ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Thursday, June 30, 2011 6:11 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); KOWALSKI David (AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 18
Attachments: RAI 277 Supplement 18 Response US EPR DC.pdf

Importance: High

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12 and Supplement 13 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010, August 27, 2010, September 22, 2010, October 25, 2010, November 12, 2010 and December 10, 2010, respectively, to provide a revised schedule. Supplement 14 response to RAI No. 277 was sent on February 28, 2011 to address 2 of the remaining 5 questions. Supplement 15, Supplement 16 and Supplement 17 responses to RAI No. 277 were sent on March 30, 2011, April 26, 2011 and May 25, 2011, respectively, to provide a revised schedule for the remaining three questions.

The attached file, “RAI 277 Supplement 18 Response US EPR DC.pdf” provides a technically correct and complete FINAL response to the remaining three questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 277 Questions 09.04.01-1, 09.04.02-1 and 09.04.03-3.

The following table indicates the respective pages in the response document, “RAI 277 Supplement 18 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 277 — 09.04.01-1	2	4
RAI 277 — 09.04.02-1	5	6
RAI 277 — 09.04.03-3	7	8

This concludes the formal AREVA NP response to RAI 277, and there are no questions from this RAI for which AREVA NP has not provided responses.

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: Wednesday, May 25, 2011 11:36 AM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 17
Importance: High

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12 and Supplement 13 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010, August 27, 2010, September 22, 2010, October 25, 2010, November 12, 2010 and December 10, 2010, respectively, to provide a revised schedule. Supplement 14 response to RAI No. 277 was sent on February 28, 2011 to address 2 of the remaining 5 questions. Supplement 15 and Supplement 16 responses to RAI No. 277 were sent on March 30, 2011 and April 26, 2011, respectively, to provide a revised schedule for the remaining 3 questions.

The schedule for a technically correct and complete response to the remaining 3 questions has been changed and is provided below.

Question #	Response Date
RAI 277 — 09.04.01-1	June 30, 2011
RAI 277 — 09.04.02-1	June 30, 2011
RAI 277 — 09.04.03-3	June 30, 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: WELLS Russell (RS/NB)
Sent: Tuesday, April 26, 2011 5:40 PM
To: 'Tesfaye, Getachew'
Cc: KOWALSKI David (RS/NB); 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. 277, FSAR Ch. 9, Supplement 16

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12 and Supplement 13 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010, August 27, 2010, September 22, 2010, October 25, 2010, November 12, 2010 and December 10, 2010, respectively, to provide a revised schedule. Supplement 14 response to RAI No. 277 was sent on February 28, 2011 to address 2 of the remaining 5 questions. Supplement 15 response to RAI No. 277 was sent on March 30, 2011 to provide a revised schedule for the remaining three questions.

To provide additional time to interact with the NRC, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the three questions is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	May 27, 2011
RAI 277 — 09.04.02-1	May 27, 2011
RAI 277 — 09.04.03-3	May 27, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Wednesday, March 30, 2011 1:02 PM
To: 'Tesfaye, Getachew'
Cc: KOWALSKI David (RS/NB); 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. 277, FSAR Ch. 9, Supplement 15

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12 and Supplement 13 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010, August 27, 2010, September 22, 2010, October 25, 2010, November 12, 2010 and December 10, 2010, respectively, to provide a revised schedule. Supplement 14 response to RAI No. 277 was sent on February 28, 2011 to address 2 of the remaining 5 questions.

To provide additional time to interact with the NRC, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the remaining three questions is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	April 29, 2011
RAI 277 — 09.04.02-1	April 29, 2011
RAI 277 — 09.04.03-3	April 29, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Monday, February 28, 2011 2:22 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 14

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12 and Supplement 13 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010, August 27, 2010, September 22, 2010, October 25, 2010, November 12, 2010 and December 10, 2010, respectively, to provide a revised schedule.

The attached file, “RAI 277 Supplement 14 Response US EPR DC.pdf” provides technically correct and complete responses to two of the remaining five questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 277 Question 09.04.05-2.

The following table indicates the respective pages in the response document, “RAI 277 Supplement 14 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 277 — 09.04.03-1	2	2
RAI 277 — 09.04.05-2	3	4

To provide additional time to interact with the NRC, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the remaining three questions has been revised and is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	March 31, 2011
RAI 277 — 09.04.02-1	March 31, 2011
RAI 277 — 09.04.03-3	March 31, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: BRYAN Martin (External RS/NB)
Sent: Friday, December 10, 2010 1:05 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 13

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11 and Supplement 12 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010, August 27, 2010, September 22, 2010, October 25, 2010 and November 12, 2010, respectively, to provide a revised schedule.

To provide additional time to interact with the NRC, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised and is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	March 10, 2011
RAI 277 — 09.04.02-1	March 10, 2011
RAI 277 — 09.04.03-1	March 10, 2011
RAI 277 — 09.04.03-3	March 10, 2011

RAI 277 — 09.04.05-2	March 10, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (External RS/NB)
Sent: Friday, November 12, 2010 2:26 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB); 'Miernicki, Michael'
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 12

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10 and Supplement 11 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010, August 27, 2010, September 22, 2010 and October 25, 2010, respectively, to provide a revised schedule.

To provide additional time to interact with the NRC, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised and is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	December 10, 2010
RAI 277 — 09.04.02-1	December 10, 2010
RAI 277 — 09.04.03-1	December 10, 2010
RAI 277 — 09.04.03-3	December 10, 2010
RAI 277 — 09.04.05-2	December 10, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (External RS/NB)
Sent: Monday, October 25, 2010 1:14 PM
To: 'Getachew.Tesfaye@nrc.gov'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 11

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9 and Supplement 10 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010, August 27, 2010, and September 22 respectively, to provide a revised schedule.

To provide additional time to process the response, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised and is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	November 12, 2010
RAI 277 — 09.04.02-1	November 12, 2010
RAI 277 — 09.04.03-1	November 12, 2010
RAI 277 — 09.04.03-3	November 12, 2010
RAI 277 — 09.04.05-2	November 12, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (External RS/NB)
Sent: Wednesday, September 22, 2010 2:38 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 10

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8 and

Supplement 9 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010, July 28, 2010 and August 27, 2010, respectively, to provide a revised schedule.

To provide additional time to interact with the NRC, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised and is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	October 26, 2010
RAI 277 — 09.04.02-1	October 26, 2010
RAI 277 — 09.04.03-1	October 26, 2010
RAI 277 — 09.04.03-3	October 26, 2010
RAI 277 — 09.04.05-2	October 26, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (External RS/NB)
Sent: Friday, August 27, 2010 11:57 AM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 9

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6, Supplement 7 and Supplement 8 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010, June 24, 2010 and July 28, 2010, respectively, to provide a revised schedule.

On June 25, 2010, DRAFT responses to the remaining 5 questions were submitted to the NRC staff.

To allow time for interaction between AREVA and the NRC staff, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised and is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	September 24, 2010
RAI 277 — 09.04.02-1	September 24, 2010
RAI 277 — 09.04.03-1	September 24, 2010
RAI 277 — 09.04.03-3	September 24, 2010

RAI 277 — 09.04.05-2	September 24, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Wednesday, July 28, 2010 5:16 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 8

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5, Supplement 6 and Supplement 7 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010, May 27, 2010 and June 24, 2010, respectively, to provide a revised schedule.

To allow time for interaction between AREVA and the NRC staff on the draft response submitted June 24, 2010, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised and is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	August 27, 2010
RAI 277 — 09.04.02-1	August 27, 2010
RAI 277 — 09.04.03-1	August 27, 2010
RAI 277 — 09.04.03-3	August 27, 2010
RAI 277 — 09.04.05-2	August 27, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, June 24, 2010 4:31 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 7

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4, Supplement 5 and Supplement 6 responses to RAI No. 277 were sent on April 14, 2010, May 6, 2010 and May 27, 2010, respectively, to provide a revised schedule.

To allow time for interaction between AREVA and the NRC staff, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised and is provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	July 28, 2010
RAI 277 — 09.04.02-1	July 28, 2010
RAI 277 — 09.04.03-1	July 28, 2010
RAI 277 — 09.04.03-3	July 28, 2010
RAI 277 — 09.04.05-2	July 28, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, May 27, 2010 7:05 AM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement , Supplement 6

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4 and Supplement 5 responses to RAI No. 277 were sent on April 14, 2010 and May 6, 2010 to provide a revised schedule. Since additional time is needed for AREVA to discuss the responses to the questions with the NRC, an updated schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised as provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	June 24, 2010
RAI 277 — 09.04.02-1	June 24, 2010
RAI 277 — 09.04.03-1	June 24, 2010
RAI 277 — 09.04.03-3	June 24, 2010
RAI 277 — 09.04.05-2	June 24, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, May 06, 2010 3:59 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement , Supplement 5

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions. Supplement 4 response to RAI No. 277 was sent on April 14, 2010 to provide a revised schedule.

To allow time for AREVA to discuss the responses to the remaining questions with the NRC, a revised schedule is provided in this e-mail that has been agreed to by the NRC.

The schedule for technically correct and complete responses to the remaining questions has been revised as provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	May 27, 2010
RAI 277 — 09.04.02-1	May 27, 2010
RAI 277 — 09.04.03-1	May 27, 2010
RAI 277 — 09.04.03-3	May 27, 2010
RAI 277 — 09.04.05-2	May 27, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Wednesday, April 14, 2010 3:51 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement , Supplement 4

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions. Supplement 3 response to RAI No. 277 was sent on March 11, 2010 to address 1 of the remaining 6 questions.

To allow time for AREVA to discuss the responses to the remaining questions with the NRC, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the remaining questions has been revised as provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	May 6, 2010
RAI 277 — 09.04.02-1	May 6, 2010
RAI 277 — 09.04.03-1	May 6, 2010
RAI 277 — 09.04.03-3	May 6, 2010
RAI 277 — 09.04.05-2	May 6, 2010

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, March 11, 2010 4:11 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 3

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. Supplement 1 response to RAI No. 277 was sent on December 9, 2009 to provide a revised schedule for the remaining questions. Supplement 2 response to RAI No. 277 was sent on February 4, 2010 to address 1 of the remaining 7 questions.

The attached file, "RAI 277 Supplement 3 Response US EPR DC.pdf" provides a technically correct and complete response to 1 of the remaining 6 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 277 Question 09.02.05-21.

The following table indicates the respective pages in the response document, "RAI 277 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 277 — 09.02.05-21	2	3

The schedule for a technically correct and complete response to the remaining 5 questions is unchanged and provided below:

Question #	Response Date
RAI 277 — 09.04.01-1	April 14, 2010
RAI 277 — 09.04.02-1	April 14, 2010
RAI 277 — 09.04.03-1	April 14, 2010
RAI 277 — 09.04.03-3	April 14, 2010
RAI 277 — 09.04.05-2	April 14, 2010

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan.ext@areva.com

From: DUNCAN Leslie E (AREVA NP INC)
Sent: Thursday, February 04, 2010 3:14 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 2

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. AREVA NP submitted Supplement 1 to the response on December 9, 2009 to provide a revised schedule. The attached file, "RAI 277 Supplement 2 Response US EPR DC.pdf" provides a technically correct and complete response to one of the remaining seven questions. The schedule for the remaining six questions has been revised.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 277 Question 09.04.03-2.

The following table indicates the respective pages in the response document, “RAI 277 Supplement 2 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 277 — 09.04.03-2	2	2

The schedule for technically correct and complete responses to the remaining questions has been changed and is provided below:

Question #	Response Date
RAI 277 — 09.02.05-21	March 12, 2010
RAI 277 — 09.04.01-1	April 14, 2010
RAI 277 — 09.04.02-1	April 14, 2010
RAI 277 — 09.04.03-1	April 14, 2010
RAI 277 — 09.04.03-3	April 14, 2010
RAI 277 — 09.04.05-2	April 14, 2010

Sincerely,

Les Duncan
Licensing Engineer
AREVA NP Inc.
An AREVA and Siemens Company
Tel: (434) 832-2849
Leslie.Duncan@areva.com

From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, December 09, 2009 4:03 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 1

Getachew,

AREVA NP Inc. provided responses to 5 of the 12 questions of RAI No. 277 on October 16, 2009. AREVA NP also provided a schedule for technically correct and complete responses to the remaining 7 questions.

Since responses to the remaining questions remain in process, a revised schedule is provided in this email.

The schedule for technically correct and complete responses to the remaining questions has been changed as provided below:

Question #	Response Date
RAI 277 — 09.02.05-21	February 4, 2010
RAI 277 — 09.04.01-1	February 4, 2010
RAI 277 — 09.04.02-1	February 4, 2010
RAI 277 — 09.04.03-1	February 4, 2010
RAI 277 — 09.04.03-2	February 4, 2010

RAI 277 — 09.04.03-3	February 4, 2010
RAI 277 — 09.04.05-2	February 4, 2010

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, October 16, 2009 5:33 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 277 Response US EPR DC.pdf" provides technically correct and complete responses to 5 of the 12 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 277 Questions 09.04.02-2, 09.04.04-1, and 09.05.01-71.

The following table indicates the respective page(s) in the response document, "RAI 277 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 277 — 09.02.05-21	2	2
RAI 277 — 09.04.01-1	3	3
RAI 277 — 09.04.02-1	4	4
RAI 277 — 09.04.02-2	5	5
RAI 277 — 09.04.03-1	6	6
RAI 277 — 09.04.03-2	7	7
RAI 277 — 09.04.03-3	8	8
RAI 277 — 09.04.04-1	9	10
RAI 277 — 09.04.04-2	11	11
RAI 277 — 09.04.05-2	12	12
RAI 277 — 09.05.01-71	13	13
RAI 277 — 09.05.06-12	14	14

A complete answer is not provided for 7 of the 12 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 277 — 09.02.05-21	December 10, 2009
RAI 277 — 09.04.01-1	December 10, 2009
RAI 277 — 09.04.02-1	December 10, 2009
RAI 277 — 09.04.03-1	December 10, 2009
RAI 277 — 09.04.03-2	December 10, 2009
RAI 277 — 09.04.03-3	December 10, 2009
RAI 277 — 09.04.05-2	December 10, 2009

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, September 16, 2009 12:52 PM
To: ZZ-DL-A-USEPR-DL
Cc: Wheeler, Larry; Segala, John; ODriscoll, James; Jackson, Christopher; Snodderly, Michael; McCann, Edward; Radlinski, Robert; Wolfgang, Robert; Hearn, Peter; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 277(3538,3371,3372,3376,3374,3375,3399,2995)), FSAR Ch. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 17, 2009, and discussed with your staff on August 31, 2009. Draft RAI Questions 09.05.01-70 was deleted 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: 3175

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D47AF4F3)

Subject: Response to U.S. EPR Design Certification Application RAI No. 277, FSAR Ch. 9, Supplement 18
Sent Date: 6/30/2011 6:10:54 PM
Received Date: 6/30/2011 6:11:00 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

Recipients:
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
Tracking Status: None
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Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: auscharmx02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	37640	6/30/2011 6:11:00 PM
RAI 277 Supplement 18 Response US EPR DC.pdf		500907

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

Response to

Request for Additional Information No. 277, Supplement 18

9/16/2009

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.05 - Ultimate Heat Sink
SRP Section: 09.04.01 - Control Room Area Ventilation System
SRP Section: 09.04.02 - Spent Fuel Pool Area Ventilation System
SRP Section: 09.04.03 - Auxiliary and Radwaste Area Ventilation System
SRP Section: 09.04.04 - Turbine Area Ventilation System
SRP Section: 09.04.05 - Engineered Safety Feature Ventilation System
SRP Section: 09.05.01 - Fire Protection Program
SRP Section: 09.05.06 - Emergency Diesel Engine Starting System

Application Section: 9.2.9

QUESTIONS for Balance of Plant Branch 2 (ESBWR/ABWR) (SBPB)
QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)
QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

Question 09.04.01-1:

Discuss method by which the capability of the safety-related ventilation systems will be verified.

The applicant has provided the performance requirements for the various safety-related ventilation systems (Described in FSAR sections 9.4.1,2,5,6,9,11) but has not provided detailed design information related to the sizing of the ventilation systems. Adequate sizing of the system is assured through the surveillance requirements (for example SR 3.7.11.1) which verify the capability or the system to remove the design heat load.

The applicant did not verify the capability of the systems. For each safety related ventilation system, provide the following:

1. Provide a description in the FSAR that verifies the capability of the system to remove the design heat load. The applicant should describe the method for verification (by testing and/or analysis) as well as a description of the methods for determining the design heat loads including the limiting or bounding assumptions for all modes of operation including normal and outage, and during all anticipated occurrences including postulated accident events.
2. Include this demonstration as part of ITAAC. Existing ITAAC (e.g., Reference Section Number 6.1 in Tier 1 Table 2.6.1-3) acceptance criteria is not adequate to verify the system's capability to maintain ambient temperature conditions in the Control Room Envelope for all modes of operation.
3. The staff noted that the CRACS space heaters are non-safety augmented quality (NS-AQ) and Seismic Category II. The staff has also noted that the heaters associated with the control room air intake and iodine filtration system are safety related. Please describe the analysis that demonstrates the failure of the CRACS space heaters would not challenge the operability of MCR equipment, adversely affect human performance in the MCR, or would still allow the minimum MCR temperature of 68°F to be met, for all outside temperature ranges stated in FSAR Table 2.1-1. Alternatively, designate the heaters safety-related and include the design basis for the heaters in the FSAR.
4. This is SER/OI Open Item 9.4.1-1.

Response to Question 09.04.01-1:

Item 1:

The following U.S. EPR FSAR Tier 1 and Tier 2 sections were revised in U.S. EPR FSAR, Revision 2 to provide design information for determining design heat loads for various modes of operation for sizing of the system and ITAAC testing data:

- U.S. EPR FSAR Tier 1, Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC.
- U.S. EPR FSAR Tier 1, Section 2.6.6 and Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC.
- U.S. EPR FSAR Tier 1, Table 2.6.7-3—Electrical Division of Safeguard Building Ventilation System ITAAC.
- U.S. EPR FSAR Tier 1, Section 2.6.9 and Table 2.6.9-3—Emergency Power Generating Building Ventilation System ITAAC.

- U.S. EPR FSAR Tier 1, Section 2.6.13 and Table 2.6.13-3—Essential Service Water Pump Building Ventilation System ITAAC.
- U.S. EPR FSAR Tier 2, Sections 9.4.1.1, 9.4.1.6, 9.4.2.1, 9.4.2.6, 9.4.5.1, 9.4.5.6, 9.4.6.1, 9.4.6.6, 9.4.9.1, 9.4.9.6, 9.4.11.1 and 9.4.11.6.

Item 2:

U.S. EPR FSAR Tier 1, Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC, Item 6.1 was revised in U.S. EPR FSAR, Revision 2 to verify the system capability to maintain ambient temperature.

Item 3:

The main control room air conditioning system (CRACS) space heaters (supply air duct heaters) were reclassified in U.S. EPR FSAR, Revision 2 as safety-related and Seismic Category I. The following U.S. EPR FSAR Tier 1 and Tier 2 items were revised to reflect this change in safety classification:

- U.S. EPR FSAR Tier 1, Figure 2.6.1-3—CRE Air Supply and Recirculation Subsystem Functional Arrangement.
- U.S. EPR FSAR Tier 2, Table 3.2.2-1—Classification Summary.
- U.S. EPR FSAR Tier 2, Table 3.10-1—List of Seismically and Dynamically Qualified Mechanical and Electrical Equipment.
- U.S. EPR FSAR Tier 2, Figure 9.4.1-3—Control Room Envelope Air Supply and Recirculation Subsystem.

Item 4:

See Parts 1, 2, and 3 of this response.

ITAAC acceptance criteria for each safety-related ventilation system will be revised to specify that tests and analyses will be performed to verify that design temperatures can be maintained while operating in a design basis accident alignment. The inspection and testing requirements will be revised to demonstrate that equipment performance is adequate to maintain design conditions during plant operating conditions. Analyses will use as-built information from equipment and test results in order to extrapolate the performance of the cooling or heating system under design basis conditions. These changes will affect the following ventilation systems:

- CRACS.
- Fuel building ventilation system (FBVS).
- Nuclear auxiliary building ventilation system (NABVS).
- Safeguard building controlled-area ventilation system (SBVS).
- Electrical division of safeguard building ventilation system (SBVSE).
- Containment building ventilation system (CBVS).

- Radioactive waste building ventilation system (RWBVS).
- Emergency power generating building ventilation system (EPGBVS).
- Station blackout room ventilation system (SBORVS).
- Essential service water pump building ventilation system (ESWPBVS).
- Main steam and feedwater valve room ventilation system (VRVS).
- Access building ventilation system (ABVS).

ITAAC acceptance criteria for ambient temperatures will be revised to be consistent with the Tier 2 design basis information; these changes will be implemented for the CRACS, SBVSE and EPGBVS.

The following U.S. EPR FSAR Tier 1 items will be revised to incorporate these changes: Section 2.6.1 and Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC; Section 2.6.4 and Table 2.6.4-3—Fuel Building Ventilation System ITAAC; Section 2.6.6 and Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC; Section 2.6.7 and Table 2.6.7-3—Electrical Division of Safeguard Building Ventilation System ITAAC; Section 2.6.9 and Table 2.6.9-3—Emergency Power Generating Building Ventilation System ITAAC; and Section 2.6.13 and Table 2.6.13-3—Essential Service Water Pump Building Ventilation System ITAAC.

The following U.S. EPR FSAR Tier 2 items will be revised to incorporate these changes: Sections 6.2.3.4, 6.2.3.6 and 6.4.2.2; Sections 9.4.1.1, 9.4.1.2.2, 9.4.1.4 and 9.4.1.6; Sections 9.4.2.4 and 9.4.2.6; Sections 9.4.3.4 and 9.4.3.6; Sections 9.4.5.2.2, 9.4.5.4 and 9.4.5.6; Sections 9.4.6.1, 9.4.6.2.2, 9.4.6.4 and 9.4.6.6; Sections 9.4.7.4 and 9.4.7.6; Sections 9.4.8.4 and 9.4.8.6; Sections 9.4.9.2.1, 9.4.9.4 and 9.4.9.6; Sections 9.4.10.4 and 9.4.10.6; Sections 9.4.11.2.1, 9.4.11.4 and 9.4.11.6; Sections 9.4.12.4 and 9.4.12.6; Sections 9.4.14.5 and 9.4.14.7; and Section 14.2.12.18.4.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.6.1, Table 2.6.1-3, Section 2.6.4, Table 2.6.4-3, Section 2.6.6, Table 2.6.6-3, Section 2.6.7, Table 2.6.7-3, Section 2.6.9, Table 2.6.9-3, Section 2.6.13 and Table 2.6.13-3 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Sections 6.2.3.4, 6.2.3.6 and 6.4.2.2; Sections 9.4.1.1, 9.4.1.2.2, 9.4.1.4 and 9.4.1.6; Sections 9.4.2.4 and 9.4.2.6; Sections 9.4.3.4 and 9.4.3.6; Sections 9.4.5.2.2, 9.4.5.4 and 9.4.5.6; Sections 9.4.6.1, 9.4.6.2.2, 9.4.6.4 and 9.4.6.6; Sections 9.4.7.4 and 9.4.7.6; Sections 9.4.8.4 and 9.4.8.6; Sections 9.4.9.2.1, 9.4.9.4 and 9.4.9.6; Sections 9.4.10.4 and 9.4.10.6; Sections 9.4.11.2.1, 9.4.11.4 and 9.4.11.6; Sections 9.4.12.4 and 9.4.12.6; Sections 9.4.14.5 and 9.4.14.7; and Section 14.2.12.18.4 will be revised as described in the response and indicated on the enclosed markup.

Question 09.04.02-1:

Heating is defined as a safety related function in tier 1 (para 2.6.4.1)- Tier 2 has heating listed as both a safety and non safety function. Confirm that Tier 1 drawing on SFP system be revised to include heaters. If heaters are safety related, they should be listed in Tier 1 table 2.6.4.2 I&C sheets for displays and controls. If the heaters are not safety-related, an explanation should be provided justifying the heaters non safety related status.

Response to Question 09.04.02-1:

U.S. EPR FSAR Tier 1, Table 2.6.4-1—Fuel Building Ventilation System Equipment Mechanical Design and Table 2.6.4-2—Fuel Building Ventilation System Equipment I&C and Electrical Design were revised in U.S. EPR FSAR, Revision 2, to include safety-related heaters.

U.S. EPR FSAR Tier 1, Figure 2.6.4-1—Fuel Building Ventilation System Functional Arrangement was revised in U.S. EPR FSAR, Revision 2 to reflect safety-related heaters.

U.S. EPR FSAR Tier 2, Sections 9.4.2.1, 9.4.2.2.3 and 9.4.2.3 were revised in U.S. EPR FSAR, Revision 2 to clarify the safety-related and non-safety-related functions of the heaters.

Justification for assigning a safety-related or non-safety-related classification to the heaters is provided as follows:

- Safety-related heaters are provided for heating the extra borating system (EBS) pump rooms and EBS pipe chase to maintain a minimum temperature of 68˚F in the rooms and surrounding areas. This action is required to prevent boron crystallization and is a safety-related functional requirement.
- Non-safety-related heaters are provided to maintain a minimum required ambient temperature. Non-safety-related heaters, which are non-seismically supported, are located in such a way that they do not damage safety-related equipment in the event of a safe shutdown earthquake (SSE). Non-safety-related heaters that are required to be located in the proximity of safety-related equipment and could damage this equipment in the event of an SSE are classified as NS-AQ Seismic II.

U.S. EPR FSAR Tier 2, Figure 9.4.2-1—Fuel Building Ventilation System was revised in U.S. EPR FSAR, Revision 2 to include safety-related and non-safety-related heaters.

U.S. EPR FSAR Tier 2, Table 3.2.2-1—Classification Summary was revised in U.S. EPR FSAR, Revision 2 to clarify the description and identification of safety-related heating units and supplemented grade heating units, and provide a description and identification of non-safety-related space heating units that serve various spaces within the Fuel Building to provide the minimum required ambient temperature. This table was revised to include the manual dampers for the supply and exhaust air.

U.S. EPR FSAR Tier 2, Table 3.10-1—List of Seismically and Dynamically Qualified Mechanical and Electrical Equipment and U.S. EPR FSAR Tier 2, Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment were revised in U.S. EPR FSAR, Revision 2 to reflect this change.

ITAAC acceptance criteria for the fuel building ventilation system (FBVS) will be revised to specify that a test and analysis will be performed to verify that ambient temperatures are being maintained during normal and accident operating conditions. An analysis will be performed on the test results in order to extrapolate the performance of the cooling system under design basis conditions. The analysis will use as-built information (nameplate heat loads, fan flow, cooling coil size) and the acceptance criteria will specify the scope during normal and accident operating conditions.

Non-safety-related heaters in the FBVS are provided to maintain ambient room temperature at or above the minimum required temperature. For non-safety-related equipment located in the same room with safety-related equipment, the seismic classification of the non-safety-related equipment is described in U.S. EPR FSAR Tier 2, Section 3.7.3.8 for interaction of Seismic Category I subsystems.

Non-safety-related heaters in the safeguard building controlled-area ventilation system (SBVS) and main steam and feedwater valve room ventilation system (VRVS) are provided to maintain a minimum required ambient temperature. For non-safety-related equipment located in the same room with safety-related equipment, the seismic classification of the non-safety-related equipment is described in U.S. EPR FSAR Tier 2, Section 3.7.3.8 for interaction of Seismic Category I subsystems.

U.S. EPR FSAR Tier 1, Section 2.6.4 and Table 2.6.4-3—Fuel Building Ventilation System ITAAC will be revised to incorporate these changes.

U.S. EPR FSAR Tier 2, Sections 9.4.2.1, 9.4.5.1, 9.4.6.1 and 9.4.12.1 will be revised to incorporate these changes.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.6.4 and Table 2.6.4-3 and U.S. EPR FSAR Tier 2, Sections 9.4.2.1, 9.4.5.1, 9.4.6.1 and 9.4.12.1 will be revised as described in the response and indicated on the enclosed markup.

Question 09.04.03-3:

Clarify the role of the CBVS in meeting GDC 41 and GDC 42

The FSAR in section 9.4.7.1 states "The containment purge subsystems remove radioactive materials via iodine filtration trains prior to release to the atmosphere (GDC 41)." However, the containment building ventilation system does not meet the requirements for General Design Criterion 41, because it is not designated as a safety system. Although these systems are designed to Seismic Category I requirements, it is not designated as a safety system. The FSAR in section 9.3.7.3 states, "The CBVS is not an engineered safety feature and has no safety-related function except the containment isolation and low-flow purge." This is inconsistent with crediting it as the system designed to meet GDC 41 which requires a safety system capable of performing the safety function assuming a single failure and loss of offsite power. The applicant needs to clarify the role of the CBVS in meeting GDC 41. The applicant needs to state how GDC 41 is met (this is typically described in FSAR section 6.2.5 and 6.5). If the CBVS system is credited the applicant needs to describe the meeting of the requirements of GDC 41.

The containment building ventilation system has not been shown to meet the requirements of GDC 41. As a result, the staff is unable to determine if the requirements for General Design Criterion 42 are met until it can determine if the requirements of GDC 41 are met.

Response to Question 09.04.03-3:

The containment building ventilation system (CBVS) is composed of separate subsystems and is described in U.S. EPR FSAR Tier 2, Section 9.4.7.2.1. The containment low-flow purge exhaust subsystem is designated as a safety-related, Seismic Category I, engineered safety features ventilation system and meets the requirements of GDC 41. U.S. EPR FSAR Tier 2, Section 6.5 describes the compliance of the low-flow purge exhaust subsystem with GDC 41.

The internal filtration subsystem is considered a normal atmosphere cleanup system and is designed to RG 1.140 and ASME AG-1.

U.S. EPR FSAR Tier 1, Section 2.6.8, Table 2.6.8-2—Containment Building Ventilation System Equipment Mechanical Design, and Figure 2.6.8-1—Containment Building Ventilation System Functional Arrangement will be revised to clarify the safety function of the CBVS low flow purge function.

U.S. EPR FSAR Tier 2, Section 9.4.7.1 will be revised to clarify that the CBVS low flow purge subsystem performs a safety function and is an engineered safety feature ventilation system. U.S. EPR FSAR Tier 2, Sections 9.4.7.2.1, 9.4.7.2.2 and 9.4.7.3 will also be revised to provide further clarification.

U.S. EPR FSAR Tier 1 and Tier 2 sections will be revised to meet guidelines of RG 1.52, Rev. 3, ASME/ANSI AG-1 1997 (including Addenda ASME AG-1a, 2000, "Housings", ASME N509-1989 and ASME N510-1989 requirements) for components in the carbon filtration system to be consistent with the current design basis.

Additionally, carbon filtration components will be revised to be in accordance with RG 1.52, Rev 3 and ASME N509-1989. Comparable revisions will be made to ventilation systems with ESF filtration units (main control room air conditioning system, annulus ventilation system and safeguard building controlled-area ventilation system).

U.S. EPR FSAR Tier 1, Section 2.6.8 will be revised to incorporate these changes.

The following U.S. EPR FSAR Tier 2 items will be revised to incorporate these changes: Table 1.9-2—U.S. EPR Conformance with Regulatory Guides; Table 3.2.2-1—Classification Summary; Sections 3A.2.1 and 3A.4; Section 6.4.7; Section 6.5.4; Sections 9.4.1.2.2 and 9.4.1.6; Sections 9.4.2.2.2 and 9.4.2.6; Sections 9.4.3.2.2 and 9.4.3.6; Sections 9.4.5.2.2 and 9.4.5.6; Section 9.4.6.6; Sections 9.4.7.1, 9.4.7.2.1, 9.4.7.2.2, 9.4.7.3 and 9.4.7.6; Sections 9.4.8.2.2 and 9.4.8.6; Sections 9.4.9.2.2 and 9.4.9.6; Sections 9.4.10.2.2 and 9.4.10.6; Sections 9.4.11.2.2 and 9.4.11.6; Sections 9.4.12.2.2 and 9.4.12.6; Sections 9.4.14.4 and 9.4.14.7; Sections 12.3.6.5.6 and 12.3.7; Section 14.2.13; and Chapter 16 TS 5.5.10.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.6.8 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Table 1.9-2, Table 3.2.2-1, Sections 3A.2.1 and 3A.4, Section 6.4.7, Section 6.5.4, Sections 9.4.1.2.2 and 9.4.1.6, Sections 9.4.2.2.2 and 9.4.2.6, Sections 9.4.3.2.2 and 9.4.3.6, Sections 9.4.5.2.2 and 9.4.5.6, Section 9.4.6.6, Sections 9.4.7.1, 9.4.7.2.1, 9.4.7.2.2, 9.4.7.3 and 9.4.7.6, Sections 9.4.8.2.2 and 9.4.8.6, Sections 9.4.9.2.2 and 9.4.9.6, Sections 9.4.10.2.2 and 9.4.10.6, Sections 9.4.11.2.2 and 9.4.11.6, Sections 9.4.12.2.2 and 9.4.12.6, Sections 9.4.14.4 and 9.4.14.7, Sections 12.3.6.5.6 and 12.3.7, Section 14.2.13 and Chapter 16 TS 5.5.10 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

1.0 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.

09.04.01-1

The CRACS maintains habitability of the CRE areas 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 during design basis conditions, including a radiological contamination event, or toxic gas contamination of the environment.
- 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 shown on the following figures:

- Figure 2.6.1-1—Control Room Air Intake and CREF (Iodine Filtration) Train Subsystem Functional Arrangement.
- Figure 2.6.1-2—Control Room Air Conditioning and Recirculation Air Handling Subsystem Functional Arrangement.
- Figure 2.6.1-3—CRE Air Supply and Recirculation Subsystem Functional Arrangement.

2.2 The location of the CRACS equipment is as listed in Table 2.6.1-1—Main Control Room Air Conditioning System Equipment Mechanical Design.

2.3 Physical separation exists between the CRACS air intake, iodine filtration, air recirculation, and air conditioning trains.

3.0 Mechanical Design Features

3.1 Deleted.

3.2 Equipment listed in Table 2.6.1-1 can perform the function listed in Table 2.6.1-1 under system operating conditions.

3.3 Components identified as Seismic Category I in Table 2.6.1-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.6.1-1.

3.4 Components listed in Table 2.6.1-1 as ASME AG-1 Code are designed in accordance with ASME AG-1 Code requirements.

3.5 Components listed in Table 2.6.1-1 as ASME AG-1 Code are fabricated in accordance with ASME AG-1 Code requirements, including welding requirements.

3.6 Components listed in Table 2.6.1-1 as ASME AG-1 Code are inspected and tested in accordance with ASME AG-1 Code requirements.

4.0 Displays and Controls

4.1 Displays listed in Table 2.6.1-2—Main Control Room Air Conditioning System Equipment I&C and Electrical Design, are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.6.1-2.

4.2 The CRACS equipment controls are provided in the MCR and RSS as listed in Table 2.6.1-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.1-2 responds to the state requested by a test signal.

5.0 Electrical Power Design Features

5.1 The equipment designated as Class 1E in Table 2.6.1-2 are powered from the Class 1E division as listed in Table 2.6.1-2 in a normal or alternate feed condition.

5.2 Deleted.

6.0 Equipment and System Performance

6.1 The CRACS maintains a positive pressure in the CRE area~~s~~ relative to the outside environment and adjacent areas, while operating in a design basis accident alignment.

09.04.01-1

6.2 Upon receipt of a containment isolation signal (CIS), ~~or high radiation alarm signal in the air intake duct,~~ the iodine filtration train will start automatically, outside air supply to the CRE area is diverted through the iodine filtration train, ~~and~~ a minimum recirculation flowrate is established from the CRE area to the iodine filtration train, and a positive pressure is maintained in the CRE area relative to the adjacent areas.

6.3 Upon actuation of the plant toxic gas alarm signal, the outside air intake dampers close automatically and the CRE area air is directed in recirculation mode without outside air.

6.4 The CRE area ventilation unfiltered air in-leakage is minimized in order to maintain the MCR habitability.

6.5 Each CRACS train has the capability to remove the design heat loadThe CRACS provides cooling and heating to maintain the design temperatures in the CRE area, while operating in a design basis accident alignment.

6.6 The CREF heaters protect the carbon adsorber from high humidity during operation of the CREF unit.

6.7 Upon receipt of a high radiation alarm signal in the air intake ducts, the iodine filtration train will start automatically, the outside air supply to the CRE area is diverted through the iodine filtration train, a minimum CRE recirculation flowrate is established from the CRE area to the iodine filtration train, and a positive pressure is maintained in the CRE area relative to the adjacent areas.

09.04.01-1

7.0 Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.1-3 lists the CRACS ITAAC.

Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
5.1	The components designated as Class 1E in Table 2.6.1-2 are powered from the Class 1E division as listed in Table 2.6.1-2 in a normal or alternate feed condition.	a. Testing will be performed for the components designated as Class 1E in Table 2.6.1-2 by providing a test signal in each normally aligned division. b. Testing will be performed for the components designated as Class 1E in Table 2.6.1-2 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.6.1-2. b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E component identified in Table 2.6.1-2.
5.2	Deleted.	Deleted.	Deleted.
6.1	The CRACS maintains a positive pressure in the CRE areas relative to the outside environment and adjacent areas, while operating in a design basis accident alignment.	A Ttests will be performed on to verify the capability of that the CRACS system to maintains a positive pressure in the CRE areas relative to the outside environment and adjacent areas, while operating in a design basis accident alignment.	The test confirms that the CRACS maintains a positive pressure of greater than or equal to 1/80.125 inches water gauge is maintained inside the CRE area (while operating in a design basis accident alignment) relative to the outside environment and adjacent areas, while operating in a design basis accident alignment.The test confirms that a positive pressure of greater than or equal to 0.01 inches water gauge is maintained inside the CRE area (while operating in a normal alignment) relative to the outside and adjacent areas.

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09.04.01-1

Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
6.2	Upon receipt of a containment isolation signal (CIS), or high radiation alarm signal in the air intake duct, the iodine filtration train will start automatically, outside air supply to the CRE area is diverted through the iodine filtration train, and a minimum recirculation flowrate is established from the CRE area to the iodine filtration train and a positive pressure is maintained in the CRE area relative to the adjacent areas.	a. A test will be performed to verify, that upon receipt of a containment isolation CIS test signal, that the iodine filtration train will start automatically; and the outside air supply to the CRE area is diverted through the iodine filtration train. A Ttest iswill be performed separately for each iodine filtration train. b. A test will be performed to verify that upon receipt of high radiation alarm signal in the air intake duct, the iodine filtration train will start automatically; and the outside air supply is diverted through the iodine filtration train. Test is performed separately for each iodine filtration train. cb. A test will be performed to verify, upon receipt of a containment isolation test signal, that a minimum recirculation flowrate is established from the CRE area to for each the iodine filtration train is achieved. A test will be performed separately for each iodine filtration train. c. A test will be performed to verify, upon receipt of a containment isolation test signal, that the CRACS maintains a positive pressure in the CRE area relative to the adjacent areas.	a. A separate test for each iodine filtration train confirms, that upon receipt of a containment isolation CIS test signal, that the iodine filtration train will start automatically within 60 seconds; and the outside air supply to the CRE area is diverted through the iodine filtration train. b. A separate test for each iodine filtration train confirms that upon receipt of high radiation alarm signal in the air intake duct, the iodine filtration train will start automatically within 60 seconds; and the outside air supply is diverted through the iodine filtration train. cb. A separate test for each iodine filtration train confirms, upon receipt of a containment isolation test signal, that a CRE recirculation flowrate of greater than or equal to 3000 scfm. is established from the CRE area to the iodine filtration train. c. A test confirms, upon receipt of a containment isolation test signal, that the CRACS maintains the pressure greater than or equal to 0.125 inches water gauge in the CRE area relative to the adjacent areas.

Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC (6 Sheets)

09.04.01-1

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
6.3	Upon actuation of the plant toxic gas alarm signal, the outside air intake dampers close automatically and the CRE area air is in recirculation mode without outside air.	A test will be performed to verify that upon actuation of the plant toxic gas alarm test signal, the outside air intake dampers close automatically and the CRE area air is in recirculation mode without outside air. Test is performed separately for each air intake train.	A separate test for each air intake train confirms that upon actuation of the plant toxic gas alarm test signal, the outside air intake dampers close automatically and the CRE area air is in recirculation mode without outside air.
6.4	The CRE area ventilation unfiltered air in-leakage is minimized in order to maintain the MCR habitability.	A ~~T~~test will be performed to measure the unfiltered air in-leakage inside the CRE area boundary.	The test confirms that the unfiltered air in-leakage inside the CRE area boundary is less than or equal to 50 scfm.

Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC (6 Sheets)

09.04.01-1

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
6.5	The CRACS provides cooling and heating to maintain the design temperatures in the CRE area, while operating in a design basis accident alignment. Each CRACS train has the capability to remove the design heat load.	a. An inspection of the manufacturer's documentation of the CRACS cooling coils will be performedand inlet air electric heaters will be performed.	a. A report confirms that each CRACS cooling coil is capable of providing design cooling capacity, while operating in a design basis accident alignment. A report confirms that each CRACS air inlet heater is capable of providing design heating capacity, while operating in a design basis accident alignment. Each CRACS cooling coil (30SAB01/02/03/04 AC001) shall have been tested and certified for a total cooling capacity of 470,000 Btu/hr.
		b. Tests and analyses of the CRACS will be performed to verify that design temperatures can be maintained in the CRE area, while operating in a design basis accident alignment.	b. A report confirms that the CRACS is capable of providing conditioned air to maintain design temperatures in the CRE area, while operating in a design basis accident alignment. A report confirms that each CRACS fan is capable of meeting the design air flow requirements, while operating in a design basis accident alignment.

Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC (6 Sheets)

09.04.01-1

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
		~~b. Tests will be performed to verify that ambient temperatures are being maintained in the CRE rooms.~~	~~b. The test shall confirm that:~~ ~~• Main control room temperature is greater than or equal to 68°F and less than or equal to 78°F.~~ ~~• I&C, computer, and rest rooms temperature is greater than or equal to 65°F and less than or equal to 78°F.~~ ~~• CRE HVAC rooms temperature is greater than or equal to 50°F and less than or equal to 95°F.~~ ~~• Other areas of the CRE, temperature is greater than or equal to 68°F and less than or equal to 78°F.~~ ~~Verify the CRACS fan (30SAB01/02/03/04 AN 001) air flow is at least a nominal 12,050 scfm (for each of two operating units).~~
6.6	The CREF heaters protect the carbon adsorber from high humidity during operation of the CREF unit.	a. An inspection of the manufacturer's documentation of the CREF heaters will be performed. b. Tests and analyses of the CREF heaters will be performed to verify that the CREF heaters functions as designed.	a. A report confirms that each CREF electric heater is capable of providing design heating capacity during operation of the CREF unit. b. A report confirms that during operation of the CREF unit the CREF heater can provide the design KW heating capacity.

Table 2.6.1-3—Main Control Room Air Conditioning System ITAAC (6 Sheets)

09.04.01-1

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
6.7	Upon receipt of a high radiation alarm signal in the air intake duct, the iodine filtration train will start automatically, the outside air supply to the CRE area is diverted through the iodine filtration train, a minimum CRE recirculation flowrate is established from the CRE area to the iodine filtration train, and a positive pressure is maintained in the CRE area relative to the adjacent areas.	a. A test will be performed to verify, upon receipt of high radiation alarm test signal in the air intake duct, that the iodine filtration train will start automatically; and the outside air supply to the CRE area is diverted through the iodine filtration train. A test will be performed separately for each iodine filtration train. b. A test will be performed to verify, upon receipt of high radiation alarm test signal in the air intake duct, that a minimum CRE recirculation flowrate for each iodine filtration train is achieved. A test will be performed separately for each iodine filtration train. c. A test will be performed to verify, upon receipt of high radiation alarm test signal in the air intake duct, that a positive pressure is maintained in the CRE area relative to the adjacent areas.	a. A separate test for each iodine filtration train confirms, upon receipt of high radiation alarm test signal in the air intake duct, that the iodine filtration train will start automatically within 60 seconds, and the outside air supply is diverted through the iodine filtration train. b. A separate test for each iodine filtration train confirms, upon receipt of high radiation alarm test signal in the air intake duct, that a CRE recirculation flowrate of greater than or equal to 3,000 scfm is established from the CRE area to the iodine filtration train. c. A test confirms, upon receipt of high radiation alarm test signal in the air intake duct, that a positive pressure of greater than or equal to 0.125 inches water gauge is maintained in the CRE area relative to the adjacent areas.

6.0 Environmental Qualifications

6.1 Components in Table 2.6.4-2, that are designated as harsh environment, will perform the function listed in Table 2.6.4-1 in the environments that exist during and following design basis events.

7.0 Equipment and System Performance

7.1 Upon receipt of a containment isolation signal (CIS), Tthe FBVS maintains a negative pressure relative to the outside environment in the Fuel Building upon receipt of a containment isolation signal.during normal operation.

09.04.01-1

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 within the design basis closure time. or high radiation alarm signal in the Reactor Building, the FB is isolated from the NABVS by automatically closing the air supply and exhaust isolation dampers listed in Table 2.6.4-1 for Fuel Building Isolation.

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

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

09.04.02-1

8.0 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 (4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
	09.04.01-1	b. Components listed as harsh environment in Table 2.6.4-2 will be inspected to verify installation in accordance with the construction drawings including the associated wiring, cables and terminations. Deviations to the construction drawings will be reconciled to the EQDP.	b. Inspection reports exists and conclude that the components listed in Table 2.6.4-2 as harsh environment has been installed per the construction drawings and any deviations have been reconciled to the EQDP.
7.1	Upon receipt of a containment isolation signal, Tthe FBVS maintains a negative pressure relative to the outside environment in the Fuel Buildingduring normal operation.	A Ttests will be performed to verify, upon receipt of a containment isolation test signal, on the capability of that the FBVS to maintains a negative pressure relative to the outside environment in the Fuel Buildingduring normal operation.	The test confirms, upon receipt of a containment isolation test signal, that the FBVS maintains a the pressure in the Fuel Building of less than or equal to -0.25 inches water gauge negative pressure of at least 0.25 inches water gauge relative to the outside environment in the Fuel Buildingduring normal operation.
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 within the design basis closure time.or high radiation alarm signal in the Reactor Building, the FB is isolated from the NABVS by automatically closing the air supply and exhaust isolation dampers listed in Table 2.6.4-1 for Fuel Building Isolation.	A test will be performed to verify, that upon receipt of a containment isolation test signal or high radiation alarm signal in the Reactor Building, that the FBVS is isolatedion dampers identified from the NABVS by automatically closing the air supply and exhaust isolation dampers listed in Table 2.6.4-1 realign to exhaust air to the SBVS iodine filtration exhaust to the plant vent stack within the design basis closure time.for Fuel Building Isolation.	A test confirms, that upon receipt of a containment isolation test signal or high radiation alarm signal in the Reactor Building, that the FBVS is isolatedion from the NABVS by automatically closing the air supply and exhaust isolation dampers identifiedlisted in Table 2.6.4-1 realign to exhaust air to the SBVS iodine filtration exhaust to the plant vent stack for Fuel Building Isolation within 60 seconds.

Table 2.6.4-3—Fuel Building Ventilation System ITAAC (4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
7.3	The FBVS provides cooling to maintain design temperatures in the Fuel Building pump rooms for systems containing borated fluid, while operating in a design basis accident alignment.	a. An inspection of the manufacturer's documentation of the FBVS cooling coils will be performed. b. Tests and analysis of the FBVS cooling units will be performed to verify that design temperatures can be maintained in the Fuel Building pump rooms, while operating in a design basis accident alignment.	a. A report confirms that each FBVS cooling coil is capable of providing design cooling requirements. b. A report confirms that the FBVS is capable of providing cooling to maintain design temperatures in the Fuel Building pump rooms, while operating in a design basis accident alignment.
7.4	The FBVS provides heating to maintain design temperatures in the Fuel Building rooms for systems containing borated fluid, while operating in a design basis accident alignment.	a. An inspection of the manufacturer's documentation of the FBVS heaters will be performed. b. Tests and analysis of the FBVS heaters will be performed to verify that design temperatures can be maintained in the Fuel Building pump rooms, while operating in a design basis accident alignment.	a. A report confirms that each FBVS heater is capable of providing design heating requirements. b. A report confirms that the FBVS is capable of providing heating to maintain design temperature in the Fuel Building pump rooms, while operating in a design basis accident alignment.

09.04.02-1

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5.0 Electrical Power Design Features

5.1 The 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 Components in Table 2.6.6-2, that are designated as harsh environment, will perform the function listed in Table 2.6.6-1 in the environments that exist during and following design basis events.

09.04.01-1

6.2 DeletedThe SBVS provides recirculation cooling s,and has the capability to remove design heat load from Safeguard Building hot mechanical rooms.

7.0 Equipment and System Performance

7.1 Upon receipt of a containment isolation signal, The the SBVS maintains a negative pressure relative to the outside environment in the hot mechanical areasrooms of the Safeguard Buildings relative to the adjacent areas during normal operation.

7.2 Upon receipt of a high radiation signal in the hot mechanical area rooms of a Safeguard Building division during normal operation, supply and exhaust air flow is configured such that the SBVS exhaust is automatically directed to the NAVBS iodine exhaust filters.

7.3 Upon receipt of a high radiation signal in the FB, or the Reactor Building, both SBVS iodine filtration trains start automatically, the isolation dampers open to the building where the high radiation signal is initiated (either the FB or the Reactor Building), and the accident air is directed through the SBVS iodine filtration trains.

7.4 Upon receipt of a containment isolation signal or high radiation signal in the Reactor Building, the SBVS is isolated from the SBVSE and NAVBS by automatically closing the air supply and exhaust isolation dampers, both SBVS iodine filtration trains start automatically, and the FB and SB exhaust air is directed through the iodine filtration trains to maintain a negative pressure inside the FB and SB.

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

8.0 Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.6-3 lists the SBVS ITAAC.

09.04.01-1

Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC (8 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
		b. Components listed as harsh environment in Table 2.6.6-2 will be inspected to verify installation in accordance with the construction drawings including the associated wiring, cables and terminations. Deviations to the construction drawings will be reconciled to the EQDP.	b. Inspection reports exists and conclude that the components listed in Table 2.6.6-2 as harsh environment has been installed per the construction drawings and any deviations have been reconciled to the EQDP.
6.2	09.04.01-1 Deleted.The SBVS provides recirculation cooling and has the capability to remove design heat load from Safeguard Building hot mechanical rooms.	Deleted.Tests will be performed to verify capability of the system to maintain the ambient conditions within each division Safeguard Building for the hot mechanical rooms	Deleted.a. Each SBVS cooling coil is to have been tested and certified for a total cooling capacity of: • KLC 51/54 AN001 64,800 Btu/hr. • KLC 51/54 AN002 32,400 Btu/hr. • KLC 51/54 AN003 21,600 Btu/hr. • KLC 52/53 AN001 54,000 Btu/hr. • KLC 52/53 AN002 32,400 Btu/hr.

Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC (8 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
		09.04.01-1	Deleted.b. A separate test for each Division of the Safeguard Building hot mechanical rooms to verify that: Ambient temperature shall be maintained between 50°F and 104°F. The nominal air flow is at least: • KLC 51/54 AN001 3,000 scfm. • KLC 51/54 AN002 1,500 scfm. • KLC 51/54 AN003 1,000 scfm. • KLC 52/53 AN001 2,500 scfm. • KLC 52/53 AN002 1,500 scfm.
7.1	Upon receipt of a containment isolation signal, The the SBVS maintains a negative pressure relative to the outside environment in the hot mechanical areasrooms of the Safeguard Buildings relative to the adjacent areas during normal operation.	A tTests will be performed on the capability of to verify upon receipt of a containment isolation test signal, that the SBVS to maintains a negative pressure relative to the outside environment in the hot mechanical areas rooms of the Safeguard Buildings relative to the adjacent areas during normal operation.	The test confirms, upon receipt of a containment isolation test signal, that the SBVS maintains the pressure less than or equal to -0.25 inches water gauge in the hot mechanical rooms of the Safeguard Buildings relative to the adjacent areas.The SBVS maintains a negative pressure of at least 0.25 inches of water gauge relative to the outside environment in the hot mechanical areas of the Safeguard Buildings during normal operation.

Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC (8 Sheets)

09.04.01-1

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
7.2	Upon receipt of a high radiation signal in the hot mechanical ~~area~~ rooms of a Safeguard Building ~~division~~ during normal operation, supply and exhaust air flow is configured such that the SBVS exhaust is automatically directed to the NAVBS iodine exhaust filters.	A test will be performed to verify that upon receipt of a high radiation signal in the hot mechanical area of a Safeguard Building division during normal operation, the supply air control dampers (30KLC11/12/13/14 AA003 on Figure 2.6.6-1) and exhaust air control dampers (30KLC21/22/23/24 AA006 on Figure 2.6.6-2) applicable to each division reposition automatically, and the NABVS dampers reposition automatically to exhaust through the iodine exhaust filters. Test is performed separately for each Safeguard Building division.	A separate test for each Safeguard Building division confirms that upon receipt of a high radiation signal in the hot mechanical area of a Safeguard Building division, the supply air control dampers (30KLC11/12/13/14 AA003 on Figure 2.6.6-1) and exhaust air control dampers (30KLC21/22/23/24 AA006 on Figure 2.6.6-2) applicable to each division reposition automatically, and the NABVS dampers reposition automatically to exhaust through the iodine exhaust filters. All the above dampers reposition automatically within 60 seconds.

Table 2.6.6-3—Safeguard Building Controlled-Area Ventilation System ITAAC (8 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
7.5	The SBVS provides recirculation cooling to maintain design temperatures in the hot mechanical rooms in the Safeguard Buildings, while operating in a design basis accident alignment.	a. An inspection of the manufacturer's documentation of the SBVS cooling coils will be performed. b. Tests and analysis of the SBVS cooling units will be performed to verify that design temperatures in the hot mechanical rooms in the Safeguard Buildings, while operating in a design basis accident alignment.	a. A report confirms that each SBVS cooling coil is capable of providing design cooling requirements. b. A report confirms that the SBVS is capable of providing cooling to maintain design temperatures in the hot mechanical rooms in the Safeguard Buildings, while operating in a design basis accident alignment. A report confirms that each SBVS fan is capable of meeting the design air flow requirements, while operating in a design basis accident alignment.

09.04.01-1

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- Figure 2.6.7-4—Electrical Division of Safeguard Building Ventilation System Division 2 and Division 3 Air Supply and Exhaust Functional Arrangement.

2.2 The location of the SBVSE equipment is as listed in Table 2.6.7-1—Electrical Division of Safeguard Building Ventilation System Equipment Mechanical Design.

2.3 Physical separation exists between the safety- related trains of the SBVSE.

3.0 Mechanical Design Features

3.1 Deleted.

3.2 Equipment listed in Table 2.6.7-1 can perform the functions listed in Table 2.6.7-1 under system operating conditions.

3.3 Components identified as Seismic Category I in Table 2.6.7-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.6.7-1.

3.4 Components listed in Table 2.6.7-1 as ASME AG-1 Code are designed in accordance with ASME AG-1 Code requirements.

3.5 Components listed in Table 2.6.7-1 as ASME AG-1 Code are fabricated in accordance with ASME AG-1 Code requirements, including welding requirements.

3.6 Components listed in Table 2.6.7-1 as ASME AG-1 Code are inspected and tested in accordance with ASME AG-1 Code requirements.

4.0 Displays and Controls

4.1 Displays listed in Table 2.6.7-2—Electrical Division of Safeguard Building Ventilation System Equipment I&C and Electrical Design, are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.6.7-2.

4.2 The SBVSE equipment controls exist in the MCR and RSS as listed in Table 2.6.7-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.7-2 responds to the state requested by a test signal.

5.0 Electrical Power Design Features

5.1 The equipment designated as Class 1E in Table 2.6.7-2 are powered from the Class 1E division as listed in Table 2.6.7-2 in a normal or alternate feed condition.

5.2 Deleted.

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6.0 Equipment and System Performance

6.1 The SBVSE provides conditioned and recirculated air to maintain design temperature in the Safeguard Buildings, while operating in a design basis accident alignment.~~Each SBVSE air intake train has the capability to remove the design heat load~~.

6.2 The recirculation cooling units start and stop automatically in the emergency feedwater system (EFWS) and the component cooling water system (CCWS) pump rooms when the room temperature reaches preset maximum and minimum temperatures in the pump rooms.

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7.0 Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)

Table 2.6.7-3 lists the SBVSE ITAAC.

Table 2.6.7-3—Electrical Division of Safeguard Building Ventilation System ITAAC (4 Sheets)

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	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
6.1	The SBVSE provides conditioned and recirculated air to maintain design temperatures in the Electrical Division of the Safeguard Buildings, while operating in a design basis accident alignment. ~~Each SBVSE air intake train has the capability to remove the design heat load.~~	a. An inspection of the manufacturer's documentation of the SBVSE cooling coils will be performed. ~~An inspection of the manufacturer's documentation of the SBVSE supply air handling unit cooling coils will be performed.~~ b. Tests and analysis of the SBVSE units will be performed to verify that design temperatures in the Electrical Division of the Safeguard Buildings, while operating in a design basis accident alignment. ~~Test will be performed to verify capability of the SBVSE supply and recirculation/exhaust units to maintain ambient conditions within the Electrical Division of the Safeguard Buildings.~~	a. A report confirms that each SBVSE cooling coil is capable of providing design cooling requirements. ~~Verify that each SBVSE 30 SAC 01/02/03/04 AC001 unit has a total cooling capacity of at least 1,134,900 Btu/hr.~~ b. A report confirms that the SBVSE is capable of providing conditioned and recirculated air to maintain design temperatures in the Electrical Division of the Safeguard Buildings, while operating in a design basis accident alignment. A report confirms that each SBVSE fan is capable of meeting the design air flow requirements, while operating in a design basis accident alignment. ~~The test shall confirm that Switchgear Rooms are maintained between 59°F and 104°F, that I&C rooms are maintained between 68°F and 82°F, that all other areas are maintained between 41°F and 104°F.~~ ~~• Verify the SBVSE supply cooling fan has a nominal air flow of at least 29,500 scfm.~~ • ~~Verify the SBVSE recirculation/exhaust fan has a nominal air flow of at least 29,500 scfm.~~

Table 2.6.7-3—Electrical Division of Safeguard Building Ventilation System ITAAC (4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
6.2	The recirculation cooling units start and stop automatically in the emergency feedwater system and the component cooling water system EFWS and CCWS pump rooms when the room temperature reaches preset maximum and minimum temperatures in the pump rooms	A test will be performed to verify that recirculation cooling units start and stop automatically in the EFWS and CCWS pump rooms when the pump room temperature reaches preset maximum and minimum temperatures in the pump rooms.	a. The recirculation cooling units start automatically in the EFWS and CCWS pump rooms prior to allowing the pump rooms to exceed the maximum design temperature.The recirculation cooling units start automatically when the pump room temperature is greater than or equal to 95°F. b. The recirculation cooling units stop automatically in the EFWS and CCWS pump rooms prior to allowing the pump rooms to fall below the minimum design temperature.The recirculation cooling units stop automatically when the pump room temperature is less than or equal to 85°F.

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2.6.8 Containment Building Ventilation System

1.0 Description

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

The CBVS provides the following safety related functions:

- Upon receipt of a containment isolation signal, the CBVS provides automatic isolation of the containment atmosphere by quick closure of the system containment isolation valves.

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- Upon receipt of a containment isolation signal during a low flow purge operation, air exhausted from containment will be filtered by the CBVS low flow iodine filtration units until the containment isolation valves are closed.~~CBVS low flow purge exhaust to iodine filtration trains.~~

The CBVS provides the following non-safety related functions:

- Containment full flow purge supply and exhaust during outages.
- Containment low flow purge supply for containment entry during normal plant operation.
- Internal filtration to reduce radioactive contamination inside the equipment compartment.
- Supply of cool air to the reactor pit area to prevent concrete degradation.
- Containment cooling to maintain ambient conditions.

2.0 Arrangement

2.1 The functional arrangement of the CBVS is as shown on Figure 2.6.8-1—Containment Building Ventilation System Functional Arrangement.

2.2 The location of CBVS equipment is as listed in Table 2.6.8-1—Containment Building Ventilation System Containment Isolation Valves Mechanical Design, and Table 2.6.8-2—Containment Building Ventilation System Equipment Mechanical Design.

3.0 Mechanical Design Features

3.1 Deleted.

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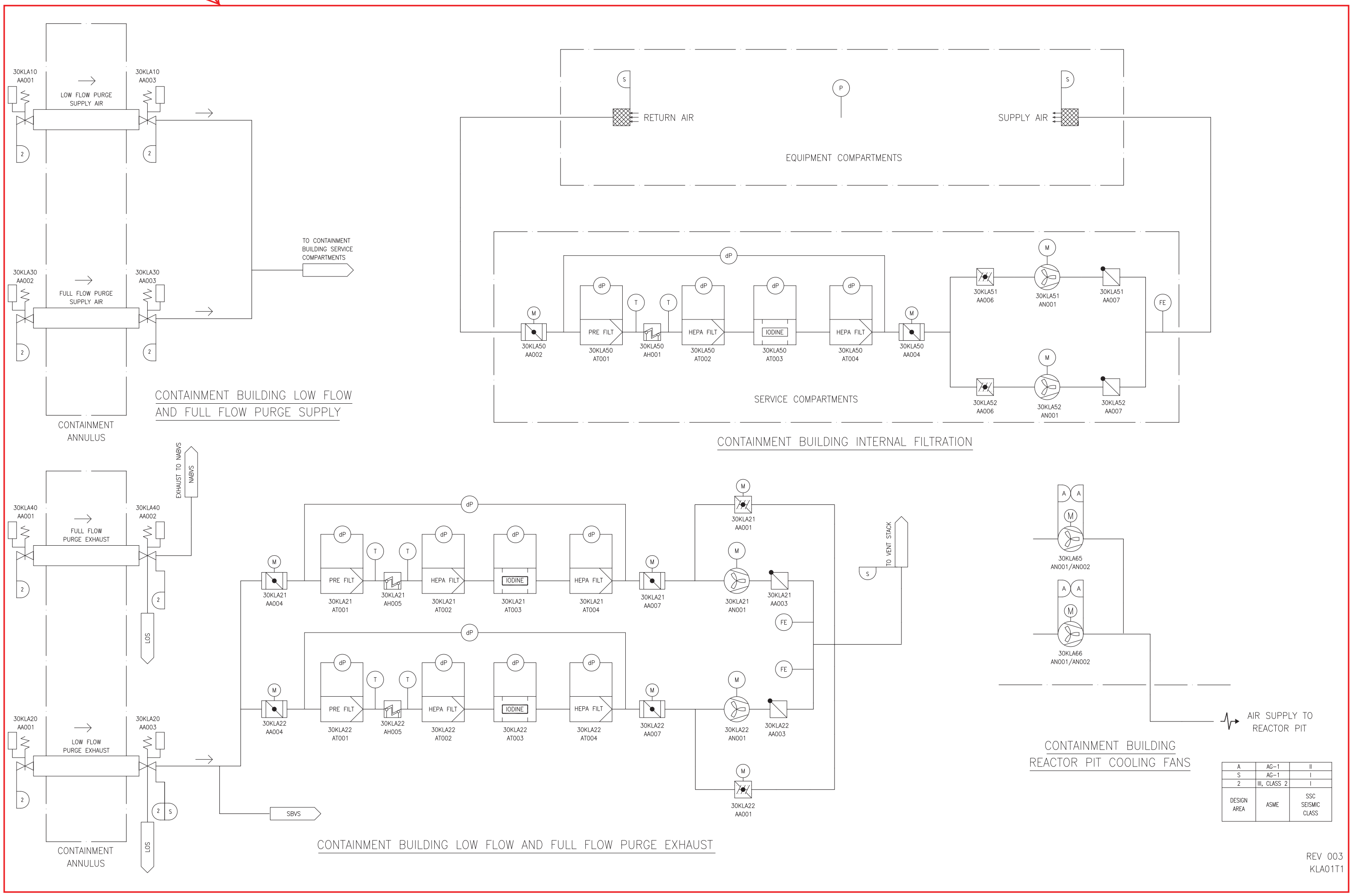
Figure 2.6.8-1—Containment Building Ventilation System Functional Arrangement



A	AG-1	II
S	AG-1	I
2	III, CLASS 2	I
DESIGN AREA	ASME	SSC SEISMIC CLASS

- Figure 2.6.9-4—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 4.

2.2 The location of the EPGBVS equipment is as listed in Table 2.6.9-1—Emergency Power Generating Building Ventilation System Equipment Mechanical Design.

2.3 Physical separation exists between the four divisions of the EPGBVS.

3.0 Mechanical Design Features

3.1 Deleted.

3.2 Equipment listed in Table 2.6.9-1 can perform the function listed in Table 2.6.9-1 under system operating conditions.

3.3 Components identified as Seismic Category I in Table 2.6.9-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.6.9-1.

3.4 Components listed in Table 2.6.9-1 as ASME AG-1 Code are designed in accordance with ASME AG-1 Code requirements.

3.5 Components listed in Table 2.6.9-1 as ASME AG-1 Code are fabricated in accordance with ASME AG-1 Code requirements, including welding requirements.

3.6 Components listed in Table 2.6.9-1 as ASME AG-1 Code are inspected and tested in accordance with ASME AG-1 Code requirements.

4.0 Displays and Controls

4.1 Displays listed in Table 2.6.9-2—Emergency Power Generating Building Ventilation System Equipment I&C and Electrical Design, are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.6.9-2.

4.2 The EPGBVS equipment controls are provided in the MCR and RSS as listed in Table 2.6.9-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.9-2 responds to the state requested by a test signal.

5.0 Electrical Power Design Features

5.1 The equipment designated as Class 1E in Table 2.6.9-2 are powered from the Class 1E division as listed in Table 2.6.9-2 in a normal feed condition.

5.2 Motor operated dampers listed in Table 2.6.9-2 fail to the position as shown in Table 2.6.9-2 on loss of power.

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6.0 Equipment and System Performance

6.1 The EPGBVS provides ventilation and cooling to maintain design temperatures in the Emergency Power Generating Buildings, while operating in a design basis accident alignment.The EPGBVS provides ventilation and is capable of removing design heat load of each division of EPGBs.

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7.0 Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.9-3 lists the EPGBVS ITAAC.

Table 2.6.9-3—Emergency Power Generating Building Ventilation System ITAAC (4 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.2	Controls exist in the MCR and the RSS as listed in Table 2.6.9-2.	Test will be performed for the existence of control signals from the MCR and the RSS to the equipment listed in Table 2.6.9-2.	a. The controls listed in Table 2.6.9-2 as being in the MCR exist in the MCR. b. The controls listed in Table 2.6.9-2 as being in the RSS exist in the RSS.
4.3	Equipment listed as being controlled by a PACS module in Table 2.6.9-2 responds to the state requested by a test signal.	A test will be performed using test signals.	Equipment listed as being controlled by a PACS module in Table 2.6.9-2 responds to the state requested by the test signal.
5.1	The components designated as Class 1E in Table 2.6.9-2 are powered from the Class 1E division as listed in Table 2.6.9-2 in a normal feed condition.	Testing will be performed for the components designated as Class 1E in Table 2.6.9-2 by providing a test signal in each normally aligned division.	The test signal provided in the normally aligned division is present at the respective Class 1E components identified in Table 2.6.9-2.
5.2	Motor operated dampers listed in Table 2.6.9-2 fail to the position as shown in Table 2.6.9-2 on loss of power.	Testing will be performed for the motor operated dampers listed in Table 2.6.9-2 to verify the position of dampers on loss of power.	Following loss of power, the motor operated dampers listed in Table 2.6.9-2 fail to the position as shown in Table 2.6.9-2.
6.1	The EPGBVS provides ventilation and cooling to maintain design temperatures in the Emergency Power Generating Buildings, while operating in a design basis accident alignment. ~~The EPGBVS provides ventilation and is capable of removing design heat load~~	a. An inspection of the manufacturer's documentation of the EPGBVS cooling coils will be performed.	a. A report confirms that each EPGBVS cooling coil is capable of providing design cooling requirements. ~~A vendor inspection to verify e coil will maintain design temperatures in the Emergency Power Generating Building,~~

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Table 2.6.9-3—Emergency Power Generating Building Ventilation System ITAAC (4 Sheets)

Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
of each division of EPGBs.	b. Tests and analysis of the EPGBVS units will be performed to verify that design temperatures in the Emergency Power Generating Buildings, while operating in a design basis accident alignment.to verify design temperaturesTests will be performed to verify capability of the system to maintain design condition within each division in the EPGBs. Test is performed separately for each division.	b. A report confirms that the EPGBVS is capable of providing ventilation and cooling to maintain design temperatures in the Emergency Power Generating Buildings, while operating in a design basis accident alignment. A report confirms that each EPGBVS fan is capable of meeting the design air flow requirements, while operating in a design basis accident alignment.Tests and analyses to verify twills ina. A cooling capacity verification is not required because this system does not contain any cooling coils. b. A test shall confirm for each division the air flow rates for each fan: • Diesel hall supply fan is at least a nominal 85,000 scfm. • Diesel hall exhaust fan is at least a nominal 85,000 scfm. • Fuel tank room exhaust fan is at least a nominal 3,200 scfm. • EDG control/electrical room supply fan is at least a nominal 6,000 scfm and greater than 1,814 scfm.

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Table 2.6.9-3—Emergency Power Generating Building Ventilation System ITAAC (4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
			~~The test shall confirm for each division (with diesel in operation) that:~~ • ~~The diesel hall temperature is maintained between 59°F and 140°F.~~ • ~~The diesel control/electrical room is maintained between 59°F and 95°F.~~

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3.6 Components listed in Table 2.6.13-1 as ASME AG-1 Code are inspected and tested in accordance with ASME AG-1 Code requirements.

4.0 Displays and Controls

4.1 Displays listed in Table 2.6.13-2—Essential Service Water Pump Building Ventilation System Equipment I&C and Electrical Design, are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.6.13-2.

4.2 The ESWPBVS equipment controls are provided in the MCR and RSS as listed in Table 2.6.13-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.13-2 responds to the state requested by a test signal.

5.0 Electrical Power Design Features

5.1 The equipment designated as Class 1E in Table 2.6.13-2 are powered from the Class 1E division as listed in Table 2.6.13-2 in a normal feed condition.

6.0 Equipment and System Performance

6.1 The ESWPBVS provides recirculation cooling to maintain design temperatures in the Essential Service Water Pump Buildings, while operating in a design basis accident alignment.~~ventilation and has the capability to remove design heat load for each ESWS Pump Building.~~

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7.0 Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.13-3 lists the ESWPBVS ITAAC.

Table 2.6.13-3—Essential Service Water Pump Building Ventilation System ITAAC (3 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
6.1	The ESWPBVS provides recirculation cooling to maintain design temperatures in the Essential Service Water Pump Buildings, while operating in a design basis accident alignment. ventilation and has the capability to remove design heat load for each ESWS Pump Building.	a. An inspection of the manufacturer's documentation of the ESWPBVS cooling coils will be performed. b. Tests and analysis of the ESWPBVS cooling units will be performed to verify that design temperatures in the hot mechanical rooms in the Essential Service Water Pump Buildings, while operating in a design basis accident alignment.Tests will be performed to verify capability of the system to maintain ambient conditions within each division in each ESWPB.	a. A report confirms that each ESWPBVS cooling coil is capable of providing design cooling requirements.A vendor inspection to verify each will maintain design temperatures in the Essential Service Water Pump Building, b. A report confirms that the ESWPBVS is capable of providing cooling to maintain design temperatures in the hot mechanical rooms in the Essential Service Water Pump Buildings, while operating in a design basis accident alignment. A report confirms that each ESWPBVS fan is capable of meeting the design air flow requirements, while operating in a design basis accident alignment.a. Each ESWPBVS Cooling Coil shall be tested and certified to have a total cooling capacity of 1,242,000 Btu/hr capacity b. A separate test for each building verifies that the ambient temperature is between 41°F and 104°F. The nominal supply fan air flow rate for each fan in each division is at least 115,000 scfm.

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Table 1.9-2—U.S. EPR Conformance with Regulatory Guides
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RG / Rev	Description	U.S. EPR Assessment	FSAR Section(s)
1.40, 03/1973	Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants	Y	3.11
1.41, 03/1973	Preoperational Testing of Redundant On-Site Electric Power Systems To Verify Proper Load Group Assignments	Y	14.2
1.43, 05/1973	Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components	Y	5.2.3
1.44, 05/1973	Control of the Use of Sensitized Stainless Steel	Y	3.6.3.3.4
			5.2.3
			6.1.1
1.45, R1, 5/2008	Reactor Coolant Pressure Boundary Leakage Detection Systems	Y	3.6.3
			5.2.5
1.47, 05/1973	Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems	Y	7.1
			7.5.2.2.4
			Table 8.1-1
			8.3.2.2.4
1.50, 05/1973	Control of Preheat Temperature for Welding of Low-Alloy Steel	Y	5.2.3
			6.1.1
1.52, R3	Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants 09.04.03-3	Y ~~EXCEPTION (ASME AG-1-2003 and ANSI/ASME N 509-2002 used)~~	6.2.3.2
			6.4.2.2
			6.5
			9.4.1.1
			9.4.5.1
			9.4.7.2.1
			12.3.3.3
			12.3.6.5.6
			14.2
1.53, R2	Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems	Y	7.1
			8.1.4
			8.3.2.2.3
			15.2
			15.3

Table 1.9-2—U.S. EPR Conformance with Regulatory Guides
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RG / Rev	Description	U.S. EPR Assessment	FSAR Section(s)
1.136, R3	Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments	Y	3.8.1.2.5
			3.8.1.3
			3.8.2.2.5
			3.8.3.2.5
		EXCEPTION (2001 Ed. ASME Code)	3.8.1.2.5
			3.8.1.3
			3.8.2.2.5
			3.8.3.2.5
1.137, R1	Fuel-Oil Systems for Standby Diesel Generators	Y	9.5.4
1.138, R2	Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants	N/A-COL	N/A
1.139, 05/1978	Guidance for Residual Heat Removal	Y	14.2
1.140, R2	Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants	Y ~~EXCEPTION (ASME AG-1-2003 and ANSI/ASME N 509-2002 used)~~ 09.04.03-3	9.4.1.1
			9.4.2.1
			9.4.3.1
			9.4.5.1
			9.4.7.2.1
			9.4.8
			12.3.3.3
			12.3.6.5.6
			14.2
1.141, 04/1978	Containment Isolation Provisions for Fluid Systems	Y	6.2.4

14. ASME AG-1 refers to ASME AG-1, “Code on Nuclear Air and Gas Treatment,” 1997 (including the AG-1a-2000, “Housings” Addenda).~~“ASME AG-1a-2004 – Code on Nuclear Air and Gas Treatment.”~~

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15. As defined in Section 3.2.1, the U.S. EPR safety classifications are:
    - S - Safety-related
    - NS - Non-safety-related
    - NS-AQ - Supplemented Grade
16. As defined in Section 3.2.1, the Seismic Classifications are:
    - I - Seismic Category I
    - II - Seismic Category II
    - RS - Radwaste Seismic
    - CS - Conventional Seismic
    - NSC - Non-seismic

3A Criteria for Distribution System Analysis and Support

This appendix provides the design criteria for the U.S. EPR distribution system analysis and supports. As noted in Section 3.7.3, this appendix describes criteria for design of supports for:

- Piping.
- Heating, ventilation, and air conditioning (HVAC) ducts.
- Cable trays.

3A.1 Piping and Supports

Information on piping, instrumentation, and supports is provided in AREVA NP Topical Report ANP-10264NP-A (Reference 1).

3A.2 Heating, Ventilation, and Air Conditioning Ducts and Supports

HVAC ductwork and its associated support structures are designed to withstand the loadings and load combinations presented in Section 3A.2.2 and Section 3A.2.3, based on the Codes and Standards provided in Section 3A.2.1. A typical HVAC duct system includes structural components (e.g., sheet metal ducts, duct stiffeners, duct supports) and inline components (e.g., heaters and dampers).

Safety-related, Seismic Category I HVAC ductwork, supports, and restraints meet the stress allowables provided in paragraph AA-4321 of ASME AG-1 (Reference 2). Seismic Category II HVAC ductwork, supports, and restraints are analyzed to make sure that a failure would not impair the safety function of safety-related equipment or components. Seismic Category II requirements are satisfied by meeting the criteria as established in Section 3.7.2.3.3.

Non-Seismic HVAC ductwork meets Sheet Metal and Air Conditioning Contractors National Association (SMACNA) standards (Reference 5). Non-Seismic HVAC ductwork support and restraint systems meet the analysis requirements of the American Institute of Steel Construction (AISC) Manual (Reference 3).

3A.2.1 Codes and Standards

HVAC ductwork, ductwork supports, and ductwork restraints conform to the following codes and standards:

- ASME AG-1 ~~2003~~, "Code on Nuclear Air and Gas Treatment," 1997 (including ~~with 2004~~ the AG-1a-2000, "Housings" Addenda (Reference 2).
- AISC Manual of Steel Construction, Ninth Edition (Reference 3).

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3A.3.6.5 Analysis Procedure for Damping

Refer to Section 3.7.3.5 for analysis procedures for damping. The damping criteria is further described in Section 3A.3.5.

3A.3.6.6 Three Components of Earthquake Motion

Refer to Section 3.7.3.6.

3A.3.6.7 Combination of Modal Responses

Refer to Section 3.7.3.7.

3A.3.6.8 Interaction of Other Systems with Seismic Category I Systems

Refer to Section 3.7.3.8.

3A.3.6.9 Multiply-Supported Equipment and Components with Distinct Inputs

Refer to Section 3.7.3.9.

3A.3.6.10 Use of Constant Vertical Static Factors

Refer to Section 3.7.3.10.

3A.3.6.11 Torsional Effects of Eccentric Masses

Refer to Section 3.7.3.11.

3A.4 References

1. ANP-10264NP-A, Revision 0, "U.S. EPR Piping Analysis and Support Design Topical Report," AREVA NP Inc., November 2008.

2. ASME AG-1 ~~2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, ~~2003 with 2004 Addenda~~1997 (including the AG-1a-2000, "Housings" Addenda.

3. AISC "Manual of Steel Construction," Ninth Edition, American Institute of Steel Construction, April 2002.

4. AISI, "North American Specification for the Design of Cold-Formed Steel Structural Members," American Iron and Steel Institute, 2001 Edition with 2003 Errata.

5. SMACNA, "HVAC Duct Construction Standards, Metal and Flexible," Sheet Metal and Conditioning Contractors National Association, Third Edition, 2005.

6. AWS D1.1/D1.1M: 2004, "Structural Welding Code-Steel," American Welding Society with errata through June 2005.

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6.2.3.3 Safety Evaluation

The AVS system components are located inside the Fuel Building, which is a Seismic Category I structure. The two AVS accident filtration trains are designed to withstand the safe shutdown earthquake and are classified as Seismic Category I.

The safety-related components of the AVS system remain functional and perform their intended function following a postulated internal hazard (e.g., fire, flood, internal missiles, pipe breaks). The two accident filtration trains are physically separated from each other to prevent common mode failures. Since the accident filtration trains are completely redundant and are both full capacity, one train alone can collect and process radioactive material that may leak from the primary containment following an accident. The supply and exhaust trains of the normal filtration train can be isolated with two redundant dampers in series.

Guard pipes surround high energy lines passing through the annulus to protect against pipe failures that could compromise the integrity of the secondary containment. Design criteria for guard pipes are presented in Section 3.6.2.2. Containment penetrations are listed in Section 6.2.4. Doors and hatches leading to the annulus are maintained under administrative control.

If a fire is detected in the annulus during normal operation, the continuous ventilation of the annulus is stopped manually from the MCR by closing the fire dampers located at the wall penetration between the Fuel Building and Nuclear Auxiliary Building ventilation supply and exhaust shafts to reduce the possibility for fire propagation.

Analyses have demonstrated the ability of the AVS to depressurize and maintain a subatmospheric pressure in the annulus during normal operation and following a design basis LOCA. The LOCA is assumed to occur concurrent with a loss of off-site power, and a loss of one of the accident trains. The total thermal and pressure expansion of the primary containment structure is assumed to occur prior to the start of the remaining accident train, resulting in a starting pressure of 14.712 psia. The drawdown of the annulus is started 60 seconds after the start of the postulated accident. Analytical results indicate that the pressure in the annulus reaches a subatmospheric pressure sufficient for the AVS to perform its safety function with substantial margin. Analytical specifications and results are presented in Table 6.2.3-2.

6.2.3.4 Inspection and Testing Requirements

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The AVS major components, such as dampers, motors, fans, filters, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Initial in-place acceptance testing of the AVS is performed as described in Section 14.2 (test abstracts #077 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The AVS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

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During normal plant operation, periodic testing of AVS is performed to demonstrate system and component operability and integrity.

Isolation dampers are periodically inspected and damper seats replaced as required.

Per IEEE 334 (Reference 17), type tests of continuous duty class 1E motors for AVS are conducted to confirm ESF system operation and availability.

Fans are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 18, 19, and 20). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 21).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 22), American Society of Mechanical Engineers, ASME N510 (Reference 23), and ASME AG-1 (Reference 24).

Heaters are tested in accordance with ASME AG-1, Section CA (Reference 24).

Emergency filtration units are tested by manufacturer for housing leakage, filter bypass leakage and airflow performance. Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.52 (Reference 25), ASME N510 (Reference 23) and ASME AG-1 (Reference 24). The charcoal adsorber samples are tested for efficiency in accordance with RG 1.52 (Reference 25) and ASTM D3803 (Reference 26). Air filtration and adsorption unit heaters are tested in accordance with ASME N510 (Reference 23).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

In-service test program and test frequency requirements are described in Section 16, "Technical Specification" Subsections 3.6.6, 3.6.7 and per Ventilation Filter Test Program (VFTP) described in Section 16, "Technical Specification" Subsection 5.5.10.

~~Refer to Section 14.2 (Test Abstract #077) for initial plant testing of the AVS. Refer to the technical specifications (Chapter 16) Section 3.6.6 and Section 3.6.7 for surveillance requirements. Inspections and testing of the ESF filter system components are described in Section 6.5.1.~~

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~~The following AVS component functions are tested for operability:~~

- ~~Temperature sensor measurement validation.~~
- ~~Damper closing and opening.~~
- ~~Fire damper closing and opening.~~
- ~~Emergency button operability.~~
- ~~Efficiency of HEPA and carbon filters.~~
- ~~In-place leakage testing of the filters.~~

~~The functionality of the AVS is verified by testing alarms and indications and by confirming the availability of selectors in the MCR and by manual operation of heaters and dampers. A periodic switchover of system fans is performed during operation to check the functioning of each fan.~~

~~The AVS system is designed to permit access and periodic inspection of the system components. The operating equipment is accessible for visual inspection during all plant operating modes. Lighting inside filter banks between the rows of filters and inspection portholes in the filter housing doors allow for viewing while in operation.~~

6.2.3.5 Instrumentation Requirements

Indication of the operational status of the AVS equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system. The radiation instrumentation requirements for controlling airborne radioactivity releases via the vent stack are addressed in Section 11.5.

14. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Facility Components," The American Society of Mechanical Engineers, 2004 Edition.

15. ANP-10299P, Revision 2, "Applicability of AREVA NP Containment Response Evaluation Methodology to the U.S. EPR for Large Break LOCA Analysis," AREVA NP Inc., December 2009.

16. Frank Kreith, "Principles of Heat Transfer," 3rd edition, New York: Intext Educational Publishers, 1973.

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17. IEEE 334-1974, "IEEE Standard for Type Tests of Continuous-Duty Class 1E Motors for Nuclear Power Generating Stations", Institute of Electrical and Electronics Engineers, 1974.

18. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

19. ANSI/AMCA 211-1987, "Certified Ratings Program -Air Performance, "American National Standards Institute/Air Movement and Control Association International, 1987.

20. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

21. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

22. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

23. ASME N510-1989 (R1995), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

24. ASME AG-1, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 1997 (including the AG-1a-2000, "Housings" Addenda).

25. NRC Regulatory Guide 1.52, Rev. 3, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post Accident Engineered Safety Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," 2001.

26. ASTM D3803-1989, reapproved 1995, "Standard Test Method for Nuclear Grade Activated Carbon," 1989.

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- Power supplies of the active components are backed up with emergency power so that they function in case of a loss of offsite power.
- Each CRACS train has the capability to remove the design heat load. Each CRACS coiling coil (30 SAB01 AC001, 30 SAB02 AC001, 30 SAB03 AC001, and 30 SAB04 AC001) has a ~~maximum~~total cooling capacity of ~~355~~470,000 Btu/hr and is designed in accordance with ASME AG-1 (Reference 2).

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6.4.2.3 Leak-tightness

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

Leak-tightness provisions for pressure boundary components are:

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

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

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

6.4.2.4 Interaction with Other Zones and Pressure-Containing Equipment

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

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

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

6.4.5 Testing and Inspection

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

Periodic testing to confirm CRE integrity is performed using testing methods and at testing frequencies consistent with RG 1.197. The air in-leakage test (tracer gas test) of the CRE boundary is performed in accordance with ASTM E741 (Reference 3). Air quality testing is performed in accordance with ANSI/ASHRAE 52.2 (Reference 4) and ASME N510 (Reference 5).

The control room envelope habitability program in Technical Specifications Section 5.5.17 defines testing requirements.

6.4.6 Instrumentation Requirements

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

Toxic chemicals whose release has the potential to affect control room operators are monitored by toxic gas sensors. A COL applicant that references the U.S. EPR design certification will identify the type(s) of Seismic Category I Class IE toxic gas sensors (i.e., the toxic chemical(s) of concern) necessary for control room operator protection.

6.4.7 References

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

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2. ~~ASME AG-1–2003, "Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 2003~~ASME AG-1, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 1997 (including the AG-1a-2000, "Housings" Addenda).

systems or subsystems. SB 2 and SB 3 are concrete reinforced and contain the MCR. Near the SB, the Nuclear Auxiliary Building provides the location and facilities to process liquids and gases that come from, or are provided to, the RCS and other systems located inside containment. The Shield Building, the SB, and the FB structures are described in Section 3.8.4.

The AVS, described in Section 6.2.3, meets the requirements for a secondary containment system. Ventilation systems in the annulus, the SB, and the FB provide adequate ventilation to their assigned areas. These systems limit offsite and MCR doses from fission product releases to within the criteria of 10 CFR 52.47(a)(2)(iv) and GDC 19, respectively, through the use of the ESF filter systems.

Following a DBA, the AVS controls and removes fission products that leak from the primary containment. The AVS maintains the annulus at a slightly negative pressure to prevent leakage from the annulus through the Shield Building. A containment isolation actuation signal automatically aligns the discharge of the AVS through its ESF filter trains.

The SBVS services the SB and FB, including areas containing containment penetration piping. Pipes that penetrate the RB have the potential to create a bypass path for radioactive fission products through the annulus. Leakage from the safety injection pumps may also release radioactive fission products. The SB and FB capture bypass leakage from the RB and process it through SBVS, described in Section 9.4.5. ESF signals automatically align the discharge of SBVS through its ESF filter trains.

6.5.4 References

1. ANSI/ASME N509, "Nuclear Power Plant Air-Cleaning Units and Components," American National Standards Institute/The American Society of Mechanical Engineers, ~~2002~~1989.

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2. ANSI/ASME N510, "Testing of Nuclear Air Treatment Systems," American National Standards Institute/The American Society of Mechanical Engineers, 1989.

3. ASME AG-1, "Code on Nuclear Air and Gas Treatment ~~Systems~~," The American Society of Mechanical Engineers, ~~2003~~1997 (including the AG-1a-2000, "Housings" Addenda).

4. ASHRAE Standard 52, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI approved)," American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

5. ASTM D3803, "Standard Test Method for Nuclear-Grade Activated Carbon," American Society for Testing and Materials, 1989.

6. ANSI/AMCA-210, "Laboratory Methods for Testing Fans for Rating," American National Standards Institute/American Movement and Control Association, 1999,

7. ANSI/AMCA-211, "Certified Ratings Program Air Performance," American National Standards Institute/American Movement and Control Association, 1987.

8. ANSI/AMCA-500, "Test Methods for Louvers, Dampers, and Shutters," American National Standards Institute/American Movement and Control Association, 1989.

9. UL-555, "Fire Dampers and Ceiling Dampers," Underwriters Laboratories Inc., 1999.

10. Regulatory Guide 1.52, Revision 3, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," U.S. Nuclear Regulatory Commission, June 2001.

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11. ERDA 76-21, "Nuclear Air Cleaning Handbook," Oak Ridge National Laboratory, 1976.

positive pressure inside the CRE area relative to the adjacent areas. The CRE air inlet and recirculation dampers operate automatically.

Upon receipt of a toxic gas alarm from a toxic gas sensor in the outside air intake duct, the CREF (iodine filtration) trains are placed in the filtered alignment mode and the CRE air is diverted to the recirculation mode on both trains. The outside air inlet isolation damper at the outside inlet in alarm will be closed by the control room operator.

The CRACS is capable of isolating all non-safety-related system penetrations of the CRE boundary so that occupation and habitability of the control room is not compromised.

Air conditioning and heating loads for the CRE rooms is calculated using methodology identified in ASHRAE Handbook (Reference 8) as follows:

- Summer air conditioning loads are 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 is completed for both a normal and accident plant alignment configuration.
- The CRACS cooling supply units are designed to provide cooling as required to prevent the CRE 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 are 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 CRACS supply air duct heaters are designed to operate for “comfort conditions only” as required when the CRE room temperature is less than the minimum “comfort temperature” set point value. The CRACS supply air duct heaters are not required to operate during accident conditions.

The CRACS maintains the following temperature ranges for the areas serviced:

Room	Temperature	Humidity
– Main Control Room:	68°F to 78°F	30 – 60%
– I&C Computer Rooms, Rest Rooms:	65°F to 78°F	30 – 60%
– HVAC Rooms:	50°F to 95°F	30 – 60%
– Other areas of CRE:	65°F to ~~79~~78°F	20 – 80%

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cooling load to allow a single CRACS air handling unit to cool the CRE rooms during a station blackout (SBO) event. During an SBO, the single CRACS air handling unit prevents 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. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components.~~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~~-2003~~ (Reference 1).

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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.

Cooling Coils and Moisture Separator

The cooling coils are of the finned tube, coil type and are connected to the safety chilled water system (SCWS). The cooling coils have a total cooling capacity of 470,000 Btu/hr and are designed in accordance with Reference 1. The moisture separator collects condensate which is directed to the drain system.

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9.4.1.2.3 System Operation

Normal Plant Operation

During normal plant operation, fresh air is admitted via air intake trains 1 and 4. The fresh air passes through the unfiltered bypass duct and bypass dampers. The fresh air passes through a prefilter, electrical heaters, and then mixes with the recirculated air from the CRE area.

The fresh and recirculated air is admitted through two of four air handling units which provide heating and cooling of the supply air. The conditioned air is then distributed through a ductwork distribution network to the CRE area. The room air conditioning is provided by the supply and exhaust air flows based on minimum air renewal rate, equipment and personnel heat loads and heat balance between the rooms.

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

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

Both CREF (iodine filtration) trains are isolated with outside air bypassing the CREF (iodine filtration) trains. The CREF iodine filtration train inlet and outlet motor operated isolation dampers are closed. In addition, the CRE recirculation motor operated isolation damper is closed to prevent the recirculation of air from the CRE rooms.

The air conditioning system for the CRE area operates in the recirculation mode with fresh air makeup. During the recirculation mode, the fresh air supply rate is equal to the rate of exhaust air from the kitchens and restrooms plus accounting for the leakage rate in the area due to controlled overpressure.

Exhaust air from the kitchen and restrooms is not recirculated. During normal operation, air is exhausted from the restrooms and the kitchen area to the SBVSE CREF (iodine filtration) air outlet. The CRACS has design features which will allow it to continue to maintain a minimum positive pressure of 0.01 inch water gauge in the CRE. Approximately twice as much outside air is supplied to the CRE during normal

CREF (iodine filtration) trains are placed in the filtered alignment manually from the control room.

9.4.1.3 Safety Evaluation

The CRACS is designed to maintain ambient conditions inside the CRE area for personnel comfort and to allow safe operation of the equipment during normal plant operation, outages, and under all anticipated occurrences including postulated accidental events (refer to Section 15.0.3 for a discussion of radiological consequences).

The CRACS keeps the CRE area at a positive pressure of 0.125 inches water gauge at a minimum with respect to the surrounding area to provide habitability in the event of radioactive contamination of the environment, and to prevent uncontrolled incoming air leakage.

During a site radiological contamination event, the fresh air intake is redirected through the CREF (iodine filtration) trains. The CRACS also can be operated in full recirculation mode without fresh air during abnormal operation or postulated accident events.

Redundancy for air cooling and iodine filtration is provided by multiple independent trains for critical functions. Sufficient redundancy is provided for proper operation of the system when one active component is out of service.

In case of fire in any room within the CRE area, the room air supply and exhaust are isolated by fire dampers and, if necessary, the plant is controlled by the remote shutdown station (RSS). The four air conditioning trains are installed in four different fire zones. Two of these zones contain the two CREF (iodine filtration) trains.

Capability for withstanding or coping with an SBO event is met by the design of the AAC power source satisfying the ten minutes criteria; that is, the AAC power source can be started from the MCR within ten minutes after the onset of an SBO event. The SBODGs are designed to operate for a minimum of twenty-four hours with available onsite fuel supplies.

9.4.1.4 Inspection and Testing Requirements

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The CRACS major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Test and analysis will be completed during normal operation with the system operating in an accident alignment. Analysis will use as-built information from equipment to extrapolate the performance of the air-conditioning system. Analysis will show that the equipment performance is adequate to maintain design conditions during plant operating conditions.

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Initial in-place acceptance testing of the CRACS is performed as described in Section 14.2 (test abstracts #082 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The CRACS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of CRACS is performed to demonstrate system and component operability and integrity.

During normal operation, equipment rotation is utilized to reduce and equalize wear on redundant equipment during normal operation.

Isolation dampers are periodically inspected and damper seats replaced as required.

Per IEEE 334 (Reference 9), type tests of continuous duty class 1E motors for CREF are conducted to maintain ESF system operation and availability.

Air handling units are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 2). Cooling coils are hydrostatically tested in accordance with ASME AG-1 (Reference 1) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 10).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 11), American Society of Mechanical Engineers, ASME N510 (Reference 3), and ASME AG-1 (Reference 1).

Outside air inlet heaters are tested in accordance with ASME AG-1, Section CA (Reference 1).

Emergency filtration units are tested by manufacturer for housing leakage, filter bypass leakage and airflow performance. Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.52 (Reference 12), ASME N510 (Reference 3) and ASME AG-1 (Reference 1). The charcoal adsorber samples are tested for efficiency in accordance with RG 1.52 (Reference 12) and ASTM D3803 (Reference 13). Air filtration and adsorption unit heaters are tested in accordance with ASME N510 (Reference 3).

In-service test program requirements, including the unfiltered in-leakage into the CRE testing will be performed per RG 1.197 (Reference 14) and ASTM E741-2000 (Reference 15).

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Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

In-service test program and test frequency requirements are described in Chapter 16, "Technical Specification" Sections 3.7.10, 3.7.11 and per Ventilation Filter Test Program (VFTP) described in Chapter 16, "Technical Specification" Section 5.5.10.

Refer to Section 14.2 (test abstracts #082 and #203) for initial plant testing. Initial inplace acceptance testing of the CRACS components is performed in accordance with Reference 1 and Reference 3.

Periodic testing will be performed to verify the unfiltered in-leakage into the CRE area per RG 1.197.

Refer to Section 16 (SR 3.7.10 and SR 3.7.11) for surveillance requirements.

9.4.1.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, and instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to monitor flow, temperature and pressure. The fire detection and sensor information are delivered to the fire detection system (refer to Section 9.5.1).

The minimum instrumentation, indication and alarms for CREF (iodine filtration) train subsystem are provided in Table 9.4.1-1—Minimum Instrumentation, Indication, and Alarm Features for CREF (Iodine Filtration) Train Subsystem.

9.4.1.6 References

1. ASME AG-1-2003, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 20031997 (including the AG-1a, -20042000 "Housings" Addenda).

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2. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

3. ASME N510-1989 (R1995), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

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4. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

5. ANSI/AMCA 211-1987, "Certified Ratings Program–Air Performance," American National Standards Institute/Air Movement and Control Association International, 1987.

6. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

7. UL 555, "Standard for Fire Dampers," Underwriters Laboratories, Sixth Edition, June 1999.

8. "ASHRAE Handbook Fundamentals," American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., 2005.

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9. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

10. "HVAC Air Duct Leakage Test Manual, "Sheet Metal and Air Conditioning Contractors' National Association, 1985.

11. ASTM D3803-1989, reapproved 1995, "Standard Test Method for Nuclear Grade Activated Carbon," 1989. NRC Regulatory Guide 1.52, Rev. 3, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post Accident Engineered Safety Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," 2001.

12. NRC Regulatory Guide 1.197, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors," 2003.

13. ASTM E741-2000, "Standard Test Methods for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution," 2000.

14. ASME N509-1989, "Nuclear Power Plant Air Cleaning Units and Components," The American Society of Mechanical Engineers, 1989.

15. IEEE 334-1974, "IEEE Standard for Type Tests of Continuous-Duty Class 1E Motors for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 1974.

16. ERDA 76-21, "Nuclear Air Cleaning Handbook," Oak Ridge National Laboratory, 1976.

A. Minimum temperature: 50°F.

B. Maximum temperature: 113°F.

C. Humidity: 25 to 70 percent.

The following ambient conditions are maintained in the fuel pool area:

D. Minimum temperature: 68°F.

E. Maximum temperature: 104°F.

F. Humidity: 25 to 70 percent.

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- Provides heating via air supply duct heaters and fan heaters to maintain minimum ambient room temperature. Electric heaters in the fuel pool rooms prevent condensation on the walls. For non-safety-related equipment located in the same rooms with safety-related equipment, the seismic classification for the non-safety-related equipment is described in Section 3.7.3.8 for interaction of Seismic Category I subsystems.
- Maintains the airborne radioactivity levels within the FB below the maximum permissible concentrations limits of 10CFR20 and consistent with the as low as reasonably achievable (ALARA) dose objectives of 10CFR50, Appendix I (refer also to Section 12.1 and Section 12.3.3).

9.4.2.2 System Description

A simplified diagram of the FBVS is shown in Figure 9.4.2-1—Fuel Building Ventilation System.

Refer to Section 12.3.6.5.6 for ventilation system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

9.4.2.2.1 General Description

The FBVS provides air distribution for ventilation of the FB. The air supply to, and exhaust from, each room of the FB is provided by a network of supply and exhaust ducts which are connected to the NABVS. The conditioned air is supplied to all levels of the building through a duct distribution network. The flow rate to each room is calculated based on the minimum air renewal rate, equipment heat loads, and heat balance between the rooms. This maintains ambient conditions during normal operation within prescribed limits for operation of equipment and personnel safety and comfort.

The supply air is the conditioned outside air that is filtered, cooled or heated, humidified by the NABVS, and delivered to the FB rooms through the FBVS supply duct network.

The air supply and exhaust duct branches for each area are fed from the main supply and exhaust shafts. 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 ~~-2003~~ (Reference 1).

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Electrical Heaters

Unit heaters maintain the room ambient conditions. The heaters meet the requirements of Reference 1.

Fan Heaters

Fan heaters consist of a fan section and an electrical heater section. The casing unit is constructed of heavy gauge steel. The fan is vane-axial design with electrical motor driver.

Recirculation Cooling Units

The recirculation cooling units consist of a fan section and a water cooling section. The casing unit is constructed of heavy gauge steel. The fan is electric motor driven. The condensate from the units is directed to the drain system. The cooling coils are designed in accordance with Reference 1.

Dampers

Manual dampers are adjusted during initial plant startup testing to establish accurate air flow balance between rooms. The motor-operated isolation dampers will fail in position in case of loss of power. The performance and testing requirements of the dampers will be per Reference 1.

Fire Dampers

Fire dampers are installed where ductwork penetrates a fire barrier. Fire damper design meets the requirements of UL 555 (Reference 2) and the damper fire rating is commensurate with the fire rating of the barrier penetrated.

9.4.2.2.3 System Operation

Normal Plant Operation

During normal plant operation, fresh conditioned air is supplied to the FB rooms by the FBVS supply duct network. The supply air to the FB is provided by the NABVS. The room air conditioning is provided by the supply and exhaust air flows based on the minimum required air renewal rate, equipment heat load, and heat balance between the rooms. The air is heated or cooled to maintain the required ambient conditions of the rooms.

- Manual isolation from the main control room (MCR) of the supply and exhaust airflow to the hall in front of the equipment hatch prior to opening of the hatch. This isolation mitigates the consequences of a fuel handling accident in the RB with the hatch opened.

- Automatic isolation of the supply airflow to the room in front of the emergency airlock in order to mitigate the consequences of a fuel handling accident in the RB. The isolation of the exhaust airflow from the room in front of the emergency airlock is performed manually from the MCR prior to opening of the emergency airlock.

- Automatic isolation of the FB from NABVS supply and exhaust ducts in the event of containment isolation signal or high radiation signal in the RB. The SBVS maintains negative pressure in the FB and filters the FB atmosphere through SBVS iodine filtration trains.

- Maintains ambient conditions in the extra borating system pump rooms and pipe chase and the fuel pool cooling system pump rooms during normal, abnormal, and postulated accident events.

- Safety-related components can function as required with failure of a single active component. The safety-related redundant components are powered from different electrical divisions so that the system can remain operable in case of failure of one of the electrical divisions.

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9.4.2.4 Inspection and Testing Requirements

The FBVS major components, such as dampers, cooling units, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Test and analysis will be completed during normal operation with the system operating in an accident alignment. Analysis will use as-built information from equipment to extrapolate the performance of the air-conditioning system. Analysis will show that the equipment performance is adequate to maintain design conditions during plant operating conditions.

Initial in-place acceptance testing of the FBVS is performed as described in Section 14.2 (test abstracts #081 and #203), Initial Plant Test Program, to verify the system is build in accordance with applicable programs and specifications.

The FBVS is designed with adequate instrumentation and temperature indicating devices to enable testing and verification of equipment function and heat transfer capability.

During normal plant operation, periodic testing of FBVS is performed to demonstrate system and component operability and integrity.

Isolation dampers are periodically inspected and damper seats replaced as required.

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Recirculation cooling units are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Cooling coils are hydrostatically tested in accordance with ASME AG-1 (Reference 1) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 7).

Ductwork is leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 8), American Society of Mechanical Engineers, ASME N510 (Reference 9), and ASME AG-1 (Reference 1).

Fan heaters are tested in accordance with ASME AG-1, Section CA (Reference 1).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.~~Refer to Section 14.2 (test abstracts #081and #203) for initial plant startup test program. Initial in-place acceptance testing of FBVS components will be performed in accordance with Reference 1.~~

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9.4.2.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to measure flow, temperature, and pressure. The fire detection and sensors information is delivered to the fire detection system. The radiation instrumentation requirements for controlling airborne radioactivity releases via the vent stack are addressed in ~~Section 11.5~~Section 11.5.3.1.7 and Table 11.5-1, Monitors R-17, R-18, and R-19.

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9.4.2.6 References

1. ASME AG-1~~-2003~~, “Code on Nuclear Air and Gas Treatment,” The American Society of Mechanical Engineers, 1997~~2003~~ (including the AG-1a~~,~~-2000~~2004~~ “Housings” Addenda).

2. UL 555, “Standard for Fire Dampers,” Underwriter’s Laboratories, Sixth Edition, June 1999.

3. “ASHRAE Handbook Fundamentals,” American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., 2005.

4. ANSI/AMCA-210-1999, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

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5. ANSI/AMCA-211-1987, "Certified Ratings Program-Air Performance," American National Standards Institute/Air Movement and Control Association International, December 1987.

6. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, December 1987.

7. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

8. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

9. ASME N510-1989 (R1996), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

10. ASME N509-1989, "Nuclear Power Plant Air Cleaning Units and Components," The American Society of Mechanical Engineers, 1989.

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exhaust fans take suction from this plenum and discharge into another exhaust plenum which directs the exhaust air to the vent stack for an elevated release.

If high radiation is detected in any of the rooms within the NAB (refer to Table 11.5-1, Monitors R-11, R-12, and R-13), Reactor Building (RB), FB (refer to Table 11.5-1, Monitors R-17 and R-18), or SBs (refer to Table 11.5-1, Monitor R-25), the NABVS exhaust is diverted to an iodine filtration plenum. It is then directed to one of the four redundant independent iodine filtration units. Each iodine filtration unit includes fire dampers, preheater, iodine adsorber using activated carbon, HEPA filters, dampers, and a booster fan. The exhaust air from the booster fan is directed to the exhaust plenum for discharge through the vent stack. See Figure 9.4.3-4—Nuclear Auxiliary Building Exhaust Iodine Filtration Train Subsystem.

The NABVS also has two iodine filtration train units and fans to serve the laboratory exhaust air. Each laboratory iodine filtration train unit includes preheater, HEPA filters, iodine adsorber, motor-operated dampers, and booster fans. The exhaust air from the booster fans is directed to the exhaust plenum for discharge through the vent stack. See Figure 9.4.3-5—Nuclear Auxiliary Building Laboratory Iodine Exhaust Filtration Train.

9.4.3.2.2 Component Description

The major components of the NABVS are listed below, along with the applicable code and standards. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components~~Table 3.2.2-1 provides the seismic design and other design classifications for components in the NABVS.

Ductwork and Accessories

The supply and exhaust air 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 ~~-2003~~ (Reference 1).

09.04.03-3

Heaters

Supply air trains have hot water heaters. The heater design is based on the minimum outside air design temperature and supply air temperature requirements. The coils are constructed and tested in accordance with Reference 1. Electric heaters are located upstream of iodine filters to prevent excessive moisture accumulation in the charcoal beds.

Humidifiers

Humidifiers add moisture to the supply air as needed to maintain acceptable ambient conditions. The design of humidifiers is based on the outside air design conditions and supply air humidity requirements.

Section 9.4.5). The remainder of the FB is ventilated by the NABVS. During and after the fuel handling accident, proper NABVS supply and exhaust flow rates are maintained by adjusting the control dampers.

Fuel Handling Accident in the Containment Building

In the event of a fuel handling accident in the Containment Building, the containment isolation valves close (refer to Section 9.4.7). Exhaust from the Containment Building is routed to the iodine filtration trains of the SB ventilation system. Excess air supply from the NABVS is redirected by adjusting the supply air control dampers.

Operation of Safety Injection System during LOCA

In the event of a loss of coolant accident (LOCA), leakages in the safety injection system (SIS) can lead to iodine activity levels that are above the limits of the NABVS iodine filtration trains. In such a case, the SB exhaust is routed through the SB ventilation system (refer to Section 9.4.5). Excess air supply from NABVS is redirected by adjusting the supply air control damper. The NABVS supply and exhaust to the FB are isolated (refer to Section 9.4.2).

Loss of Offsite Power (LOOP)

Upon loss of offsite power, the isolation dampers fail to the closed position, preventing any pathway for potentially contaminated air to leak out to the environment.

Station Blackout (SBO)

In the event of SBO, there will be no power to any of the electrical components of the NABVS. Isolation dampers with spring return will fail to the closed position. Other isolation dampers will fail “as-is”.

9.4.3.3 Safety Evaluation

None of the components of the NABVS perform a nuclear safety-related function. The NABVS components are not required to operate during a design basis accident (DBA). In case of a DBA, the NABVS is isolated from the HVAC systems of other buildings by isolation dampers.

The NABVS provides adequate capacity and redundant trains to maintain proper temperature levels in the NAB, FB, Containment Building, and annulus.

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9.4.3.4 Inspection and Testing Requirements

The NABVS major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Initial in-place acceptance testing of the NABVS is performed as described in Section 14.2 (test abstracts #079 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The NABVS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of NABVS is performed to demonstrate system and component operability and integrity.

During normal operation, equipment rotation is utilized to reduce and equalize wear on redundant equipment during normal operation.

Isolation dampers are periodically inspected and damper seats replaced as required.

Fans and air handling units are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 2). Cooling coils are hydrostatically tested and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 8).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 9), American Society of Mechanical Engineers, ASME N510 (Reference 3), and ASME AG-1 (Reference 1).

Outside air inlet heaters are tested in accordance with ASME AG-1, Section CA (Reference 1).

Carbon filtration units are tested by manufacturer for housing leakage, filter bypass leakage and airflow performance. Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.140 (Reference 10), ASME N510 (Reference 3) and ASME AG-1 (Reference 1). The charcoal adsorber samples are tested for efficiency in a laboratory in accordance with RG 1.140 (Reference 10) and ASTM D3803 (Reference 11). Air filtration and adsorption unit heaters are tested in accordance with ASME AG-1, Section CA (Reference 1).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

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Next File

~~Refer to Section 14.2 (test abstracts #079 and #203) for initial plant startup test program. Initial in-place acceptance testing of NABVS components will be performed in accordance with Reference 1 and Reference 3.~~

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9.4.3.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters, and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure.

The fire detection and sensors information is delivered to the fire detection system.

All instrumentation provided with the filtration units is as required by RG 1.140.

The radiation instrumentation requirements for controlling airborne radioactivity releases via the vent stack are addressed in ~~Section 11.5~~Section 11.5.3.1.6 and Table 11.5-1.

9.4.3.6 References

09.04.03-3

1. ASME AG-1 ~~2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 1997~~2003~~ (including the AG-1a~~,~~ -2000, "Housings"~~2004~~ Addenda).

2. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," ANSI/American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

3. ASME N510-1989 (R1995), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

4. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

5. ANSI/AMCA-211-1987, "Certified Ratings Program–Air Performance," American National Standards Institute/Air Movement and Control Association International, 1987.

6. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

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7. UL 555, "Standard for Fire Dampers," Underwriter's Laboratories, Sixth Edition, June 1999.

8. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

9. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

10. NRC Regulatory Guide 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," 2001.

11. ASTM D3803-1989, reapproved 1995, "Standard Test Method for Nuclear Grade Activated Carbon," 1989.

12. ASME N509-1989, "Nuclear Power Plant Air Cleaning Units and Components," The American Society of Mechanical Engineers, 1989.

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9.4.5 Safeguard Building Controlled-Area Ventilation System

Each of the four safeguard divisions is separated into two functional areas:

- Hot mechanical area serviced by the safeguard building controlled-area ventilation system (SBVS).
- Electrical, instrumentation and control (I&C) and heating, ventilation and air conditioning (HVAC) area serviced by the electrical division of the safeguard building ventilation system (SBVSE). Refer to Section 9.4.6.

The SBVS provides a suitable and controlled environment, in the mechanical areas of the Safeguard Buildings (SB) where engineered safety feature components are located, for personnel access and to allow safe operation of the equipment during normal plant operation, outages, under anticipated operational occurrences, and postulated accidental events.

The SBVS, through its interconnections to the SBVSE and the nuclear auxiliary building ventilation system (NABVS), provides conditioned air for ventilation to the mechanical part of the SBs. The conditioned air supply to all four divisions of SB is provided independently for each division by the SBVSE (refer to Section 9.4.6). The exhaust air (normal exhaust) from the four divisions of the SB is processed by the NABVS (refer to Section 9.4.3).

9.4.5.1 Design Bases

The SBVS is safety-related and designed to Seismic Category I requirements, except the following:

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- Electric air heating convectors (fanunit heaters) which are non-safety--related and nNon-sSeismic. These heaters are located in stairwell and service access areas and are used for personnel comfort only. For non-safety-related equipment located in the same room with safety-related equipment, the seismic classification for the non-safety-related equipment is described in Section 3.7.3.8 for interaction of Seismic Category I subsystems.

The safety-related components of the SBVS are located inside the SB that is designed to withstand the effect of natural phenomena, such as earthquake, tornados, hurricanes, floods and external missiles (GDC 2). The SBVS vents and louvers are supplied by the SBVSE for supply and the NABVS for exhaust air.

The safety-related components of the SBVS are appropriately protected against dynamic effects and designed to accommodate the effects of, and to be compatible with, the environmental conditions associated with normal operation, maintenance, testing and postulated accidents. The safety-related components of the SBVS remain functional and perform their intended safety function after anticipated operational occurrences and design basis accidents, such as a fire, internal missiles, or pipe break

- Rooms where hydrogen and containment atmosphere monitoring system (divisions one and four), and severe accident sampling system (division four) components are installed.

Electric air heating convectors are provided in the service corridors, interconnecting passageway, and stairways to maintain the minimum allowable temperatures in these areas.

The SBVS is designed to circulate sufficient air to prevent accumulation of flammable or explosive gas or fuel-vapor mixture from components such as storage batteries and stored fuel.

Refer to Section 12.3.6.5.6 for ventilation system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

9.4.5.2.2 Component Description

The major components of the SBVS are listed below, along with the applicable code and standards. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components~~Table 3.2.2-1 provides the seismic design and other design classifications for components in the SBVS.

Ductwork and Accessories

The main supply and exhaust air shafts 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 shafts. These ducts are constructed of steel and structurally designed for fan shutoff pressures. The ductwork meets the design, testing and construction requirements per ASME AG-1~~-2003~~ (Reference 2).

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Electric Air Heating Convectors (Area Heaters)

The electrical air heating convectors are installed to maintain room ambient conditions. The convectors are controlled by local room temperature sensors and control circuits.

Moisture Separator

The moisture separator is a combination of moisture separator and prefilter. The moisture separator must meet the requirements of RG 1.52 (Reference 10), ASME N509 (Reference 9), and ASME AG-1 (Reference 2). The moisture separator is located upstream of the filter air heater and the HEPA prefilter. The moisture separator shall be a design that has been qualified by testing in accordance with the procedures described in Reference 9.

Recirculation Cooling Units

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The recirculation cooling units consist of a fan section, a water cooling section, and a moisture separator. The fan is driven by an electric motor. The cooling coils are finned coil type and are connected to the safety chilled water system (SCWS). The total cooling capacity for the SBVS recirculation cooling units is as follows:

- KLC 51/54 AN001

  64,800 Btu/hr.
- KLC 51/54 AN002

  32,400 Btu/hr.
- KLC 51/54 AN003

  21,600 Btu/hr.
- KLC 52/53 AN001

  54,000 Btu/hr.
- KLC 52/53 AN002

  32,400 Btu/hr.

The cooling coils are designed in accordance with Reference 2. The moisture separator collects condensate which is directed to drain system.

9.4.5.2.3 System Operation

Normal Plant Operation

During normal plant operation, the fresh conditioned air is supplied to four divisions of the SBs independently for each division by the SBVSE (refer to Section 9.4.6). The isolation dampers on each supply duct are in the open position and the volume control dampers on each supply duct are set to a flow rate in order to maintain a negative pressure in the controlled areas compared to the atmospheric pressure.

The room air conditioning is obtained by the supply and exhaust air flows based on the minimum air renewal rate, equipment heat load, and heat balance between the rooms. The air is heated or cooled to maintain the required ambient conditions of the rooms.

The operational air exhaust from the four divisions of the SBs (hot area) is processed by the NABVS. The isolation dampers on each exhaust duct are in open position, and the volume control dampers on each exhaust duct are set to a flow rate in order to maintain negative pressure in the controlled areas.

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, the SBVS directs the exhaust through the SBVS activated charcoal filtration beds located in the FB prior to release through the plant stack. As a backup, the contaminated air also can be processed through the activated charcoal filtration beds of NABVS. Sufficient redundancy is provided to provide 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 equipment is located. These dampers close during RHR operation to prevent the spread of steam and airborne contamination due to a RHR system pipe failure.

Redundant components are powered from different electrical divisions to remain available in case of failure of one division. As a backup, power is supplied to the engineered safety equipment by the emergency diesel generators (EDG).

Capability for withstanding or coping with an SBO event is met by the design of the AAC power source satisfying the ten minute criteria; (i.e., the AAC power source can be started from the main control room (MCR) within ten minutes of the onset of an SBO event). The SBO diesel generators are designed to operate for a minimum of twenty-four hours with available onsite fuel supplies.

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9.4.5.4 Inspection and Testing Requirements

The SBVS major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Test and analysis will be completed during normal operation with the system operating in an accident alignment. Analysis will use as-built information from equipment to extrapolate the performance of the air-conditioning system. Analysis will show that the equipment performance is adequate to maintain design conditions during plant operating conditions.

Initial in-place acceptance testing of the SBVS is performed as described in Section 14.2 (test abstracts #083 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The SBVS designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of SBVS is performed to demonstrate system and component operability and integrity.

Isolation dampers are periodically inspected and damper seats replaced as required.

Per IEEE 334 (Reference 12), type tests of continuous duty class 1E motors for SBVS are conducted to confirm ESF system operation and availability.

Recirculation cooling units and fans are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 5, 6, and 7). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 3). Cooling coils are hydrostatically tested in accordance with ASME AG-1 (Reference 2) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 13).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 14), American Society of Mechanical Engineers, ASME N510 (Reference 4), and ASME AG-1 (Reference 2).

Emergency filtration units are tested by manufacturer for housing leakage, filter bypass leakage and airflow performance. Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.52 (Reference 10), ASME N510 (Reference 4) and ASME AG-1 (Reference 2). The charcoal adsorber samples are tested for efficiency in accordance with RG 1.52 (Reference 10) and ASTM D3803 (Reference 15). Air filtration and adsorption unit heaters are tested in accordance with ASME N510 (Reference 4).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

In-service test program and test frequency requirements are described in Section 16, "Technical Specification" Subsection 3.7.12 and per Ventilation Filter Test Program (VFTP) described in Section 16, "Technical Specification" Subsection 5.5.10.

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Next File

~~Refer to Section 14.2 (test abstracts #083 and #203) for initial plant startup test program. Initial inplace acceptance testing of SBVS components is performed in accordance with Reference 2, and Reference 4.~~

~~Refer to Section 16 (SR 3.7.12) for surveillance requirements.~~

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9.4.5.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system. The radiation instrumentation requirements for controlling airborne radioactivity releases via the plant stack are addressed in ~~Section 11.5~~Section 11.5.3.1.9 and Table 11.5-1, Monitor R-25.

The minimum instrumentation, indication and alarms for ESF filter systems are provided in Table 9.4.1-1.

9.4.5.6 References

1. NUREG-CR/0660, Boner, G.L. and Hanners, H.W., "Enhancement of Onsite Emergency Diesel Generator Reliability," (subsection A–item 2, and subsection C-item 1), University of Dayton Research Institute UDR-TR-79-07 for U.S. Nuclear Regulatory Commission, January 1979.

2. ASME AG-1~~-2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, ~~2003~~1997 (including the AG-1a~~,~~ -2000, "Housings"~~2004~~ Addenda).

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3. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," American National Standards Institute/American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

4. ASME N510-1989 (R1995), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

5. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

6. ANSI/AMCA-211-1987, "Certified Ratings Program–Air Performance," American National Standards Institute/Air Movement and Control Association International, 1987.

7. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

8. UL 555, "Standard for Fire Dampers," Underwriters Laboratories, Sixth Edition, June 1999.

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9. ASME N509-1989, "Nuclear Power Plant Air Cleaning Units and Components," The American Society of Mechanical Engineers, 1989.~~ASME N509, "Nuclear Power Plant Air Cleaning Units and Components," American National Standards Institute/The American Society of Mechanical Engineers, 2002.~~

10. Regulatory Guide 1.52, Revision 3, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," U.S. Nuclear Regulatory Commission, June 2001.

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11. "ASHRAE Handbook Fundamentals," American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc., 2005.

12. IEEE 334-1974, "IEEE Standard for Type Tests of Continuous-Duty Class 1E Motors for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 1974.

13. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

14. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

15. ASTM D3803-1989, reapproved 1995, "Standard Test Method for Nuclear Grade Activated Carbon," 1989.

16. ERDA 76-21, "Nuclear Air Cleaning Handbook," Oak Ridge National Laboratory, 1976.

- 10CFR 50.63, as it relates to the SBSVE because during a station blackout (SBO), two of the four SBs are backed up by the SBO diesel generators alternate AC (AAC) power. An analysis to determine capability for withstanding or coping with a station blackout event as described by RG 1.155, position C.3.2.4, will be performed. The safety chilled water system (SCWS) chillers which provide cooling to the division 1 and 4 SBVSE air coolers and recirculation units are also powered by the SBO diesels and are available.

The SBVSE maintains acceptable ambient conditions in the SB during SBO conditions. It also ventilates the battery rooms and SCWS rooms in the SB during SBO conditions to maintain the hydrogen concentration and refrigerant concentration below the maximum allowable limits.

The SCWS chillers which provide cooling to the division 1 and 4 SBVSE air coolers and recirculation units are also powered by the SBO diesels and are available.

Air conditioning and heating loads for the SBVSE 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 SBVSE 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 SBVSE supply air duct heaters are designed to operate as required when the supply air temperature is less than the minimum set point value.

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

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Room	Temperature	Humidity
Rest Rooms, changing rooms	65°F - 78°F	30 - 60%
~~I&C and Computer Room,~~ RSS	65°F - 78°F	30 - 60%
Switchgear~~board~~ Rooms	59°F - 104°F	30 - 60%
Cable Floor	41°F - 95°F	30 - 60%

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I&C Equipment Room	68°F - 82°F	30 - 60%
Battery Rooms	65°F - 77°F	30 - 60%
HVAC Rooms	50°F - 95°F	20 - 80%
Cold Mechanical Areas, Emergency Feedwater Pump Rooms, and Component Cooling Water Pump Rooms	41°F - 104°F	30 - 60%
Corridors	50°F - 104°F	30 - 60%

The SBVSE performs the following safety-related system functions:

- Maintains acceptable ambient conditions for the safety-related components in the electrical and instrumentation and controls (I&C) rooms in the SB during accident conditions, taking into account internal and external heat loads.
- Maintains acceptable ambient conditions inside the emergency feed water system (EFWS) pumps and component cooling water system (CCWS) component rooms of the SB during accident conditions, taking into account internal and external heat loads.
- Ventilates the battery rooms and SCWS rooms in the SB to maintain the hydrogen and refrigerant concentration below maximum allowable limits during accident conditions.

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

- Maintains acceptable ambient conditions (temperature and humidity) in the SB for equipment operation and personnel comfort during normal plant operation and plant maintenance.
- Ventilates the battery rooms and safety chilled water system rooms in the SB to maintain the hydrogen concentration and the refrigerant concentration below maximum allowable limits during normal plant operation and plant maintenance.

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For non-safety-related equipment located in the same room with safety-related equipment, the seismic classification for the non-safety-related equipment is described in Section 3.7.3.8 for interaction of Seismic Category I subsystems.

9.4.6.2 System Description

9.4.6.2.1 General Description

The heating, ventilation and air conditioning (HVAC) of each electrical division (SBs 1 through 4) is provided by a separate and independent SBVSE train. In the normal operation state of the system, these functions are provided by a safety-related train.

9.4.6.2.2 Component Description

The major components of the SBVSE are described in the following paragraphs. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components~~Table 3.2.2-1 provides the seismic design and other design classifications for components in the SBVSE.

Supply Air System – Safety-Related Train

The supply air units are located in divisions 1 and 4 at elevation +39 ft and in divisions 2 and 3 at elevation +69 ft (also elevation +96 ft for air intake components). The components are installed in a sheet metal structure.

Each air conditioning train includes:

- Weather protection grilles, electrically heated to prevent ice formation.
- Dampers.
- Insect protection screens.
- Isolation damper, manually operated.
- Set of control dampers with electrical actuator.
- Prefilter.
- Final filter.
- Electric heater, with tubular elements, comprised of four heating stages.

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- Air cooling coil of finned tube coil type has a total cooling capacity of 1,134,900 Btu/hr, supplied with chilled water by the SCWS of the same division.
- Droplet separator, connected to the nuclear island drain and vent system (NIDVS).
- Silencer on fan suction side, splitter type.
- Supply air fan, free wheel radial type, direct driven, with a design air flow of 29,500 scfm.
- Non-return damper.
- Silencer on fan discharge side, splitter type.
- Two air humidifiers, electrically heated and connected to the potable and sanitary water system (PSWS), and NIDVS.

Recirculation-Exhaust Air – Safety-Related Train

The recirculation and exhaust air trains are located in divisions 1 and 4 at elevation +39 ft and in divisions 2 and 3 at elevation +69 ft.

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Each train includes:

- Isolation dampers, manually operated.
- Recirculation and exhaust air fan, radial type, direct driven, with a design air flow of 29,500 scfm.
- Control damper with electrical actuator.
- Non-return damper.
- Isolation damper, manually operated.
- Dampers.
- Weather protection grilles.

Exhaust Air for Battery-Safety Chilled Water Room and Non-controlled Mechanical Area – Safety-Related Train

The exhaust air trains are located in divisions 1 and 4 at elevation +39 ft and in divisions 2 and 3 at elevation +69 ft.

Each train includes:

- Isolation damper, manually operated.
- Exhaust air fan, radial type, direct driven.
- Non-return damper.
- Isolation damper with electrical actuator.

Supply Air System – Maintenance Train

The maintenance train is non-safety-related. The supply air units are located in divisions 1 and 4 at elevation +39 ft. The components are installed in a sheet metal structure.

Each air conditioning train includes:

- Insect protection screen.
- Isolation damper, manually operated.

- Set of control dampers with electrical actuator.
- Prefilter.
- Roughing filter.
- Electric heater, with tubular elements, comprised of four heating stages.

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- Air cooling coil of finned tube coil type, has a total cooling capacity of 1,134,900 Btu/hr supplied with chilled water by the operational chilled water system (OCWS).
- Droplet separator, connected to the NIDVS.
- Silencer on fan suction side, splitter type.
- Supply air fan, free wheel radial type, direct driven, with a design air flow of 29,500 scfm.
- Non-return damper.
- Silencer on fan discharge side, splitter type.
- Two air humidifiers, electrically heated and connected to the PSWS and the NIDVS.

Recirculation-Exhaust Air – Maintenance Train

The maintenance train is non-safety related. The recirculation-exhaust air trains are located in divisions 1 and 4 at elevation +39 ft.

Each train includes:

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- Isolation dampers, manually operated.
- Recirculation and exhaust air fan, radial type, direct driven, with a design air flow of 29,500 scfm.
- Control damper with electrical actuator.
- Non-return damper.
- Isolation damper, manually operated.

Exhaust Air for Battery/Safety Chilled Water Room and Non-controlled Mechanical Area – Maintenance Train

The maintenance train is non-safety related. The exhaust air trains are located in divisions 1 and 4 at elevation +39 ft and in divisions 2 and 3 at elevation +69 ft.

- The design of the SBVSE provides for complete redundancy with four independent divisions; therefore, a single failure in any portion of the SBVSE will not compromise the ability of the system to perform its safety function. Vital power can be supplied from either onsite or offsite power systems, as described in Section 8.2 and Section 8.3. Initial testing and periodic inservice functional testing are carried out in accordance with Section 9.4.6.5.

- Section 3.2 delineates the quality group classification and seismic category applicable to the safety-related portion of this system and supporting systems. The power supplies and control functions necessary for safe function of the SBVSE are Class IE, as described in Section 7.1 and Section 8.3.

- Section 9.4.6.3 describes provisions made to identify and isolate leakage or malfunction and to provide isolation of the non-safety-related portions of the system.

9.4.6.4 Inspection and Testing Requirements

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The SBVSE major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Test and analysis will be completed during normal operation with the system operating in an accident alignment. Analysis will use as-built information from equipment to extrapolate the performance of the air-conditioning system. Analysis will show that the equipment performance is adequate to maintain design conditions during plant operating conditions.

Initial in-place acceptance testing of the SBVSE is performed as described in Section 14.2 (test abstracts #078 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The SBVSE is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of SBVSE is performed to demonstrate system and component operability and integrity.

Isolation dampers are periodically inspected and damper seats replaced as required.

Fans and air handling units are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 7). Cooling coils are hydrostatically tested in accordance with ASME AG-1 (Reference 2) and their performance is rated in accordance with the Air Conditioning and Refrigeration

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Institute (ARI) standards (Reference 8). Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 9), and ASME AG-1 (Reference 2).

Outside air inlet and battery room heaters are tested in accordance with ASME AG-1, Section CA (Reference 2).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

In-service test program and test frequency requirements are described in Chapter 16, "Technical Specification," Section 3.7.13 and per Ventilation Filter Test Program (VFTP) described in Chapter 16, "Technical Specification," Section 5.5.10.

~~Refer to Section 14.2 (test abstracts #078 and #203) for initial plant startup test program. Initial inplace acceptance testing of SBVSE components will be performed in accordance with ASME AG-1-2003 (Reference 2).~~

~~The safety-related portions of the SBVSE are designed and located to permit required periodic testing.~~

9.4.6.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system.

9.4.6.6 References

1. NUREG-CR/0660, Boner, G.L. and Hanners, H.W., “Enhancement of Onsite Emergency Diesel Generator Reliability,” University of Dayton Research Institute UDR-TR-79-07 for U.S. Nuclear Regulatory Commission, January 1979.

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2. ASME AG-1~~-2003~~, “Code on Nuclear Air and Gas Treatment,” The American Society of Mechanical Engineers, ~~2003~~1997 (including the AG-1a~~, -2004~~2000, “Housings” Addenda).

3. “ASHRAE Handbook Fundamentals,” American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., 2005.

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4. ANSI/AMCA-210-1999, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

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5. ANSI/AMCA-211-1987, "Certified Ratings Program-Air Performance," American National Standards Institute/Air Movement and Control Association International, December 1987.

6. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, December 1987.

7. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," American National Standards Institute/American Society of Heating, Refrigerating and Air Conditioning, 1999.

8. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

9. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

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9.4.7 Containment Building Ventilation System

The containment building ventilation system (CBVS) is designed to maintain acceptable ambient conditions inside the Containment Building for proper operation of equipment and instrumentation during normal plant operation and normal shutdown (i.e., outages). The CBVS also provides acceptable ambient conditions for personnel access to the service compartment during normal plant operation, and equipment compartment during outage for conducting inspections, tests and maintenance during normal plant operation.

9.4.7.1 Design Bases

The containment low-flow purge exhaust subsystem outside of Containment is designated as a safety-related, Seismic Category I, ESF ventilation system.

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This exhaust subsystem serves a safety function when operating in a low flow purge alignment (during power operation) and upon receipt of a containment isolation signal. During the short period of time required to close the containment isolation valves, exhaust air from containment flows through the CBVS purge iodine filtration units and is exhausted to the plant vent stack.

The containment penetration isolation valves are safety related and designed to Seismic Category I requirements. The reactor pit cooling fans and internal filtration system components are non-safety related but designed to Seismic Category I requirements. All other components of the CBVS are non-safety related and Non-Seismic.

The CBVS components are located inside buildings that are designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, floods, and external missiles (GDC 2).

The containment low-flow purge exhaust subsystem removes radioactive materials via iodine filtration trains prior to release to the atmosphere (GDC 41). The filtration system is designed to allow periodic inspection (GDC 42).

The internal filtration subsystem filters airborne radioactive materials from the equipment compartments during normal operation.

The containment isolation valves are automatically closed within five seconds upon receipt of a containment isolation signal, in accordance with BTP 6-4 (Reference 8), to maintain the integrity of the containment boundary and to limit the potential release of radioactive material.

The reactor pit area temperature is maintained less than 150°F under postulated accident conditions to prevent concrete degradation.

The containment purge subsystem is designed in accordance with ASME AG-1-2003 (Reference 1) and RG 1.52 for atmospheric cleanup.

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Internal Filtration Subsystem

The internal filtration subsystem (See Figure 9.4.7-3—Containment Building Internal Filtration Subsystem) limits the release of radioactive material by reducing radioactive iodine contamination inside the equipment compartment with air circulation and filtration during normal plant operation. The internal filtration subsystem contains one filtration train which consists of an electric heater, prefilter, upstream HEPA filter, carbon adsorbers, and a downstream HEPA filter; with two redundant fans downstream of the filtration train. The air is drawn from the equipment compartments, filtered, and returned to the equipment compartments.

Radiation monitors are located upstream of the filtration trains for monitoring the radiation in the equipment compartments prior to filtration (refer to Section 11.5.3.1.5 and Table 11.5-1, Monitor R-10).

The system is designed in accordance with Reference 1 and RG 1.140.

Containment Building Cooling Subsystem

The containment building cooling subsystem (See Figure 9.4.7-4—Containment Building Cooling Subsystem) provides cool air into a stainless steel sheet metal circular header located above the residual heat removal-safety injection room, and into the reactor pit cooling fan plenum. The containment building cooling subsystem provides cool air to the reactor coolant pumps, steam generators, chemical volume control system (CVCS), control rod drive mechanism system (CRDMS), and vent and drain system. There are two trains of two main fans and four cooling coils located in the equipment compartments. The cooling coils receive cold water from the operational chilled water system (OCWS).

Two trains of two reactor pit cooling fans located in the equipment compartments supply cool air to the reactor pit area. These fans are used to ventilate the reactor pit during normal and station blackout (SBO) conditions. The reactor pit is cooled by air from a plenum between the main fans and the reactor pit cooling fans. The supply air subsystem to the reactor pit is composed of a 16 duct layout around the main coolant piping.

The exhaust from these areas is recycled through the cooling coils located in the equipment compartments.

The system is designed in accordance with Reference 1.

assigned during the laboratory tests. The periodic in-place testing of adsorbers to determine the leak-tightness is performed per Reference 3.

Fans

The supply and exhaust fans are centrifugal or vane-axial designed with electric motor drivers. Fan performance is rated in accordance with ANSI/AMCA-210-99 (Reference 4), ANSI/AMCA-211 ~~1987~~ (Reference 5), and ANSI/AMCA-300 ~~1985~~ (Reference 6).

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Isolation Dampers

Manual dampers are adjusted during initial plant startup testing to establish accurate air flow balance between rooms. The motor-operated isolation dampers will fail in position in case of power loss. The performance and testing requirements of the dampers will be conducted in accordance with Reference 1.

Fire Dampers

Fire dampers are installed where ductwork penetrates a fire barrier. Fire damper design meets the requirements of UL 555 (Reference 7) and the damper fire rating is commensurate with the fire rating of the barrier penetrated.

Recirculation Cooling Units

The recirculation cooling units consist of a fan section, a water cooling section, and a moisture separator. The housing is constructed of heavy gauge steel. The fan is driven by an electric motor. The cooling coils are finned coil type and are connected to the operational chilled water system. The cooling coils are designed in accordance with Reference 1. The moisture separator collects condensate which is directed to drain system.

9.4.7.2.3 System Operation

Normal Plant Operation

The containment low-flow purge subsystem can operate during normal operation. The containment building negative pressure is maintained by controlling the supply air flow through the motorized dampers. The internal filtration subsystem equipment compartment is isolated unless airborne radioactivity contamination is detected (refer to Section 11.5.3.1.5 and Table 11.5-1, Monitor R-10) and personnel access is required in the service compartment. When the low-flow purge subsystem is in operation, a negative pressure is maintained between the equipment and service compartments.

When the reactor is in cold shutdown, ventilation in the Containment Building is provided by both low-flow and full-flow purge subsystems. The negative pressure in and reactor pit cooling fans is supplied from corresponding emergency diesel generators. Air cooling unit fans stop in the service compartment cooling subsystem.

Fuel Handling Accident in the Containment Building

In the event of a fuel handling accident in the Containment Building, the containment isolation valves on the containment purge subsystem can be manually closed by pushing the emergency push button located in the fuel handling area inside the Containment Building. The dampers are closed when the hatch is opened. The low-flow purge exhaust subsystem is used to avoid the spread of contamination by keeping a negative pressure in the Containment Building. To achieve this safety function, the low-flow purge subsystem exhaust is switched over to the iodine filtration trains of the safeguard building controlled-area ventilation system (refer to Section 9.4.5, Section 11.5.3.1.5, Section 11.5.4.8, and Table 11.5-1, Monitor R-10).

High Pressure Level or Safety Injection Signal

In case of high-pressure level or a safety injection signal, the containment penetration valves on the containment purge subsystem are closed and air flow in the Containment Building is stopped.

Station Blackout

In the event of a SBO, the reactor pit area is air cooled to prevent degradation of the concrete structure. The reactor pit cooling fans take air from the supply air shaft. The air is supplied to the bottom of the pit and transferred through openings in the pit wall around the main coolant piping to maintain a temperature less than 150°F. The power supply to the reactor pit cooling fans is provided by the alternate AC (AAC) diesel generators.

Small-Break Loss-of-Coolant Accident and Loss-of-Coolant Accident

In the event of a small-break loss-of-coolant accident (SBLOCA) or loss-of-coolant accident (LOCA), containment isolation valves automatically close after receipt of the containment isolation signal. These valves are designed to perform their isolation function under LOCA conditions and will close within five seconds after receipt of a containment isolation signal.

9.4.7.3 Safety Evaluation

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The CBVS maintains proper temperatures in the Containment Building during normal operations and shutdown conditions. Sufficient redundancy is included for proper operation of the system when one active component is out of service. The CBVS is ~~not~~ an engineered safety feature and ~~has no~~the safety-related function provides containment isolation and low-flow purge exhaust from the containment isolation

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valves during a postulated rod ejection accident~~except the containment isolation and low flow purge~~.

The CBVS low flow purge removes radioactive materials via two 100 percent iodine filtration trains prior to release to the plant vent stack. Each train operates independently. A failure in one train will not prevent the remaining train from providing the required engineered safety feature function.

The containment purge subsystem supply and exhaust penetrations through the containment annulus are equipped with two normally open isolation valves, each connected to separate control trains. A failure in one train will not prevent the remaining isolation valve from providing the required capability. The valves automatically close within five seconds after receipt of a containment isolation signal. The isolation valves and containment penetrations are the only portions of the CBVS that are safety related.

9.4.7.4 Inspection and Testing Requirements

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The CBVS major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Initial in-place acceptance testing of the CBVS is performed as described in Section 14.2 (test abstracts #073 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The CBVS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of CBVS is performed to demonstrate system and component operability and integrity.

During normal operation, equipment rotation is utilized to reduce and equalize wear on redundant equipment during normal operation.

Isolation dampers are periodically inspected and damper seats replaced as required.

Per IEEE 334 (Reference 9), type tests of continuous duty class 1E motors for CBVS are conducted to ensure ESF system operation and availability.

Fans and air handling units are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 2). Cooling coils are

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hydrostatically tested in accordance with ASME AG-1 (Reference 1) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 10).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 11), American Society of Mechanical Engineers, ASME N510 (Reference 3), and ASME AG-1 (Reference 1).

Emergency filtration units are tested by manufacturer for housing leakage, filter bypass leakage and airflow performance. Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.52 (Reference 12), ASME N510 (Reference 3) and ASME AG-1 (Reference 1). The charcoal adsorber samples are tested for efficiency in accordance with RG 1.52 (Reference 12) and ASTM D3803 (Reference 13). Air filtration and adsorption unit heaters are tested in accordance with ASME N510 (Reference 3).

Internal carbon filtration units are tested for housing leakage, filter bypass leakage and airflow performance. Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.140 (Reference 14), ASME N510 (Reference 3) and ASME AG-1 (Reference 1). The charcoal adsorber samples are tested for efficiency in accordance with RG 1.140 (Reference 14) and ASTM D3803 (Reference 13). Air filtration and adsorption unit heaters are tested in accordance with ASME AG-1, Section CA (Reference 1).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

In-service test program requirements are described per Ventilation Filter Test Program (VFTP) in Chapter 16, "Technical Specification" Section 5.5.10. ESF filtration unit testing will be completed at least once every 24 months.

9.4.7.4.1 Preoperational Tests

Refer to Section 14.2 (test abstracts #073, #075, #076, and #203) for initial plant startup test program. Initial in-place acceptance testing of CBVS components will be performed in accordance with Reference 1 and Reference 3.

9.4.7.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the main control room (MCR). Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local

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instruments are provided to measure differential pressure across filters, flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system.

The minimum instrumentation, indication and alarms for ESF filter systems are provided in Table 9.4.1-1.

The radiation instrumentation requirements for controlling airborne radioactivity releases via the plant stack are addressed in ~~Section 11.5~~Sections 11.5.3.1.4, 11.5.3.1.5, Section 11.5.4.8, and Table 11.5-1, Monitors R-7 and R-8 (Low Purge Subsystem) and R-10 (Internal Filtration Subsystem).

9.4.7.6 References

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1. ASME AG-1 ~~2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, ~~2003~~1997 (including the AG-1a~~, 2004~~2000, "Housings" Addenda).

2. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," ANSI/American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

3. ASME N510-1989 (R1995), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

4. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

5. ANSI/AMCA-211-1987, "Certified Ratings Program–Air Performance," American National Standards Institute/Air Movement and Control Association International, 1987.

6. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

7. UL 555, "Standard for Fire Dampers," Underwriter's Laboratories, Sixth Edition, June 1999.

8. NUREG-0800, BTP 6-4, Revision 3, "Containment Purging During Normal Plant Operations," U.S. Nuclear Regulatory Commission, March 2007.

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9. IEEE 334-1974, "IEEE Standard for Type Tests of Continuous-Duty Class 1E Motors for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 1974.

10. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

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11. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

12. Regulatory Guide 1.52, Revision 3, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants", U.S. Nuclear Regulatory Commission, June 2001.

13. ASTM D3803-1989, reapproved 1995, "Standard Test Method for Nuclear Grade Activated Carbon," 1989.

14. Regulatory Guide 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants", U.S. Nuclear Regulatory Commission, June 2001.

15. ASME N509-1989, "Nuclear Power Plant Air Cleaning Units and Components," The American Society of Mechanical Engineers, 1989.

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16. ERDA 76-21, "Nuclear Air Cleaning Handbook," Oak Ridge National Laboratory, 1976.

9.4.8.2.2 Component Description

The major components of the RWBVS are described in the following paragraphs. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components~~Table 3.2.2-1 provides the seismic design and other design classifications for components in the RWBVS.

Supply Air Handling Units

Each of the two supply air handling units consists of a housing, a preheater, a heater, a cooler, a prefilter, and a filter. The outlets of the air handling units combine into a common duct that provides supply air to two parallel supply fans. The outlet of the two supply fans combine into a common duct with a supply air humidifier.

System Exhaust Air Handling Units

Each of the two exhaust air handling units consists of an airtight housing, a prefilter, a HEPA filter, a carbon adsorber, a HEPA post-filter, and motor operated inlet and outlet dampers. The outlets of both air handling units join into a single line and then separate to supply the inlets of the two parallel exhaust fans, allowing each air handling unit to supply either exhaust fan. Upstream of the two exhaust air handling units in the common duct are electric heaters to maintain proper air inlet temperature to the filtration system.

Room Exhaust Air Handling Units

Each of the five parallel room exhaust air filtration units consists of an air-tight housing, a prefilter, a HEPA filter, and the associated manual dampers. The manual dampers align the filter units to the room exhaust fans or the iodine filtration unit. These parallel air filtration units supply air to two parallel room exhaust fans. The units can also be aligned to a single room exhaust air iodine filtration unit.

Room Exhaust Air Iodine Filtration Unit

The room exhaust air iodine filtration unit consists of an air-tight housing, an electric air inlet heater, a carbon adsorber, a HEPA post-filter, and associated manual air dampers. The manual air dampers reroute air to the two parallel iodine filter booster fans, which supply air to the inlet of the room exhaust air fans.

Supply, System Exhaust, Room Exhaust, and Iodine Filter Unit Booster Fans

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The supply, exhaust, and iodine filter unit booster fans are centrifugal type fans and are directly driven by the shaft of an electric motor. The fans are designed and rated in accordance with ANSI/AMCA 210~~-99~~ (Reference 4), ANSI/AMCA 211~~-1987~~ (Reference 5), and ANSI/AMCA 300~~-1985~~ (Reference 6).

Isolation Dampers

The isolation dampers are located upstream and downstream of each filtration train. The motor-operated dampers will fail to “close” or “open” position in case of loss of power, depending on the safety function of the dampers. The performance and testing requirements of the dampers are per ASME AG-1 ~~-2003.~~ (Reference 1).

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Electric Heaters

Electric heaters meet the requirements of Reference 1.

Heating and Cooling Coils

Preheating, heating, and cooling coils are of the continuous tube type, which are made of finned tubes with return bends providing continuous and uninterrupted flow of water within each tube.

Prefilters

The prefilters are located upstream of HEPA filters and collect large particles to increase the useful life of the high efficiency filters. The prefilters meet the requirements of ANSI/ASHRAE Standard 52.2-1999 (Reference 2).

HEPA Filters

HEPA filters are constructed, qualified and tested in accordance with Reference 1. The periodic in-place testing of HEPA filters to determine the leak-tightness is performed per ASME N510-1989 (Reference 3).

Adsorbers

Carbon adsorbers are used to remove radioactive iodine from the exhaust air. The efficiency for removal of methyl iodine is based on the decontamination efficiency assigned during the laboratory tests. The periodic inplace testing of the adsorbers to determine the leak-tightness is performed per Reference 3. The activated carbon total bed depth requirement will be 2 inches with a maximum assigned activated carbon decontamination efficiency of 95 percent.

Fire Dampers

Fire dampers are installed where ductwork penetrates a fire barrier. Fire damper design meets the requirements of UL 555 (Reference 7) and the damper fire rating is commensurate with the fire rating of the barrier penetrated.

Abnormal Operation

The RWBVS is not required to operate during a loss of offsite power (LOOP) or station blackout (SBO) and the RWBVS is not required to operate during or after a design basis accident; therefore the system is provided with no emergency or backup power. A failure in the SHS, AHS, OCWS, or the SAMS has no major impact on the RWBVS. A failure in the RWBVS has no impact on the above support systems.

9.4.8.3 Safety Evaluation

The RWBVS is not required for the safe shutdown of the plant or for mitigating the consequences of a design basis accident or a 10 CFR Part 100 event. Therefore, the RWBVS has no safety-related function.

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9.4.8.4 Inspection and Testing Requirements

The RWBVS major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Initial in-place acceptance testing of the RWBVS is performed as described in Section 14.2 (test abstracts #080 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The RWBVS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of RWBVS is performed to demonstrate system and component operability and integrity.

During normal operation, equipment rotation is utilized to reduce and equalize wear on redundant equipment during normal operation.

Isolation dampers are periodically inspected and damper seats replaced as required.

Fans are tested by the manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 2). Cooling coils are hydrostatically tested and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 8).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC

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Air Duct Leakage Test Manual" (Reference 9), American Society of Mechanical Engineers, ASME N510 (Reference 3), and ASME AG-1 (Reference 1).

Heaters are tested in accordance with ASME AG-1, Section CA (Reference 1). Carbon filtration units are tested for housing leakage, filter bypass leakage and airflow performance. Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.140 (Reference 8), ASME N510 (Reference 3) and ASME AG-1 (Reference 1). The charcoal adsorber samples are tested for efficiency in accordance with RG 1.140 (Reference 8) and ASTM D3803 (Reference 10). Air filtration and adsorption unit heaters are tested in accordance with ASME AG-1, Section CA (Reference 1).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

~~Refer to Section 14.2 (test abstracts #080 and #203) for initial plant startup test program. Initial inplace acceptance testing of RWBVS components is performed in accordance with Reference 1, and Reference 3.~~

9.4.8.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters, and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure.

The fire detection and sensors information is delivered to the fire detection system.

The radiation instrumentation requirements for controlling airborne radioactivity releases via the plant stack are addressed in ~~Section 11.5~~Section 11.5.3.1.8 and Table 11.5-1, monitor/sample points R-20, R-21, R-22 (exhaust), and R-23 and R-24 (supply).

All instrumentation provided with the filtration units is as required by RG 1.140.

9.4.8.6 References

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1. ASME AG-1~~-2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 1997~~2003~~ (including the AG-1a~~,~~ -2000, "Housings,"~~2004~~ Addenda).

2. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," ANSI/American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

3. ASME N510-1989 (R1995), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

4. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

5. ANSI/AMCA-211-1987, "Certified Ratings Program–Air Performance," American National Standards Institute/Air Movement and Control Association International, 1987.

6. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

7. UL 555, "Standard for Fire Dampers," Underwriters Laboratories, Sixth Edition, June 1999.

09.04.01-1

8. NRC Regulatory Guide 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," 2001.

9. HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

10. ASTM D3803-1989, reapproved 1995, "Standard Test Method for Nuclear Grade Activated Carbon," 1989.

11. ASME N509-1989, "Nuclear Power Plant Air Cleaning Units and Components," The American Society of Mechanical Engineers, 1989.

12. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

Ventilation of Diesel Hall

The outside air is drawn into the HVAC supply room through an air intake screen or grill which prevents large objects from entering the air intake. The fresh air intake is located approximately fifty feet above grade elevation and is protected against tornado missiles. The screen or grill is heated during the winter to prevent ice buildup.

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The air from the HVAC supply room is supplied through two separate air trains which include back draft damper, prefilter, and supply fan. Each Diesel Hall supply fan air flow is designed for 85,000 scfm. The supply air is then delivered through ductwork to the diesel hall ~~and inlet duct to the electric room air conditioning unit~~. The main tank room supply air is supplied from the diesel hall or HVAC supply air room.

During winter conditions, when the EDGs are not in operation, the air in the diesel hall is recirculated through four electrical air fan heaters. These fans are controlled by local thermostats to maintain the required minimum temperature.

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The exhaust air from the diesel hall is directed to the HVAC exhaust room through two separate ducts which include an exhaust fan and a back draft damper. Each Diesel Hall supply fan air flow is designed for 85,000 scfm. The exhaust air is then directed to the building exhaust through an outlet screen or grill.

Ventilation of Electric Room

The inlet air supply for the electric room is drawn from ~~a common air supply duct of the diesel hall~~ HVAC supply air room through ~~a fire damper and~~ an electric louver damper. The supply air is then directed through an air conditioning unit which consists of a manual louver damper, prefilter, high efficiency particulate air (HEPA) filter, cooling coil, moisture separator, electric heater, supply fan, and a humidifier. The control/electrical room supply fan air flow is designed for 6,000 scfm. The cooling coil has a total cooling capacity of 140,000 Btu/hr and is cooled by a packaged chiller unit. The conditioned air is supplied to the electric room through a back draft damper and a fire damper. The electric heater increases the supply air temperature during winter conditions.

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The exhaust air from the electric room is recirculated back to the air conditioning unit through a fire damper and a back draft damper. The outside air supply and recirculated air from the electric room are controlled to maintain ambient conditions inside the electric room.

Ventilation of Main Tank Room

The air supply to the main tank room is drawn from the diesel hall or HVAC supply air room through an electric louver damper, a back draft damper, and a fire damper. The exhaust air from the main tank room is directed through louver damper, exhaust fan,

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and a back draft damper. The exhaust air is then directed to the building exhaust through an outlet screen or grill. The exhaust fan is designed to maintain the required ventilation rate of the main tank room. The main tank room exhaust design air flow is 3,200 scfm. During winter, local heaters maintain the required minimum temperature inside the main tank room. These heaters are controlled by local thermostats.

9.4.9.2.2 Component Description

The major components of the EPGBVS are listed in the following paragraphs, along with the applicable codes and standards. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components~~Table 3.2.2-1 provides the seismic design and other design classifications for components in the EPGBVS.

Ductwork and Accessories

The supply and exhaust air ducts are constructed of galvanized ~~sheet~~ or stainless steel plates or sheets, and structurally designed for fan shutoff pressures. The ductwork meets the design, testing and construction requirements of ASME AG-1~~-2003~~ (Reference 1).

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Electric Air Heating Convectors (Area Heaters)

The electric area heaters are installed in the main tank room to maintain room ambient conditions and controlled by local room temperature sensors. Electrical heating coils are fin tubular type and meet the requirements of Reference 1.

In-line Electric Air Heaters

In-line electric air heaters are installed in the air conditioning ductwork for the electric room and used to heat the supply air to the acceptable temperature. The heaters will meet the requirements of Reference 1.

Fan Heaters

Fan heaters are used in the diesel hall to maintain acceptable temperature in the area. The fan heaters include a fan and electric heater. These fan heaters are controlled by a thermostat.

Prefilters

The prefilters are located upstream of HEPA filters and collect large particles to increase the useful life of high efficiency filters. The prefilters meet the requirements of ANSI/ASHRAE Standard 52.2~~-1999~~ (Reference 2).

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HEPA Filters

HEPA filters are constructed, qualified and tested in accordance with Reference 1. The periodic inplace testing of HEPA filters to determine the leak-tightness is performed in accordance with ASME N510-1989 (Reference 3).

09.04.03-3

Fans

The supply and exhaust fans are centrifugal or axial type with electrical motor drivers. Fan performance is rated in accordance with ANSI/AMCA 210-99 (Reference 4), ANSI/AMCA-211-1987 (Reference 5), and ANSI/AMCA 300-1985 (Reference 6).

Isolation Dampers

Manual dampers are adjusted during initial plant testing to establish accurate flow balance between the rooms. The motor-operated dampers will fail to "close" or "open" in the "as-is" position in the case of power loss, depending on the safety function of the dampers. The performance and testing requirements of the dampers are in accordance with Reference 1.

Fire Dampers

Fire dampers are installed where ductwork penetrates a fire barrier. Fire damper design meets the requirements of UL 555 (Reference 7) and the damper fire rating is commensurate with the fire rating of the barrier penetrated. The fire dampers are included in the discussion of the EPGB fire protection system (refer to Appendix 9A.3.6).

Cooling Coils

Cooling coils are installed in the supply train for cooling of the electrical room. The cooling coils are of finned tube coil type and designed in accordance with Reference 1. The coil is cooled using a refrigerant from a packaged chiller unit.

Humidifiers

A humidifier is installed in the air conditioning train to maintain humidity conditions as required in the electric room. Humidity levels are controlled by the humidity sensors in the room.

Moisture Separator

The moisture separator is installed in the air conditioning train to collect condensate, which is directed to the drain system.

phenomena. Chapter 3 provides the bases for adequacy of the structural design of the EPGBs.

The EPGBVS remains functional after a safe shutdown earthquake (SSE) event. Chapter 3 provides the design loading conditions, and Section 7.4 addresses the systems required for safe shutdown.

Redundancy is provided for the EPGBVS components and no single failure compromises the safety function of the system. Vital power is supplied from onsite or offsite power systems.

9.4.9.4 Inspection and Testing Requirements

The EPGBVS major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Test and analysis will be completed during normal operation with the system operating in an accident alignment. Analysis will use as-built information from equipment to extrapolate the performance of the air-conditioning system. Analysis will show that the equipment performance is adequate to maintain design conditions during plant operating conditions.

Initial in-place acceptance testing of the EPGBVS is performed as described in Section 14.2 (test abstracts #084 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The EPGBVS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of EPGBVS is performed to demonstrate system and component operability and integrity.

Isolation dampers are periodically inspected and damper seats replaced as required.

Fans are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 2). Cooling coils are hydrostatically tested in accordance with ASME AG-1 (Reference 1) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 9).

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Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 10), and ASME AG-1 (Reference 1).

Heaters are tested in accordance with ASME AG-1, Section CA (Reference 1).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

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Refer to Section 14.2 (test abstract #084) for initial plant startup test program. Initial inplace acceptance testing of the EPGBVS components is performed in accordance with Reference 1 and Reference 3.

9.4.9.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system.

9.4.9.6 References

1. ASME AG-1 2003, “Code on Nuclear Air and Gas Treatment,” The American Society of Mechanical Engineers, 20031997 (including the AG-1a, -2000, “Housings,” 2004 Addenda).

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2. ANSI/ASHRAE Standard 52.2-1999, “Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size,” ANSI/American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

3. ASME N510-1989 (R1995), “Testing of Nuclear Air-Treatment Systems,” The American Society of Mechanical Engineers, 1989.

4. ANSI/AMCA-210-99, “Laboratory Methods of Testing Fans for Aerodynamic Performance Rating,” American National Standards Institute/Air Movement and Control Association International, December 1999.

5. ANSI/AMCA-211-1987, “Certified Ratings Program–Air Performance,” American National Standards Institute/Air Movement and Control Association International, 1987.

6. ANSI/AMCA-300-1985, “Reverberant Room Method of Testing Fans for Rating Purposes,” American National Standards Institute/Air Movement and Control Association International, 1985.

7. UL 555, “Standard for Fire Dampers,” Underwriter’s Laboratories, Sixth Edition, June 1999.

8. “ASHRAE Handbook Fundamentals,” American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., 2005.

9. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

10. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

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Ventilation of Diesel Hall and Fuel Tank Room

The outside air is drawn to the SBODG division through an air intake screen and grill, which prevents large objects from entering the air intake. The screen and grill are heated during cold weather to prevent ice buildup. The outside air is supplied through supply fans which are designed to provide the required air delivery flow rates. During winter conditions, when the SBODGs are not in operation, the air in the diesel hall is recirculated through the electric fan heaters to maintain the required minimum temperature. The exhaust air from the diesel hall and fuel tank room is exhausted outside the building.

Ventilation of Electrical Room

The inlet air supply for the electrical room is drawn from a common air supply shared with the diesel hall. The inlet air is then directed through an air conditioning unit. The conditioned air is supplied to the electrical room. The electric heaters increase the supply air temperature during cold weather conditions. The exhaust air from the electrical room is recirculated back through the air conditioning unit.

9.4.10.2.2 Component Description

The major components of the SBORVS are listed as follows, along with the applicable codes and standards. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components~~Table 3.2.2-1 provides the seismic design and other design classifications for components in the SBORVS.

Ductwork and Accessories

The supply and exhaust air ducts are constructed of sheet steel and are structurally designed for fan shutoff pressures. The ductwork meets the design, testing and construction specifications of ASME AG-1~~-2003~~ (Reference 1).

09.04.03-3

Electric Heaters

The electric heaters are installed to maintain room ambient conditions, which are controlled by local room temperature sensors. The electric heaters are designed to commercial standards.

Prefilters

The prefilters are located upstream of the fans to prevent large particles from entering the system. The prefilters meet the specifications of ANSI/ASHRAE Standard 52.2~~-1999~~ (Reference 2).

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conditioning train. The mixed air supply temperature and humidity are maintained by the electrical heater, cooling coils, and humidifier located in the air conditioning train.

The exhaust air is discharged through the duct to an exhaust fan, then exhausted from the Switchgear Building. Air renewals for the electrical room, diesel hall, and fuel tank room are maintained as needed to obtain the required ambient temperatures.

Fire dampers are located in the ventilation system to avoid fire propagation within the SBODG divisions. These rooms are completely isolated from each other in case of a fire in an individual room. Fire is detected by a fire alarm system, which automatically closes the corresponding fire damper.

Abnormal Operating Conditions

Failure of a Component

If one or more components of the SBODG division fail, the SBORVS is not able to maintain the required ambient conditions in the affected SBO diesel division. Because there are two redundant divisions, the failure of a component in one division does not affect the other division.

Station Blackout

In the event of SBO, the SBODGs are started. Each of the two SBORVS divisions receives power from its associated SBODG.

9.4.10.3 Safety Evaluation

There are no safety-related components for the SBORVS. The SBODGs are required only for BDBEs.

9.4.10.4 Inspection and Testing Requirements

09.04.01-1

The SBORVS major components, such as dampers, motors, fans, filters, coils, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Initial in-place acceptance testing of the SBORVS is performed as described in Section 14.2 (test abstracts #086 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The SBORVS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of SBORVS is performed to demonstrate system and component operability and integrity.

09.04.01-1

Isolation dampers are periodically inspected and damper seats replaced as required.

Fans are tested by the manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 3, 4, and 5). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 2). Cooling coils are hydrostatically tested and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 7). Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 8).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

~~Refer to Section 14.2 (test abstract #086) for initial plant startup test program.~~

9.4.10.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the main control room (MCR). Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system.

9.4.10.6 References

09.04.03-3

1. ASME AG-1~~-2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, ~~2003~~1997 (including the AG-1a~~, -2004~~2000, "Housings" Addenda).

2. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," ANSI/American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

3. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

4. ANSI/AMCA-211-1987, "Certified Ratings Program–Air Performance," American National Standards Institute/Air Movement and Control Association International, 1987.

5. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

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6. UL 555, "Standard for Fire Dampers," Underwriter's Laboratories, Sixth Edition, June 1999.

7. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

8. HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

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Air conditioning and heating loads for the ESWS pump rooms are calculated using methodology identified in ASHRAE Handbook (Reference 8).

- 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 ESWS pump 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).

9.4.11.2 System Description

9.4.11.2.1 General Description

A drawing of the ESWPBVS applicable to each of the four ESWS Pump Buildings is shown in Figure 9.4.11-1—Essential Service Water Pump Building Ventilation System.

The ESWPBVS supplies the recirculation air for cooling or heating of the ESWS pump area and electrical equipment area located inside each of the four ESWS Pump Buildings. Each building has its own independent ventilation system.

This ventilation system is not expected to contain or interface with any radioactive materials, and so is not considered an Engineered-Safety-Feature Atmospheric Clean-Up System.

Room air is drawn through an air inlet grill and processed through an air conditioning train. The conditioned air is supplied to the ESWS pump area and electrical equipment area. The room air is then returned to the air conditioning train. The air conditioning train for each building is comprised of the following components:

- Recirculation supply air ductwork.

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- Cooling coils, which cool the recirculation air to the required supply air temperature, have a total cooling capacity of 619,400 Btu/hr. The cooling coils are supplied with water from the ESWS pump and the water is discharged into the respective cooling tower basin. Manual isolation valves are provided to isolate the cooling coils for maintenance.

- Moisture separator, which drains the condensate to the cooling tower basin.

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- Heaters, which heat the recirculation air during winter conditions to maintain the minimum required temperature.
- Supply air recirculation fans, ~~which~~ are designed to provide an air flow rate of 30,000 scfm.~~the required airflow rate.~~
- Supply air louver dampers, which control the air flow to the ESWS pumps area and electrical equipment area.

9.4.11.2.2 Component Description

The major components of the ESWPBVS are listed in the following paragraphs, along with the applicable codes and standards. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components~~Table 3.2.2-1 provides the seismic design and other design classifications for components in the ESWPBVS.

Ductwork and Accessories

The supply air duct is constructed of galvanized sheet steel and is structurally designed for the fan shutoff pressure. The ductwork meets the design, construction and testing requirements of ASME AG-1 ~~2003~~ (Reference 2).

09.04.03-3

Cooling Coils

The cooling coils are designed in accordance with Reference 2.

Cooling Coil Isolation Valves

The cooling coil isolation valves are designed to meet ASME Boiler and Pressure Vessel Code, Section III, Class 3 (Reference 7).

Moisture Separators

Each moisture separator is installed to collect the condensate which is directed to the cooling tower basin.

Electric Heaters

The electric heaters meet the requirements of Reference 2.

Air Supply Fan

The fan is centrifugal or axial type with an electrical motor driver. Fan performance is rated in accordance with ANSI/AMCA-210 ~~99~~ (Reference 4), ANSI/AMCA-211 ~~1987~~ (Reference 5), and ANSI/AMCA-300 ~~1985~~ (Reference 6).

09.04.03-3

the outside air is at the maximum site design ambient temperature of 115°F. The heater is controlled by a local temperature control system having a predetermined temperature setpoint.

The ESWPBVS is located in the ESWS Pump Building, which is designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other similar natural phenomena. Section 3.3, Section 3.4, Section 3.5, Section 3.7, and Section 3.8 provide the bases for the adequacy of the structural design of these buildings.

The components of the ESWPBVS remain functional and perform their intended safety function after anticipated operational occurrences and design basis accidents, such as a fire, internal missiles, or pipe break (GDC 4). Section 3.5.1.1 provides the bases for this determination for internally generated missiles outside containment. For missiles generated by tornadoes and extreme winds, see Section 3.5.1.4 and Section 3.5.2. Piping failures due to high energy line breaks are addressed in Section 3.6.1.

Since redundancy of the ESWPBVS is provided, no single failure compromises the safety functions of the system. Vital power is supplied from either onsite or offsite power systems, as described in Chapter 8.

The power supplies and control functions necessary for safe function of the ESWPBVS are from a Class 1E system, as described in Chapter 7 and Chapter 8.

9.4.11.4 Inspection and Testing Requirements

09.04.01-1

The ESWPBVS major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Test and analysis will be completed during normal operation with the system operating in an accident alignment. Analysis will use as-built information from equipment to extrapolate the performance of the air-conditioning system. Analysis will show that the equipment performance is adequate to maintain design conditions during plant operating conditions.

Initial in-place acceptance testing of the ESWPBVS is performed as described in Section 14.2 (test abstracts #088 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The ESWPBVS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

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During normal plant operation, periodic testing of ESWPBVS is performed to demonstrate system and component operability and integrity.

Isolation dampers are periodically inspected and damper seats replaced as required.

Fans are tested by the manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 9). Cooling coils are hydrostatically tested in accordance with ASME AG-1 (Reference 2) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 10).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 11), and ASME AG-1 (Reference 2).

Heaters are tested in accordance with ASME AG-1, Section CA (Reference 2).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

~~Refer to Section 14.2 (test abstracts #088 and #203) for initial plant startup test program. Initial in place acceptance testing of ESWPBVS components is performed in accordance with Reference 2, and ASME N510-1989 (Reference 3).~~

9.4.11.5 Instrumentation Requirements

Indication of the operational status of the equipment, instrument indications and alarms are provided in the main control room (MCR). Fans and heaters are operable from the MCR. Local instruments are provided to measure flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system.

9.4.11.6 References

1. NUREG-CR/0660, Boner, G.L. and Hanners, H.W., "Enhancement of Onsite Emergency Diesel Generator Reliability," University of Dayton Research Institute UDR-TR-79-07 for U.S. Nuclear Regulatory Commission, January 1979.

2. ASME AG-1 ~~-2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, ~~2003~~1997 (including the AG-1a~~, -2004~~2000, "Housings," Addenda).

3. ASME N510-1989 (R1995), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

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4. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

5. ANSI/AMCA-211-1987, "Certified Ratings Program–Air Performance," American National Standards Institute/Air Movement and Control Association International, 1987.

6. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

7. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Facility Components," Class 3 Components, The American Society of Mechanical Engineers, 2004.

8. "ASHRAE Handbook Fundamentals," American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., 2005.

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9. ANSI/ASHRAE Standard 52.2-1999, " Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," ANSI/ American Society of Heating,Refrigerating and Air Conditioning Engineers, 1999.

10. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

11. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

9.4.12 Main Steam and Feedwater Valve Room Ventilation System

The main steam and feedwater valve room ventilation system (VRVS) is designed to maintain ventilation and ambient temperatures to allow personnel access for the following areas:

- Main steam valve rooms.
- Feedwater valve rooms.
- Steam generator blowdown valve room.

9.4.12.1 Design Bases

The VRVS performs no safety-related functions and the system is not required to operate during a design basis accident (DBA). The safety and seismic classification of VRVS components is provided in Section 3.2.

09.04.02-1

For non-safety-related equipment located in the same room with safety-related equipment, the seismic classification for the non-safety-related equipment is described in Section 3.7.3.8 for interaction of Seismic Category I subsystems.

The VRVS is designed to maintain a minimum temperature of 50°F and a maximum temperature of 104°F in the valve rooms for personnel accessibility during normal plant operation and planned shutdowns.

9.4.12.2 System Description

9.4.12.2.1 General Description

A simplified diagram of the VRVS for divisions 1, 2, 3 and 4, is shown in Figure 9.4.12-1—Main Steam and Feedwater Valve Room Ventilation System.

The room air flow rates are calculated based on the heat released by operating equipment, lighting, external loads, and heat loads from adjacent rooms.

The recirculation cooling unit for each valve room is comprised of the following components:

- Recirculation ductwork to supply and extract air to and from the rooms.
- Cooling coils connected to operational chilled water system.
- Moisture separator.
- Recirculation fan.

The room hot air is recirculated by the recirculation fan through the air inlet duct and cooling coils. The cool air is supplied back to the room through the air outlet duct. Electric heaters are located in each room to maintain the minimum room temperature during normal operations.

9.4.12.2.2 Component Description

The major components of the VRVS, along with their applicable codes and standards, are described in the following paragraphs. ~~Refer to Section 3.2 for the seismic and system quality group classification of these components.~~Table 3.2.2-1 provides the seismic design and other design classifications for components in the VRVS.

Ductwork

The supply and exhaust air ducts are constructed of sheet steel and are structurally designed for the fan shutoff pressure. The ductwork meets the design, testing and construction requirements per ASME AG-1~~-2003~~ (Reference 1).

09.04.03-3

Recirculation Cooling Units

The recirculation cooling units consist of a fan section and a water cooling section. The condensate from the cooling section is directed to the drain system. The cooling coils are designed in accordance with Reference 1.

Fans

The recirculation fans are centrifugal or vane-axial design with electrical motor driver. Fan performance is rated in accordance with ANSI/AMCA-210~~-99~~ (Reference 2), ANSI/AMCA-211-1987 (Reference 3), and ANSI/AMCA-300~~-1985~~ (Reference 4).

09.04.03-3

Electric Heater

The electric heaters have tubular sheathed elements arranged in a housing.

9.4.12.2.3 System Operation

Normal Plant Operation

The VRVS operates during normal operation and shutdown conditions. Recirculation cooling units for each valve room operate automatically. Room air is recirculated through the cooling units to maintain an acceptable room temperature. Operation of the recirculation fans is controlled by room temperature sensors. The recirculation cooling units start automatically when the room temperature exceeds 100°F, and stop when the temperature falls below 91°F.

Electric heater operation is controlled by room temperature sensors. Unit heaters start automatically when the room temperature drops below the temperature setpoint.

Abnormal Operating Conditions

Failure of Recirculation Cooling Units

In case of loss of a recirculation cooling unit for a specific room, equipment function will not be affected since the equipment is designed for higher temperatures. A high temperature alarm is generated in the main control room (MCR) for operator action.

Failure of Electric Heaters

Redundant heaters are provided in each of the main steam valve rooms. If a heater fails, the redundant heater in the room will operate to maintain the temperature above the minimum value of 50°F.

Redundant heaters are not provided in the feedwater valve rooms and the steam generator blowdown valve room. If a heater fails in a one of these rooms, equipment function will not be affected since the equipment is designed for lower temperatures. A low temperature alarm is generated in the MCR for operator action.

Loss of Offsite Power

Recirculation cooling units and electric heaters for the valve rooms are not provided with emergency power; these components will not operate during loss of offsite power (LOOP). The operation of these components is not required for equipment operability in these rooms.

Station Blackout

Recirculation cooling units and electric heaters for valve rooms are not supplied from the alternate alternating current (AAC) source; therefore these components will not operate during a station blackout (SBO). The operation of these components is not required for equipment operability in these rooms.

9.4.12.3 Safety Evaluation

The operation of VRVS is not required for the safe shutdown of the plant or for mitigating the consequences of a DBA; therefore the system has no safety-related function.

9.4.12.4 Inspection and Testing Requirements

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The VRVS major components, such as motors, fans, coils, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Initial in-place acceptance testing of the VRVS is performed as described in Section 14.2 (test abstracts #089 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

During normal plant operation, periodic testing of VRVS is performed to demonstrate system and component operability and integrity.

Fans are tested by the manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 2, 3, and 4). Cooling coils are hydrostatically tested and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 5).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 6).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

~~Refer to Section 14.2 (test abstract #087) for initial plant startup test program. Initial in-place acceptance testing of VRVS components will be performed in accordance with Reference 1.~~

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9.4.12.5 Instrumentation Requirements

Indication of the operational status of the equipment, instrument indications and alarms are provided in the MCR. Fans, heaters and cooling units are operable from the MCR. Local instruments are provided to measure flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system.

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9.4.12.6 References

1. ASME AG-1 ~~2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, ~~2003~~1997 (including the AG-1a~~, 2004~~2000, "Housings," Addenda).

2. ANSI/AMCA-210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

3. ANSI/AMCA-211-1987, "Certified Ratings Program–Air Performance," American National Standards Institute/Air Movement and Control Association International, 1987.

4. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

5. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

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6. HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

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9.4.14.3.2 Shutdown

When the plant is shut down, the operation of the supply air subsystem and exhaust air subsystems is the same as described in Section 9.4.14.3.1.

9.4.14.3.3 Abnormal Operation

Fan Failures

In case of failure of one supply air fan, one supervised area exhaust air fan or one controlled area exhaust air failure, the unaffected standby fan switches on automatically. Since redundant fans are provided, failure of one fan does not result in the loss of the system function. A failure of the prestressing gallery exhaust air fan leads to the loss of the ventilation of the prestressing gallery.

Failure of an Intake Line

Two supply air intake lines are provided so that the failure of one component in one air intake line does not affect the other intake line. The loss of one air intake train due to a component failure or the securing of one air intake for maintenance does not create a significant heating or cooling concern in the Access Building. This situation allows one air intake line to provide approximately 70 percent of the design air flow rate during normal plant operation. Considering the low likelihood of this situation and the fact that the ABVS heating and cooling functions are not safety functions, two 50 percent intakes are provided.

Loss of Offsite Power (LOOP)

A LOOP results in a loss of power to the ABVS electrical components, such as fans, dampers, cooling units, and heaters. The ABVS system is not provided with emergency power.

9.4.14.4 Safety Evaluation

The operation of the ABVS is not required for the safe shutdown of the plant or for mitigating the consequences of a DBA. Therefore, the system has no safety-related function and requires no nuclear safety evaluation.

To meet the requirements of GDC-60, the controlled area exhaust system of the ABVS is designed, installed, and tested in accordance with RG 1.143, RG 1.140 and ASME N509~~-2002~~ (Reference 2), ASME N510~~-1989~~ (Reference 3), and ASME AG-1~~-2003~~ (Reference 4).

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9.4.14.5 Testing and Inspection Requirements

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The ABVS major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Initial in-place acceptance testing of the ABVS is performed as described in Section 14.2 (test abstracts #224), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The ABVS is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of ABVS is performed to demonstrate system and component operability and integrity.

Isolation dampers are periodically inspected and damper seats replaced as required.

Fans are tested by the manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 5, 6, and 7). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 8). Cooling coils are hydrostatically tested and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 9).

Housings and ductwork are leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 10), American Society of Mechanical Engineers.

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

~~Refer to Section 14.2 (test abstract #224) for initial plant startup test program. Initial in-place acceptance testing of the ABVS components is performed in accordance with Reference 3, RG 1.140, and Reference 4.~~

~~Periodic testing is performed in accordance with Reference 3 and RG 1.140.~~

9.4.14.6 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system.

The radiation instrumentation requirements for controlling airborne radioactivity releases via the plant stack are addressed in ~~Section 11.5~~Section 11.5.3.1.1 and Table 11.5-1, measurement point R-31.

9.4.14.7 References

1. UL 555, "Standard for Fire Dampers," Underwriter's Laboratories, Sixth Edition, June 1999.

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2. ASME N509-1989~~2002~~, "Nuclear Power Plant Air-Cleaning Units and Components," The American Society of Mechanical Engineers, 1989~~2002~~.

3. ASME N510-1989 (R1995), "Testing of Nuclear Air-Treatment Systems," The American Society of Mechanical Engineers, 1989.

4. ASME AG-1~~-2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 2003 (including the AG-1a~~,~~-2000, "Housings,"~~2004~~ Addenda).

5. ANSI/AMCA-210-1999, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, December 1999.

6. ANSI/AMCA-211-1987, "Certified Ratings Program-Air Performance," American National Standards Institute/Air Movement and Control Association International, December 1987.

7. ANSI/AMCA-300-1985, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, December 1987.

8. ANSI/ASHRAE Standard 52.2-1999, " Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," ANSI/ American Society of Heating, Refrigerating and Air Conditioning Engineers, 1999.

9. ANSI/ ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

10. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

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designed with instruments to measure differential pressure across filters to avert clogging.

Facility contamination associated with potentially contaminated condensate from cooling coils in the CBVS, FBVS, NABVS, SBVS, and RWBVS is minimized by the inclusion of moisture separators and collection trays underneath the coils which collect and drain the condensate to the nuclear island drain and vent system.

The materials of the equipment used in these ventilation systems are compatible with the material in the process and facilitate decontamination. The exhaust and supply ductwork for these units are made of galvanized steel with the following exceptions:

- For CBVS, the exhaust ducts of the iodine filtration trains have airtight housings and all the ducts located outside the Containment Building are airtight and welded.
- For AVS, the accident train exhaust ducts are ferritic steel and the ducts of the normal ventilation train are concrete inside of the annulus and ferritic steel outside of the annulus.
- For FBVS, the main supply and exhaust duct chases are constructed of painted concrete and the ductwork for the fuel pool room is welded and constructed from stainless steel or from carbon steel with a coated surface suitable for decontamination.
- For SBVS, the main supply and exhaust air shafts are constructed of painted concrete and the surfaces of the metal and concrete exhaust ductwork which could be exposed to airborne contamination are painted with a special paint that allows easy decontamination.

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The ductwork meets the design, testing, and construction requirements, per ASME AG-1 ~~2003~~ (Reference 13). Components for each of these ventilation systems are designed with consideration of minimizing deposits of material on component surfaces and ease of decontamination. For the CBVS and FBVS, all exhaust portions of ducts are capable of being decontaminated. Removal and transfer of contaminated filters are implemented under the Radiation Protection Program (see Section 12.5).

Design Provisions for Minimizing Contamination of the Environment

The filtered exhaust and the negative differential pressures with respect to the environment produced by the CBVS, AVS, FBVS, SBVS, NABVS, and RWBVS provide the primary protection against contamination of the environment. During normal operation, these ventilation systems produce a sub-atmospheric pressure in their ventilated zones and filter the air from these zones for removal of potential contaminants prior to release to the environment via the vent stack. The AVS provides isolation of the secondary containment and collects containment building leakage. Following a design basis accident, the AVS removes particulates from the

These filtration systems are also designed to permit periodic inspection and periodic pressure and functional testing per ASME AG-1-~~2003~~ (Reference 13). The filters are contained in housings and a dedicated, ventilated room to minimize the potential for facility and environmental contamination. For some units, lighting is also available inside filter banks between the rows of filters and inspection portholes in the filter housing doors to enable viewing while in operation.

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There are certain containment penetrations that introduce the potential for primary containment leakage to bypass the filtered annulus and escape directly to the environment. These potential bypass leakage paths exist through the double seals of the equipment hatch, personnel airlocks, fuel transfer tube, and containment ventilation system isolation valves. The negative pressure difference between the annulus and the environment provides a driving force to route these bypass leakage paths to the annulus, thereby providing an additional barrier against a release to the environment.

For these ventilation systems, there are no buried pipes handling potentially contaminated exhaust gases and therefore, no means to contaminate the environment from a leaking pipe. Gases that may potentially leak from these ventilation systems upstream of the HEPA filters are collected and subsequently filtered by one of these ventilation systems, which are providing a sub-atmospheric pressure in the room where the leak may occur.

The registers of the ventilation systems are placed in each area to deliver the supply air high in the room or corridor, and to draw the air into the exhaust register high in the room or area served by the HVAC system. As a general design rule, the HVAC register placement is high above the flood plane.

The following design features are provided to prevent or mitigate contamination of the environment:

- HVAC air handling equipment is provided with drain connections at the bottom of the equipment for gravity drainage. The drainage fluid flows through the hard piping to collection tanks for processing. Drainage may also be collected in trays that have connections to the hard piping which ultimately goes to the nuclear island vent and drain system.
- Drainage from below-grade HVAC equipment is also collected in tanks and pumped to other collection tanks at a higher elevation for processing. Process piping is hard piping which ultimately goes to the nuclear island vent and drain system.
- HVAC systems are designed so that the supply air flow path is directed from clean areas to areas of increasingly higher potential contamination under normal and accident modes of operation. Potentially contaminated areas are maintained at a

4. MicroShield® User's Manual," Version 7, Grove Software, Inc., Lynchburg, VA, October 2006.

5. RANKERN Version 15a – A Point Kernel Integration Code for Complicated Geometry Problems," Serco Assurance, October 2005.

6. ANSI/ANS-HPSSC-6.8.1-1981, "Location and Design Criteria for Area Radiation. Monitoring Systems for Light Water Nuclear Reactors," American National Standards Institute/American Nuclear Society, May 1981.

7. IEEE Standard 497-2002, "Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, Inc, 2002.

8. ANSI/HPS-N13.1-1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," American National Standards Institute, 1999.

9. NUREG-0713, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities," U.S. Nuclear Regulatory Commission, December 1997.

10. LA-13709-M, "MCNP–A General Monte Carlo N-Particle Transport Code," Version 4c, J.F. Briesmeister, Ed., Los Alamos National Laboratory, April 2000.

11. NEI 07-07, "Industry Ground Water Protection Initiative - Final Guidance Document," Nuclear Energy Institute, August 2007.

12. ANS 57.1-1992, R1998, R2005 (R=Reaffirmed): "Design Requirements for Light Water Reactor Fuel Handling Systems," American National Standards Institute/ American Nuclear Society, 2005.

13. ASME AG-1 ~~2003~~, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 1997~~2003~~ (including the AG-1a~~, 2004~~2000, "Housings," Addenda).

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3.0 TEST METHOD

3.1 Maintain reactor power, T_{avg}, and pressurizer level constant during data collection.

3.2 Calculate RCS flow.

4.0 DATA REQUIRED

4.1 Secondary calorimetric data.

4.2 RCS flow data.

4.3 RCS temperature data.

4.4 Design value for RCP pump heat.

5.0 ACCEPTANCE CRITERIA

5.1 The RCS flow indications have been calibrated to agree with the calculated primary calorimetric.

5.2 The RCS flow rate meets the requirements of Technical Specification 3.4.1 or the discrepancy has been analyzed and appropriate levels of management have determined that it is acceptable to proceed to the next test plateau.

5.2.1 Table 14.3-1 Item 1-3.

14.2.12.18.4 Ventilation Capability (Test #203)

1.0 OBJECTIVE

1.1 To verify that various heating, ventilating and air conditioning (HVAC) systems for the following buildings and structures are capable of maintaining design temperatures:

1.1.1 Containment.

1.1.2 Containment annulus.

1.1.3 Safeguard Buildings.

1.1.4 Nuclear Auxiliary Building.

1.1.5 Fuel Building.

1.1.6 Radioactive Waste Building.

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1.1.7 Essential Service Water Building.

1.1.8 Emergency Diesel Building.

1.1.9 Station Blackout Diesel Room.

1.2 This test shall be performed at the following power plateaus:

1.2.1 25 percent reactor power.

1.2.2 50 percent reactor power.

1.2.3 ≥98 percent reactor power.

2.0 PREREQUISITES

2.1 The plant is operating at or near the desired power.

3.0 TEST METHOD

3.1 Verify that the minimum number of operable air handlers is supplying cooling to each area. If there is more than one potentially limiting alignment make sure that limiting alignments are tested.

3.2 Record temperature values in rooms with safety-related components while operating with normal ventilation lineups.

3.3 Record temperature readings in specified areas during the LOOP test.

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3.4 Verify that environmental temperatures meet design requirements.

3.5 Verify performance of cooling and heating system at operating conditions. Use testing and analysis to determine performance in order to extrapolate to design basis conditions.

4.0 DATA REQUIRED

4.1 Reactor power level.

4.2 Temperature data in designated locations (i.e., general area and adjacent to major heat loads).

4.3 Equipment operating data.

5.0 ACCEPTANCE CRITERIA

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5.1 Design temperatures are maintained during all plant operating conditions within the operable limits in areas as designed (refer to Sections 6.2.3 and 9.4).~~Temperature conditions are maintained within the operable limits in areas as designed (refer to Section 9.4).~~

14.2.12.18.5 Sampling Primary and Secondary Systems (Test #204)

1.0 OBJECTIVE

1.1 To collect chemistry samples of the RCS and secondary at various power levels to record the following:

1.1.1 Boron concentration and boron-10 isotopic abundance.

1.1.2 Concentration of non-radioactive elements and soluble particulates.

1.1.3 Measured pH of the fluids.

1.1.4 Radio isotopic concentration data of the radioactive elements (e.g., cesium, iodine, iron, cobalt).

1.2 To demonstrate performance of permanent plant sampling and analysis procedures, while confirming that primary and secondary chemistry requirements are being met.

5.0 ACCEPTANCE CRITERIA

5.1 RCSL and turbine controls remain within analyzed limits and reactor power is stabilized at the lower power for at least 30 minutes following the test initiation without unanticipated operator action.

5.2 Electrical distribution system voltage and frequency measurements can be correlated with the transient load flow analysis.

5.3 RCPs continue to operate with power supplied from the turbine-generator.

5.4 Partial rod trip occurs but the reactor remains critical.

5.5 Turbine-Generator output breakers remain closed.

5.6 Turbine-Generator performance remains within design limits and as described in Section 10.2.

5.7 Secondary performance remains within design limits as described in Sections 10.2, 10.3, and 10.4.

14.2.13 References

1. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Facility Components," The American Society of Mechanical Engineers, 2004 ~~(No Addenda)~~.

2. ASME Code, Section III, Division 1, Subsection NE, "Class MC Components," The American Society of Mechanical Engineers, 2004 ~~(No Addenda)~~.

3. ASME PTC-6, "~~Guidance for Evaluation of Measurement Uncertainty in Performance Tests of~~ Steam Turbines," The American Society of Mechanical Engineers, 2004.

4. ASME PTC-4, "Fired Steam Generators," The American Society of Mechanical Engineers, 2008.

5. NFPA 72, "National Fire Alarm Code," National Fire Protection Association Standards, 2007~~2~~.

6. ANSI/ACI 349, "Code Requirements for Nuclear Safety Related Concrete Structures," American National Standards Institute, 2001~~6~~.

7. ASME NOG-1-2004, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)," The American Society of Mechanical Engineers, 2004.

8. NFPA 13, "Standard for Installation of Sprinkler Systems," National Fire Protection Association Standards, 2007.

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9. ASME AG-1, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 1997 (including the AG-1a-2000, "Housings" Addenda).

5.5 Programs and Manuals

5.5.10 Ventilation Filter Testing Program (VFTP)

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A program shall be established to implement the following required testing of Engineered Safety Feature (ESF) filter ventilation systems in accordance with Regulatory Guide 1.52, Revision 3, ASME N510-1989, and ASME AG-1-~~2003~~1997 (including ASME AG-1a-2000 “Housings” Addenda). The frequencies of 5.5.10a, 5.5.10b and 5.5.10c are in accordance with Regulatory Guide 1.52, Revision 3. The Frequency for 5.5.10d and 5.5.10e is 24 months.

a. Demonstrate for each of the ESF systems that an in-place test of the high efficiency particulate air (HEPA) filters shows a penetration and system bypass < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 3, and ASME N510-1989 at the system flowrate specified below.

ESF Ventilation System	Flowrate (cfm)
Annulus Ventilation System (AVS)	≥ 1060 and ≤ 1295
Safeguards Building Controlled Area Ventilation System (SBVS)	≥ 2160 and ≤ 2640
Control Room Emergency Filtration (CREF)	≥ 3600 and ≤ 4400
Containment Low Flow Purge Subsystem (CLFPS)	≥ 2700 and ≤ 3300

b. Demonstrate for each of the ESF systems that an in-place test of the charcoal adsorber shows a penetration and system bypass < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 3, and ASME N510-1989 at the system flowrate specified below.

ESF Ventilation System	Flowrate (cfm)
AVS	≥ 1060 and ≤ 1295
SBVS	≥ 2160 and ≤ 2640
CREF	≥ 3600 and ≤ 4400
CLFPS	≥ 2700 and ≤ 3300

c. Demonstrate for each of the ESF systems that a laboratory test of a sample of the charcoal adsorber, when obtained as described in Regulatory Guide 1.52, Revision 3, shows the methyl iodide penetration less than the value specified below when tested in accordance with ASTM D3803-1989 at a temperature of 30°C (86°F) and the relative humidity specified below.