Article CC-2520. Materials used in ASME Section III, Division 1 attachments and appurtenances meet the fracture toughness requirements of ASME Section III,

6.3 Emergency Core Cooling System

The safety injection system (SIS) provides emergency core cooling for the U.S. EPR. Four supply and return trains comprise the system, one for each of the reactor coolant system (RCS) loops. Individually, each of these trains can supply the required core cooling. The four supply trains, which serve the safety injection function, charge through parallel paths from a low head safety injection (LHSI) pump, a medium head safety injection (MHSI) pump, and an accumulator in each train. The injection pumps draw water from the in-containment refueling water storage tank (IRWST) for their emergency function. The IRWST also provides gravity-driven coolant flow through the non-safety-related severe accident heat removal system (SAHRS) flooding lines to quench molten corium in the core spreading area during severe accidents.

The MHSI pumps and the accumulators inject directly into the cold legs. The LHSI pumps inject through the LHSI heat exchangers (HX) to the cold legs. Closed loop cooling via the LHSI pump (in residual heat removal mode) for post-accident heat removal is also available by aligning the suction to the RCS hot legs. The LHSI system may be realigned during accident recovery for hot-leg injection to prevent boron precipitation and mitigate steaming from the break. During severe accidents, an operator action is required when the core outlet temperature reaches 1,200°F to open the normally closed, de-energized, SAHRS passive flooding line motor-operated isolation valves upstream of the normally closed passive flooding devices to initiate coolant flow to the core spreading area. This arrangement protects the IRWST inventory against a single failure that could result in inadequate IRWST level to maintain sufficient ECCS pump NPSH. The SAHRS is also capable of providing support for mitigation of a beyond design basis event.

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The SAHRS passive flooding line motor-operated isolation valves are powered by the Class 1E electrical distribution system and can receive power from offsite power sources, emergency diesel generator or the SBO diesel generator. In addition, safety-related motor-operated isolation valves are backed by battery power (12UPS) during a severe accident with a loss of offsite power and emergency diesel generators.

The residual heat removal (RHR) function of the safety injection system/residual heat removal system (SIS/RHRS) for normal shutdown cooling of the reactor is described in Section 5.4.7. The SAHRS passive flooding lines and their function are described in Tier 2, Section 19.2.

6.3.1 Design Bases

The SIS limits fuel assembly damage during core flooding and emergency core cooling following a loss of coolant accident (LOCA). The SIS removes post-accident decay heat from the RCS and provides post-accident containment cooling via the LHSI HXs. The system consists of four independent and separated trains, each housed and

- Controls for foreign material exclusion to limit the introduction of foreign material and debris sources into containment.

- Controls to assess and manage maintenance activities, including associated temporary changes, to confirm that ECCS function is not reduced by associated changes in analytical inputs or assumptions, or other activities that could introduce debris or potential debris sources into containment.

- Controls on the introduction of coating materials into containment and to address deficiencies of coating materials used in containment.

- [*Latent debris will be limited to 150 pounds (10.2 lbs of fiber and 139.8 lbs of particulate) and 100 ft*^{2}*.*]* These latent debris limits derive from U.S. EPR sump strainer and fuel assembly testing that demonstrates adequate long term core cooling under debris-laden coolant conditions.

Coolant pH adjustment baskets containing granulated trisodium phosphate dodecahydrate (TSP-C) are strategically placed in the inlet flow path to the IRWST within the boundary perimeter of the weirs at the four heavy floor openings of the RB. Flow through the baskets dissolves the TSP-C into the coolant that returns to the IRWST to passively neutralize entrained acids and maintain the alkalinity of the coolant. The pH of the recirculated coolant is maintained above 7.0. The control of pH in the recirculated coolant reduces the potential for stress-corrosion cracking of the austenitic stainless steel components, limits the generation of hydrogen attributable to corrosion of containment metals, and minimizes the re-evolution of iodine in post-LOCA containment solution, maintaining the radioiodine in solution to reduce radioactive releases to the environment. The minimum amount of granulated TSP-C for this pH control is 12,200 lb_m. Section 15.0.3.12 provides an evaluation of post-accident water chemistry control.

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The IRWST is connected to the molten core spreading area by pipes that are closed during normal operation and accident conditions. If a severe accident occurs, operator action to manually open the normally-closed, de-energized motor-operated isolation valves in the passive flooding lines is required when core outlet temperature reaches 1,200°F. When~~and~~ molten material reaches the spreading area, an actuation device melts, flooding valves open, and IRWST water flows into the spreading area to support the operation of the SAHRS. The IRWST is located at a higher elevation than the core spreading area to provide gravity flooding of the spreading area with the IRWST water inventory. The core spreading area and the SAHRS are described in Section 19.2.3.3.

The debris interceptor components, including trash racks, retention baskets and ECCS strainers, are designed and analyzed per the provisions of ANSI/AISC N690-1994, “Specification for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities,” including Supplement 2 (S2). The structural qualification of the debris interceptors includes an evaluation of the structural

7.3.1.3.3 Main Control Room Air Conditioning System

The main control room air conditioning system (CRACS) is designed to maintain design temperature conditions for rooms within the Control Room Envelope (CRE) during normal and accident conditions. The CRACS also maintains the habitability of the MCR and associated rooms even in the case of radioactive contamination of the environment. See Section 9.4.1 for more information about the CRACS.

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Iodine Filtration Train Heater Control

The ~~main control room air conditioning system (~~CRACS~~)~~ has an safety-related function to preheat the inlet air in order to reduce the airborne moisture prior to entry into the carbon bed within the filter unit. The relative humidity is limited to a maximum of 70% in order to maintain the capability of the carbon filters to remove iodine from the annulus supply air. Carbon filter heaters shut down when the respective inlet or outlet dampers are not fully open. The heaters will turn off if the carbon filtration unit fan stops, the carbon filter inlet isolation damper is not open or the carbon filter outlet isolation damper is not open. The functional logic is shown in Figure 7.3-42—CRACS Iodine Filtration Train Heater Control.

Heater Control for Outside Inlet Air

The CRACS has an safety-related function to preheat the outside air to verify that the inlet air temperature is not less than 37°F (GDC 19). The heaters are designed to heat the outside air during cold weather conditions and to preheat the cold outside air to prevent the CRACS air handling unit chilled water cooling coils from freezing. Inlet air that bypasses the iodine filtration unit is heated by an electric heater for temperature control. Heating of the outside air is performed by multi-stage heaters located in each outside air intake duct. The functional logic is shown in Figure 7.3-43—CRACS Heater Control for Outside Inlet Air.

Pressure Control

The CRACS has a safety-related function to verify the MCR is maintained at a positive pressure with respect to the ambient air pressure in adjacent areas to prevent unfiltered in-leakage into the MCR and associated rooms (GDC 19). Differential pressure sensors sense the pressure difference between the MCR and the pressure in a reference areas. The functional logic is shown in Figure 7.3-44—CRACS Pressure Control.

Cooler Temperature Control

The CRACS has safety-related functions that verify that the air supply temperature is maintained within the preset temperature range (GDC 19). A control signal is developed when the supply air temperature exceeds a preset temperature set point of

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~~a single~~ two CRACS air handling units to cool the CRE rooms during a station blackout (SBO) event. During an SBO, ~~the single~~ two CRACS air handling units prevent~~s~~ the CRE room temperature from exceeding 104°F.

The air conditioning system for the CRE area operates in the recirculation mode with fresh air makeup. The fresh air flow rate corresponds to the exhaust of kitchens and restrooms and the leakage rate in the CRE area due to controlled overpressure. The exhaust from the kitchen and restrooms is directed to the electrical division of the SB ventilation system (SBVSE) air outlet duct (refer to Section 9.4.6).

CRE Air Supply and Recirculation Subsystem

The CRE air supply and recirculation subsystem is illustrated in Figure 9.4.1-3—Control Room Envelope Air Supply and Recirculation Subsystem.

The common supply air plenum receives air from the operating CRACS air handling units and provides conditioned air to the CRE areas through the duct distribution network. Electric air heaters are installed in the supply air ducts to maintain individual room temperatures. The exhaust air from the CRE area, except from the kitchen and restrooms, flows through the recirculation air handling units. The exhaust from kitchen and restrooms is separated from the recirculated return air and is processed separately through the SBVSE.

9.4.1.2.2 Component Description

The major components of the CRACS are listed below, along with the applicable codes and standards. Table 3.2.2-1 provides the seismic design and other design classifications for components in the CRACS.

Ductwork and Accessories

The main supply and exhaust air plenums are constructed of concrete with painted surfaces. The air supply and exhaust duct branches for each area are fed from the main supply and exhaust air plenum. These ducts are constructed of galvanized sheet steel and are structurally designed for fan shutoff pressures. The ductwork meets the design, testing and construction requirements per ASME AG-1 (Reference 1).

Electric Heaters (Duct Heaters)

The electric heaters (duct heaters) are installed in the supply duct to maintain room ambient conditions. These are controlled by local room temperature sensors and control circuits. The heaters meet the requirements of Reference 1.

During LOOP, the CREF (iodine filtration) train electrical components located inside the SB division two receive power from the EDGs of division one. The electrical components located inside the SB division three receive power from the EDGs of division four.

Station Blackout

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- In the event of station blackout (SBO), the electrical components which receive power from the EDGs of divisions one and two are backed-up by alternate AC (AAC) power from ~~the~~ an SBO diesel generator~~s~~ (SBODG) of ~~division~~ train one. The electrical components which receive power from the EDGs of divisions three and four are backed up by the AAC power from ~~the~~ an SBODG~~s~~ of ~~division~~ train four.
- In the event of a simultaneous SBO and site radiological event, the CRE area is isolated and CRACS is maintained in a full recirculation mode through the CREF (iodine filtration) train until site power is restored or EDGs are started. Power restoration is assumed to occur within eight hours following the occurrence of a SBO event.

Loss of Ultimate Heat Sink

The conditioned air supply is cooled by chilled water provided by the SCWS. Two water-cooled chillers are located in SB divisions two and three, and two air-cooled chillers are located in SB divisions one and four. In case of loss of ultimate heat sink (LUHS), the water-cooled chillers are not available. The safety chilled water is then supplied by air-cooled chillers which provide the cooling function for the filtration trains located in divisions one and four, which also include both CREF (iodine filtration) trains. The cooling function for any two of the four CRACS cooling units in divisions 1, 2, 3, and 4 will continue to be available.

Operation During Radiological Site Contamination

During a site radiological contamination event, the fresh air supply is automatically redirected through the CREF (iodine filtration) trains, instead of the normal intake air supply, by closing and opening the associated dampers. When one CREF (iodine filtration) train operates, the outside fresh airflow rate of 1000 cfm and CRE recirculation airflow rate of 3000 cfm (a total flow rate of 4000 cfm) provides an unlimited stay by the CRE personnel.

Exhaust from the kitchen and restrooms is stopped and all other exhaust air is recirculated.

The operation of CRACS creates an minimum pressure of 0.125 inches of water gauge inside the CRE area with respect to the surrounding area. This limits unfiltered incoming air leakage into these areas.

9.4.2 Fuel Building Ventilation System

The fuel building ventilation system (FBVS) is designed to maintain acceptable ambient conditions in the Fuel Building (FB), to permit personnel access, and to control airborne radioactivity in the area during normal operation, anticipated occurrences, and following fuel handling accidents.

The conditioned air supply to the FB is provided by the nuclear auxiliary building ventilation system (NABVS) (refer to Section 9.4.3). The exhaust from the building is also processed by the NABVS through a filtration train, and the exhaust air is directed to the vent stack (refer to Section 9.4.3).

9.4.2.1 Design Bases

The following components are safety-related and designed to Seismic Category I requirements:

- Fuel handling hall isolation dampers.
- Isolation dampers for the fuel handling hall located in front of the equipment hatch.
- Isolation dampers for the room located in front of the emergency airlock.
- NABVS supply and exhaust isolation dampers to and from FBVS.
- FB isolation dampers to safeguard building ventilation system (SBVS).
- Electric fan heaters for heating of rooms that have safety-related systems, structures or components containing borated fluid and the rooms surrounding the extra borating system tanks.
- Recirculation cooling units in the extra borating system pump rooms, and fuel pool cooling system pump rooms.
- FBVS exhaust duct.

The FBVS air supply duct and other components of the FBVS are designated as Supplemental Grade (NS-AQ) safety class and Seismic Category II.

The FBVS components are located inside the FB structure, which is designed to withstand the effects of natural phenomena, such as earthquake, tornados, hurricanes, floods and external missiles (GDC-2).

The safety functions of the FB ventilation system can be performed assuming a single active component failure coincident with the loss of offsite power (LOOP). Upon

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receipt of a containment isolation signal, the FBVS supply and exhaust is isolated from the NABVS. Bypass leakage from primary containment is captured and filtered by the SBVS iodine filtration trains before being released into the environment.

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The seismic design of the system components meets the guidance of RG 1.29 (Position C.1 for the safety-related portion and Position C.2 for the non-safety-related portion). Table 3.2.2-1 provides the seismic design and other design classifications for components in the FBVS.

The safety-related components and systems of the FB ventilation system are not shared among nuclear power units (GDC-5).

The release of radioactive material to the environment is controlled by meeting the guidance of RG 1.140, positions C.2 and C.3 (GDC-60). RG 1.52 is not applicable because the FBVS is not required to operate during post-accident engineered safety features (ESF) atmospheric cleanup. In case of high radiation alarm in the FB (refer to Table 11.5-1, Monitors R-17 and R-18), the system will automatically direct the building exhaust through activated charcoal filtration beds located in the NABVS.

The FBVS provides appropriate ventilation and filtration to limit potential release of airborne radioactivity to the environment from the fuel storage facility under normal operation and in the event of a fuel handling accident in the fuel pool area. The design of the ventilation system meets the guidance of RG 1.13, Position C.4 (GDC-61).

Air conditioning and heating loads for the FB Rooms are calculated using methodology identified in ASHRAE Handbook (Reference 3).

- Summer air conditioning loads will be calculated with a maximum outside air design temperature 0 percent exceedance value, using U.S. EPR Site Design Envelope Temperature (See Table 2.1-1). The analysis will be completed for both a normal and accident plant alignment configuration.
- The cooling supply units are designed to provide cooling as required to prevent the FB room temperatures from exceeding their maximum design temperature.
- Winter heating loads will be calculated with the plant operating in an outage alignment configuration. Winter heat loads will be calculated with a minimum outside air design temperature 0 percent exceedance value, using U.S. EPR Site Design Envelope Temperature (See Table 2.1-1).

The FBVS provides the following important non-safety-related functions:

- Controls and maintains a negative pressure during normal operation within the FB relative to the outside environment. Rooms identified as having possible radioactive contamination are designed to be at a negative pressure relative to the adjacent rooms to make sure air flows from areas of low radioactivity to areas of potentially higher radioactivity.

(GDC 4). Refer to Section 3.5.1.1, Section 3.5.1.4, Section 3.5.2, and Section 3.6.1 for information on compliance with GDC 4 as it relates to protection from missiles and postulated piping failures.

The safety-related components and systems of the SBVS are not shared among nuclear power units (GDC 5).

The essential onsite electrical power systems meet the guidance of NUREG-CR/0660 (subsection A–item 2, and subsection C-item 1) (Reference 1) for protection of essential electrical components (such as contactors, relays, circuit breakers) from failure due to the accumulation of dust and particulate materials (GDC 17). This is accomplished by the roughing prefilters and filters of the supply air units of the SBVSE as described in Section 9.4.6.

The release of radioactive materials to the environment is controlled by meeting the guidance of RG 1.52 (position C.3) (GDC 60). Upon receipt of a high radiation alarm in the hot mechanical areas of the SBs (refer to Table 11.5-1, Monitor R-25), the SBVS will direct the exhaust air (accident exhaust) through NABVS activated charcoal filtration beds located in the NAB prior to release through the plant stack.

Filtration during normal operation is provided by the NABVS by meeting the guidance of RG 1.140 (positions C.2 and C.3). Refer to Section 9.4.3.

Capability for withstanding or coping with a station blackout (SBO) event is provided to comply with the requirements of 10 CFR 50.63. Acceptance is based on meeting the applicable guidance of RG 1.155, including position C.3.2.4. Refer to Section 8.4 for a description of the design features to cope with the SBO event.

The SBVS provides isolation and confinement of the hot mechanical areas of the SBs. The system also provides reduction of a possible radioactive release into the environment.

In case of fuel handling accident in the FB, the exhaust air (accident air) from the FB and the hot mechanical area of the SB is directed through the SBVS activated charcoal filtration beds located in the FB prior to release through the plant stack.

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On receipt of containment isolation signal, the SB mechanical areas are isolated and the SBVS iodine filtration trains are initiated. ~~the NABVS supply and exhaust isolation dampers are closed to limit leakage out of the FB.~~ The SBVS maintains negative pressure in the FB and SB mechanical areas to capture bypass leakage from primary containment. The exhaust air is directed to the SBVS iodine filtration trains before being released into the environment ~~air from the FB is directed to the SBVS iodine filtration trains~~ (refer to Section 9.4.2).

The SBVS can be used for containment building ventilation system (CBVS) low flow containment purge in an emergency for redundancy to the CBVS iodine filtration trains (refer to Section 9.4.7).

The seismic design of the system meets the guidance of RG 1.29 (position C.1 for the safety-related portions and position C.2 for the non-safety-related portions).

Air conditioning and heating loads for the SBVS rooms are calculated using methodology identified in ASHRAE Handbook (Reference 11).

- Summer air conditioning loads will be calculated with a maximum outside air design temperature 0 percent exceedance value, using U.S. EPR Site Design Envelope Temperature (See Table 2.1-1). The analysis will be completed for both a normal and accident plant alignment configuration.
- The recirculation cooling units are designed to provide cooling as required to prevent the SBVS room temperatures from exceeding their maximum design temperature.
- Winter heating loads are calculated with the plant operating in an outage alignment configuration. Winter heat loads will be calculated with a minimum outside air design temperature 0 percent exceedance value, using U.S. EPR Site Design Envelope Temperature (See Table 2.1-1).

The SBVS performs the following important non-safety-related system functions:

- With outside air ambient design temperature conditions of -40°F to 115°F, the SBVS maintains the following temperature and humidity ranges for the areas serviced.

– Minimum temperature	50°F.
– Maximum temperature	104°F.
– Humidity	25 to 70 percent.

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- ~~Controls and maintain a negative pressure within the hot mechanical areas of Safeguard Buildings relative to the outside environment.~~

The SBVS performs the following safety-related system functions:

- Controls and maintain a negative pressure within the hot mechanical areas of Safeguard Buildings and Fuel Building relative to the outside environment.
- Maintains acceptable ambient conditions for the safety-related components in the hot mechanical rooms in the SB during accident conditions, taking into account internal and external heat loads.

Residual Heat Removal System Break outside Containment

The rooms inside SB divisions one and four containing the residual heat removal (RHR) equipment and piping are equipped with isolation dampers in the supply and exhaust air ducts. These dampers are manually closed during RHR operation to prevent the spread of steam and airborne contamination due to a pipe failure.

Operation of Containment Heat Removal System in Severe Accidents

The rooms inside SB division four containing the severe accident heat removal system equipment are isolated from the other rooms by closing the associated dampers located in the supply air ducts for each room.

9.4.5.3 Safety Evaluation

The SBVS is designed to maintain ambient conditions in areas of the SB divisions (refer to Section 11.5.3.1.9 and Table 11.5-1, Monitor R-25) one through four where engineered safety equipment is located. This permits personnel access and allows safe operation of the equipment during normal plant operation, outages, and under all anticipated occupational occurrences, including postulated accident events.

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The SBVS provides isolation and confinement of the hot mechanical areas of the SBs (refer to Section 11.5.3.1.9 and Table 11.5-1, Monitor R-25). Two isolation dampers and one volume control damper are provided in the supply and exhaust ducts to make sure that hot mechanical areas can be purged or isolated without any leakage. The hot mechanical areas and Fuel Building are maintained at negative pressure with respect to the outside atmospheric air pressure. The system also provides reduction of radioactive release into the environment.

Each recirculation cooling unit for SB divisions one through four operates independently of the recirculation cooling unit in the other divisions. In case of a recirculation cooling unit failure inside one division, the recirculation cooling units for the other three divisions are unaffected.

Upon receipt of a high radiation alarm in the hot mechanical areas of the SBs (refer to Section 11.5.3.1.9 and Table 11.5-1, Monitor R-25), the SBVS directs the exhaust through the NABVS activated charcoal filtration beds located in the NAB prior to release through the plant stack. Sufficient redundancy provides reasonable assurance of proper system operation with one active component out of service.

Confinement of the four SB hot mechanical areas and startup of the SBVS accident iodine filtration trains is initiated by the safety automation system (SAS) signal.

Isolation dampers in the supply and exhaust ducts are provided for the SB division one through four rooms where safety injection and residual heat removal system

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

1.2 To demonstrate electrical independence and redundancy of power supplies.

1.3 To verify that radiation monitors respond as designed to check sources.

1.4 To verify that radiation monitors initiate automatic control functions upon detecting high activity levels.

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, including radiation monitors, 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:

3.4.1 Detection of radiation in one of the outside inlets places the CREF (iodine filtration) units in the filtered alignment.

3.4.2 Safety injection actuation/primary containment isolation signal.

3.5 Verify the HEPA filter efficiency, carbon adsorber 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 external areas adjacent to the CRE boundary while operating in the design basis accident alignment~~the outside atmosphere during system operation~~.

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3.8 Verify the system maintains the CRE at the required positive pressure while in the normal operation alignment.

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 (refer to Table 11.5-1, Monitors R-29 and R-30).~~

3.12 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

3.13 Verify operation of radiation monitors using check sources (refer to Table 11.5-1, Radiation Measuring Points R-29 and R-30) and external test equipment, as necessary:

3.13.1 Check the self-testing features of radiation monitors.

3.13.2 Record the response of radiation monitors to check sources.

3.13.3 Initiate a high radiation signal to each radiation monitor to verify monitor response (alarm actuations) meets design requirements.

3.13.4 Record alarm actuations at local and remote locations, as appropriate.

3.14 Confirm that Automatic Control Functions (refer to Table 11.5-1, Radiation Measuring Points R-29 and R-30) initiate upon detecting high activity levels.

3.15 Verify that duct/housing leakage requirements are met.

4.0 DATA REQUIRED

4.1 Air balancing verification.

4.2 Fan and damper operating data.

4.3 Temperature data in the CRE.

4.4 Response to ~~radioactivity and~~ smoke.

4.5 Setpoints of alarms, interlocks, and controls.

4.6 Pressurization data for the CRE.

4.7 Filter and carbon adsorber data.

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

4.9 ~~The CRACS response to radiation monitors.~~

4.10 Radiation monitor response to check source.

4.11 Technical data associated with check source.

4.12 Signal levels necessary to initiate alarm actuation.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.7.12.9~~8~~	Verify each SBVS recirculation cooler has the capability to remove the design heat load.	24 months
SR 3.7.12.10	Verify Safeguard Building and Fuel Building structural integrity by performing a visual inspection of the exposed interior and exterior surfaces of the Safeguard Building and Fuel Building.	During shutdown for SR 3.6.1.1 Type A tests

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B 3.6 CONTAINMENT SYSTEMS

B 3.6.6 Shield Building

BASES

BACKGROUND

The shield building is a concrete structure that surrounds the Containment Building. Between the Containment Building and the shield building inner wall is an annular space that collects containment leakage that may occur following a loss of coolant accident (LOCA). This space also allows for periodic inspection of the outer surface of the Containment Building.

The Annulus Ventilation System (AVS) establishes a negative pressure in the annulus between the shield building and the containment building. Filters in the system then control the release of radioactive contaminants to the environment. The description of the AVS is provided in the Bases for Specification 3.6.7. The shield building is required to be OPERABLE to ensure retention of containment leakage and proper operation of the AVS in the event of a Design Basis Accident.

To ensure the retention of containment leakage within the Containment Building:

a. The door in each access opening is closed except when the access opening is being used for normal transit entry and exit; and

b. The sealing mechanism associated with each penetration (e.g., welds, bellows, or O-rings) is OPERABLE.

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As discussed in Reference 1, the shield building, portions of the safeguard buildings, and the fuel building are maintained at a negative pressure in order to process any post-accident containment leakage through filters in the AVS and the Safeguard Building Controlled Area Ventilation System (SBVS).

APPLICABLE SAFETY ANALYSES

The design basis for shield building OPERABILITY is a LOCA. Maintaining shield building OPERABILITY ensures that the release of radioactive material from the containment atmosphere is restricted to those leakage paths and associated leakage rates assumed in the accident analyses.

The shield building satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

SURVEILLANCE REQUIREMENTS (continued)

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 pressure of ≤ -0.25 inches wg using one AVS train. SR 3.6.6.4 demonstrates that the annulus can be maintained at a pressure of ≤ -0.25 inches wg using one AVS train at a flow rate ≤ 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 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.

SR 3.6.6.5

This SR would give advance indication of gross deterioration of the concrete structural integrity of the Shield Building. The Frequency of this SR is the same as that of SR 3.6.1.1. The verification is done during shutdown.

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REFERENCES ~~None.~~1. FSAR Section 6.2.6.5.

B 3.7 PLANT SYSTEMS

B 3.7.11 Control Room Air Conditioning System (CRACS)

BASES

BACKGROUND

The CRACS provides temperature control for the control room envelope (CRE) following isolation of the control room.

The CRACS operates in the recycling mode with fresh outside air makeup. There are two 100% capacity identical fresh air intake trains. Train 1 is located in Safeguard Building 2 and train 4 is located in Safeguard Building 3. For each intake train, the fresh air is taken from outside environment through a motor-operated inlet isolation damper, and a pressure control damper. If operating in the unfiltered bypass alignment (intake air bypasses the CREF), outside air flows through a prefilter and duct heater. The fresh outside air then goes to the common recirculation plenum and mixes with CRE recycled air. The mixed air is then directed through two of the four air conditioning trains.

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During normal and emergency operation each CRACS cooling unit provides 50% of the cooling for the rooms within the CRE. Each CRACS air handling unit is capable of cooling up to 50% of the normal and emergency cooling load to allow two CRACS air handling units to cool the CRE rooms ~~during a station blackout (SBO) event. During an SBO event, the CRACS air handling units will prevent the CRE room temperature from exceeding 78°F~~.

Each air conditioning train consists of a final filter, cooling coil, moisture separator, fan suction and discharge silencers, supply air fan, and backdraft damper. The conditioned air is supplied to the control room envelope (CRE) areas. Electric heaters are installed in the supply air ducts to maintain individual room temperature. The air is pulled from the CRE areas into a common recirculation air plenum and then recycled through the air conditioning units for each train. Upon receipt of a high radiation alarm or upon receipt of a containment isolation alarm, the CREF unit operates in the filtered alignment. Operation of either CREF unit or closure of either outside inlet air isolation damper will shut down the normal kitchen or restroom exhaust fan and close isolation dampers in ducting routed to the safeguard building ventilation system (SBVS) where it is exhausted to the outside environment.

During normal operation, the CREF units operate in the bypass alignment (air bypasses the iodine filtration unit). CRE room exhaust from clean areas continues to recycle back to the recirculation plenum and CRACS air conditioning units.

BASES

BACKGROUND (continued)

HEPA filter is not credited in the analysis, but serves to collect carbon particles and provides a backup in case the upstream HEPA filter bank fails. The moisture separator removes any large particles in the air and any entrained water droplets present to prevent excessive loading of the HEPA filters and carbon adsorbers.

In case of a LOCA with assumed ECCS leakage, the accident air exhaust from the safeguard building controlled areas and fuel building is also directed through the accident iodine exhaust filtration trains prior to release through the vent stack.

The SBVS accident iodine filtration train is a standby system which may also be operated during normal plant operations. Upon receipt of an actuating signal, the normal air exhaust from the buildings is isolated and the accident air is redirected through the iodine filtration train.

The SBVS is discussed in FSAR Section 9.4.5 (Ref. 3).

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As discussed in Reference 8, the shield building, portions of the safeguard buildings, and the fuel building are maintained at a negative pressure in order to process any post-accident containment leakage through filters in the Annulus Ventilation System (AVS) and the SBVS.

APPLICABLE SAFETY ANALYSES

The SBVS design basis is established by the consequences of the limiting postulated accident, which is a LOCA with assumed ECCS leakage. The analysis of a LOCA, given in Reference 4, assumes ECCS leakage to the safeguard building controlled areas and fuel building is a conservative four gallons a minute. The SBVS consists of two 100% capacity iodine filtration trains in parallel configuration. There are only two iodine filtration trains since only slow failure modes are assumed and filtration efficiency is checked periodically. Both sets of iodine filtration trains are required to be OPERABLE. One SBVS train is then assumed to be lost due to a single failure. The postulated accident analysis assumes that two trains of the SBVS are OPERABLE. The accident analysis accounts for the reduction in airborne radioactive material provided by the one train of this filtration system. The amount of fission products available for release from the safeguard building controlled areas and fuel building is determined for a LOCA. These assumptions and the analysis follow the guidance provided in Regulatory Guide 1.25 (Ref. 5).

The SBVS is not credited in the Fuel Handling Accident evaluation.

The SBVS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.12.9~~8~~

This SR verifies that the SBVS recirculation coolers that cool the hot mechanical areas are capable of removing the design heat load assumed in the safeguards building heat load calculation. This SR consists of a combination of testing and calculations. The 24-month Frequency is appropriate since significant degradation of the SBVS is slow and is not expected over this time period.

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SR 3.7.12.10

This SR would give advance indication of gross deterioration of the concrete structural integrity of the safeguard buildings and the fuel building. The Frequency of this SR is the same as that of SR 3.6.1.1. The verification is done during shutdown.

REFERENCES

1. FSAR Section 9.4.6.
2. FSAR Section 9.4.3.
3. FSAR Section 9.4.5.
4. FSAR Chapter 15.
5. Regulatory Guide 1.25, March 1972.
6. 10 CFR 50.34.
7. Regulatory Guide 1.52, Rev. 3, June 2001.

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8. FSAR Section 6.2.6.5.

elements that line the floor and side walls of the spreading compartment. To enhance heat transfer, the horizontal and vertical plates have fins that form rectangular cooling channels. The sacrificial concrete layer protects the cooling structure against thermal loads resulting from melt spreading. It also delays melt contact with the metallic cooling structure so that the cooling elements will be flooded with water from the IRWST prior to the initial contact between them and the molten debris. The structural elements are joined using flexible connections so that the cooling structure withstands expansion and deformation.

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Prior to core melt, the normally closed, de-energized motor operated isolation valves of the passive flooding lines will be manually opened by the operator when core outlet temperature reaches 1,200°F. The arrival of the melt into the spreading compartment triggers the opening of spring-loaded valves that initiate the gravity-driven flow of water from the IRWST into the spreading compartment. Initially, a cable holds each spring-loaded valve closed. Within the spreading compartment the cable is attached to a thermally sensitive initiator, consisting of a material of low melting point. When the initiator is destroyed during contact with molten debris, the cable will allow the spring-loaded actuator to open the flooding valve and allow water to flow from the IRWST.

The water first fills the central supply duct underneath the spreading area. From there, it enters the horizontal cooling channels and then fills the space behind the sidewall cooling structure. Finally, the water pours onto the surface of the melt and overflow will continue until the hydrostatic pressure in the IRWST and the spreading room is equal. Both the spreading room and the IRWST are open to the containment atmosphere with sufficient area of communication so there is no buildup of pressure as steam is generated in the spreading room. In parallel with the inflow of water, the melt interacts with the sacrificial concrete covering the horizontal and vertical cooling plates. The resulting delay allows the walls of the cooling structure to be cooled on the outside prior to the first contact with the molten corium.

19.2.3.3.3.2 Severe Accident Heat Removal System

The SAHRS works along with the CMSS to cool the molten debris. The SAHRS is a dedicated thermal-fluid system used to remove the heat generated in the containment during a severe accident. The SAHRS has four modes of operation, each playing a role in containment heat removal and controlling the environmental conditions within the containment so that its fission product retention function is maintained. These modes of SAHRS operation include:

- Passive cooling of molten debris.
- Active spray for environmental control of the containment atmosphere.
- Active recirculation cooling of the molten debris and containment atmosphere.

- Active backflush of the SAHRS pump suction strainer.

The SAHRS equipment is located in Safeguard Building 4, and includes:

- A suction line from the IRWST.
- Containment isolation valves.
- A recirculation pump.
- A heat exchanger for containment heat rejection.
- Discharge line to a containment spray header, the spreading room, and sump screen.
- Support from a dedicated cooling chain via plant auxiliary systems.

The SAHRS heat exchangers transfer the residual heat from the containment to the ultimate heat sink via dedicated portions of component cooling water system (CCWS) and essential service water system (ESWS) trains. During operation, the three possible flow paths downstream of the pump and the heat exchanger are:

- To a containment spray system with a ring header and spray nozzles.
- To the spreading area of the CMSS.
- To a sump screen flushing device which is used to remove accumulated debris.

The general configuration of the SAHRS is shown in Figure 19.2-2, with key design parameters provided in Table 19.2-2—SAHRS Design and Operating Parameters. The SAHRS simplified Piping and Instrumentation Diagram is shown in Figure 19.2-22.

Passive Cooling of Molten Debris

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In this mode the SAHRS provides water to the cooling structure surrounding the spreading compartment. To enter this mode, operator action is required to open the normally-closed, de-energized, SAHRS passive flooding line motor-operated isolation valves, located upstream of the normally-closed passive flooding devices. Once molten debris is within the spreading compartment and the passive flooding spring loaded valves are actuated, water from the IRWST passively starts to fill the cooling structure. This dedicated flooding line is equipped with a flow limiter downstream of the IRWST outlet, which limits the flow such that its subsequent complete vaporization does not present a containment overpressurization challenge. This passive flow of water fills the cooling structure within five minutes. Water then overflows into the spreading compartment until it is hydrostatically balanced with water from the IRWST. This flooding submerges the spreading area and transfer channel, as well as a portion of the reactor cavity, thereby cooling any residual debris in those areas.