ArevaEPRDCPEm Resource

From:	WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent:	Thursday, June 30, 2011 8:24 PM
To:	Tesfaye, Getachew
Cc:	BENNETT Kathy (AREVA); DELANO Karen (AREVA); HALLINGER Pat (EXTERNAL AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); KOWALSKI David (AREVA); PATTON Jeff (AREVA); BALLARD Bob (AREVA); HARRINGTON James (AREVA)
Subject:	DRAFT Response to U.S. EPR Design Certification Application RAI No. 385, FSAR Ch. 9 ,Questions 09.01.04-15,-16 & -17 (Part 1 of 4)
Attachments:	RAI 385 Response Questions 09.01.04-15,-16 & -17 US EPR DC - DRAFT - Part 1 of 4.pdf
Importance:	High

Getachew,

Draft responses to RAI 385, Questions 09.01.04-15, 09.01.04-16 and 09.01.04-17 are provided in the attached file, “RAI 385 Response Questions 09.01.04-15,-16 & -17 US EPR DC - DRAFT - Part 1 of 4.pdf.” The remaining parts will be provided in subsequent e-mails. Earlier today, AREVA submitted Supplement 20 that provided a date for the final responses as August 18, 2011. Please let us know if you have any questions or if we can submit these responses as final.

Sincerely,

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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, June 30, 2011 4:42 PM
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. 385, FSAR Ch. 9, Supplement 20
Importance: High

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12, Supplement 13, Supplement 14 and Supplement 15 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010, January 6, 2011, January 12, 2011, February 9, 2011, March 2, 2011 and April 5, 2011, respectively, to provide a revised schedule. Supplement 16 response to RAI No. 385 was sent on April 18, 2011 to provide technically correct and complete responses to three of the seven questions. Supplement 17 response to RAI No. 385 was sent on May 6, 2011 to provide a revised schedule. Supplement 18 response to RAI No. 385 was sent on May 20, 2011 to provide a technically correct and complete response to Question 09.01.05-22. Supplement 19 response to RAI No. 385 was sent on June 10, 2011 to provide a revised schedule for the remaining questions.

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

Question #	Response Date
RAI 385 — 09.01.04-15	**August 18, 2011**
RAI 385 — 09.01.04-16	**August 18, 2011**
RAI 385 — 09.01.04-17	**August 18, 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: WILLIFORD Dennis (RS/NB)
Sent: Friday, June 10, 2011 8:58 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. 385, FSAR Ch. 9, Supplement 19

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12, Supplement 13, Supplement 14 and Supplement 15 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010, January 6, 2011, January 12, 2011, February 9, 2011, March 2, 2011 and April 5, 2011, respectively, to provide a revised schedule. Supplement 16 response to RAI No. 385 was sent on April 18, 2011 to provide technically correct and complete responses to three of the seven questions. Supplement 17 response to RAI No. 385 was sent on May 6, 2011 to provide a revised schedule. Supplement 18 response to RAI No. 385 was sent on May 20, 2011 to provide a technically correct and complete response to Question 09.01.05-22.

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

Question #	Response Date
RAI 385 — 09.01.04-15	June 30, 2011
RAI 385 — 09.01.04-16	June 30, 2011
RAI 385 — 09.01.04-17	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: WILLIFORD Dennis (RS/NB)
Sent: Friday, May 20, 2011 1:10 PM
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. 385, FSAR Ch. 9, Supplement 18

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12, Supplement 13, Supplement 14 and Supplement 15 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010, January 6, 2011, January 12, 2011, February 9, 2011, March 2, 2011 and April 5, 2011, respectively, to provide a revised schedule. Supplement 16 response to RAI No. 385 was sent on April 18, 2011 to provide technically correct and complete responses to three of the seven questions. Supplement 17 response to RAI No. 385 was sent on May 6, 2011 to provide a revised schedule.

The attached file, “RAI 385 Supplement 18 Response US EPR DC.pdf” provides a technically correct and complete final response to Question 09.01.05-22.

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 385 Question 09.01.05-22.

The following table indicates the respective pages in the response document, “RAI 385 Supplement 18 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 385 — 09.01.05-22	2	3

The schedule for technically correct and complete responses to the remaining three questions has not changed and is provided below:

Question #	Response Date
RAI 385 — 09.01.04-15	June 10, 2011
RAI 385 — 09.01.04-16	June 10, 2011
RAI 385 — 09.01.04-17	June 10, 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: Friday, May 06, 2011 10:18 AM
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. 385, FSAR Ch. 9, Supplement 17

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12, Supplement 13, Supplement 14 and Supplement 15 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010, January 6, 2011, January 12, 2011, February 9, 2011, March 2, 2011 and April 5, 2011, respectively, to provide a revised schedule. Supplement 16 response to RAI No. 385 was sent on April 18, 2011 to provide technically correct and complete responses to three of the seven questions.

To provide additional time to interact with the NRC on Questions 09.01.04-15, 09.01.04-16 and 09.01.04-17, a revised schedule is provided in this e-mail.

A final response to Question 09.01.05-22 is being prepared to incorporate NRC review comments on the revised draft response; a revised schedule is provided in this e-mail.

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

Question #	Response Date
RAI 385 — 09.01.04-15	June 10, 2011
RAI 385 — 09.01.04-16	June 10, 2011
RAI 385 — 09.01.04-17	June 10, 2011
RAI 385 — 09.01.05-22	May 20, 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, April 18, 2011 4:36 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. 385, FSAR Ch. 9, Supplement 16

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12, Supplement 13, Supplement 14 and Supplement 15 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010, January 6, 2011, January 12, 2011, February 9, 2011, March 2, 2011 and April 5, 2011, respectively, to provide a revised schedule.

The attached file, "RAI 385 Supplement 16 Response US EPR DC.pdf" provides technically correct and complete responses to three of the seven 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 385 Questions 09.01.05-20 and 09.01.05-21.

The following table indicates the respective pages in the response document, "RAI 385 Supplement 16 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 385 — 09.01.05-20	2	2
RAI 385 — 09.01.05-21	3	4
RAI 385 — 09.01.05-23	5	6

The schedule for technically correct and complete responses to the remaining four questions has not changed and is provided below:

Question #	Response Date
RAI 385 — 09.01.04-15	May 6, 2011
RAI 385 — 09.01.04-16	May 6, 2011
RAI 385 — 09.01.04-17	May 6, 2011
RAI 385 — 09.01.05-22	May 6, 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: Tuesday, April 05, 2011 8:27 AM
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. 385, FSAR Ch. 9, Supplement 15

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11, Supplement 12, Supplement 13 and Supplement 14 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010, January 6, 2011, January 12, 2011, February 9, 2011 and March 2, 2011, 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 is provided below.

Question #	Response Date
RAI 385 — 09.01.04-15	May 6, 2011
RAI 385 — 09.01.04-16	May 6, 2011
RAI 385 — 09.01.04-17	May 6, 2011
RAI 385 — 09.01.05-20	May 6, 2011
RAI 385 — 09.01.05-21	May 6, 2011
RAI 385 — 09.01.05-22	May 6, 2011
RAI 385 — 09.01.05-23	May 6, 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 02, 2011 10:22 AM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); ROMINE Judy (RS/NB); DELANO Karen (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 385, FSAR Ch. 9, Supplement 14

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, 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. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010, January 6, 2011, January 12, 2011 and February 9, 2011, 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 is provided below.

Question #	Response Date
RAI 385 — 09.01.04-15	April 7, 2011
RAI 385 — 09.01.04-16	April 7, 2011
RAI 385 — 09.01.04-17	April 7, 2011
RAI 385 — 09.01.05-20	April 7, 2011
RAI 385 — 09.01.05-21	April 7, 2011
RAI 385 — 09.01.05-22	April 7, 2011
RAI 385 — 09.01.05-23	April 7, 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: Wednesday, February 09, 2011 2:52 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. 385, FSAR Ch. 9, Supplement 13

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10, Supplement 11 and Supplement 12 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010, January 6, 2011, and January 12, 2011, 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 385 — 09.01.04-15	March 9, 2011
RAI 385 — 09.01.04-16	March 9, 2011
RAI 385 — 09.01.04-17	March 9, 2011
RAI 385 — 09.01.05-20	March 9, 2011
RAI 385 — 09.01.05-21	March 9, 2011
RAI 385 — 09.01.05-22	March 9, 2011
RAI 385 — 09.01.05-23	March 9, 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: Wednesday, January 12, 2011 6:35 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. 385, FSAR Ch. 9, Supplement 12

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9, Supplement 10 and Supplement 11 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010, December 15, 2010 and January 6, 2011, respectively, to provide a revised schedule.

To provide additional time to interact with the NRC, a revised schedule is provided in this e-mail for the responses to Questions 09.01.05-20 and 09.01.05-22.

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

Question #	Response Date
RAI 385 — 09.01.04-15	February 10, 2011
RAI 385 — 09.01.04-16	February 10, 2011
RAI 385 — 09.01.04-17	February 10, 2011
RAI 385 — 09.01.05-20	February 10, 2011
RAI 385 — 09.01.05-21	February 10, 2011
RAI 385 — 09.01.05-22	February 10, 2011
RAI 385 — 09.01.05-23	February 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: Thursday, January 06, 2011 8:14 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. 385, FSAR Ch. 9, Supplement 11

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8, Supplement 9 and Supplement 10 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010, November 23, 2010 and December 15, 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 for the responses to Questions 09.01.04-15, 09.01.04-16, 09.01.04-17, 09.01.05-21 and 09.01.05-23.

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

Question #	Response Date
RAI 385 — 09.01.04-15	February 10, 2011
RAI 385 — 09.01.04-16	February 10, 2011
RAI 385 — 09.01.04-17	February 10, 2011
RAI 385 — 09.01.05-20	January 14, 2011
RAI 385 — 09.01.05-21	February 10, 2011
RAI 385 — 09.01.05-22	January 14, 2011
RAI 385 — 09.01.05-23	February 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: Wednesday, December 15, 2010 9:44 AM
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. 385, FSAR Ch. 9, Supplement 10

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7, Supplement 8 and Supplement 9 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010, November 18, 2010 and November 23, 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 for the responses to Questions 09.01.05-20 and 09.01.05-22.

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

Question #	Response Date
RAI 385 — 09.01.04-15	January 6, 2011
RAI 385 — 09.01.04-16	January 6, 2011
RAI 385 — 09.01.04-17	January 6, 2011
RAI 385 — 09.01.05-20	January 14, 2011
RAI 385 — 09.01.05-21	January 6, 2011
RAI 385 — 09.01.05-22	January 14, 2011
RAI 385 — 09.01.05-23	January 6, 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: Tuesday, November 23, 2010 9:22 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. 385, FSAR Ch. 9, Supplement 9

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6, Supplement 7 and Supplement 8 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010, October 28, 2010 and November 18, 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 for the responses to Questions 09.01.04-15 thru -17, 09.01.05-21 and 09.01.05-23.

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

Question #	Response Date
RAI 385 — 09.01.04-15	January 6, 2011
RAI 385 — 09.01.04-16	January 6, 2011
RAI 385 — 09.01.04-17	January 6, 2011
RAI 385 — 09.01.05-20	December 16, 2010
RAI 385 — 09.01.05-21	January 6, 2011
RAI 385 — 09.01.05-22	December 16, 2010
RAI 385 — 09.01.05-23	January 6, 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: Thursday, November 18, 2010 3:11 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. 385, FSAR Ch. 9, Supplement 8

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, Supplement 6 and Supplement 7 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, October 22, 2010 and October 28, 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 for the responses to Questions 09.01.05-20 and 09.01.05-22.

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

Question #	Response Date
RAI 385 — 09.01.04-15	November 23, 2010
RAI 385 — 09.01.04-16	November 23, 2010
RAI 385 — 09.01.04-17	November 23, 2010
RAI 385 — 09.01.05-20	December 16, 2010
RAI 385 — 09.01.05-21	November 23, 2010

RAI 385 — 09.01.05-22	December 16, 2010
RAI 385 — 09.01.05-23	November 23, 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: Thursday, October 28, 2010 3:55 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. 385, FSAR Ch. 9, Supplement 7

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4, Supplement 5, and Supplement 6 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010, September 22, 2010, and October 22, respectively, to provide a revised schedule.

To provide additional time to interact with the NRC, and to provide time to process the responses, a revised schedule is provided in this e-mail for the responses to Questions 09.01.04-15, 09.01.04-16, 09.01.04-17, 09.01.05-21 and 09.01.05-23. The schedule for the responses to the remaining questions is unchanged and is provided below.

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

Question #	Response Date
RAI 385 — 09.01.04-15	November 23, 2010
RAI 385 — 09.01.04-16	November 23, 2010
RAI 385 — 09.01.04-17	November 23, 2010
RAI 385 — 09.01.05-20	November 18, 2010
RAI 385 — 09.01.05-21	November 23, 2010
RAI 385 — 09.01.05-22	November 18, 2010
RAI 385 — 09.01.05-23	November 23, 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, October 22, 2010 2:06 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. 385, FSAR Ch. 9, Supplement 6

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3, Supplement 4 and Supplement 5 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010, September 15, 2010 and September 22, 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 for the responses to Questions 09.01.05-20 and 09.01.05-22.

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

Question #	Response Date
RAI 385 — 09.01.04-15	October 28, 2010
RAI 385 — 09.01.04-16	October 28, 2010
RAI 385 — 09.01.04-17	October 28, 2010
RAI 385 — 09.01.05-20	November 18, 2010
RAI 385 — 09.01.05-21	October 28, 2010
RAI 385 — 09.01.05-22	November 18, 2010
RAI 385 — 09.01.05-23	October 28, 2010

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Wednesday, September 22, 2010 11:46 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. 385, FSAR Ch. 9, Supplement 5

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2, Supplement 3 and Supplement 4 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010, August 24, 2010 and September 15, 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 for the responses to Questions 09.01.05-20 and 09.01.05-22.

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

Question #	Response Date
RAI 385 — 09.01.04-15	October 28, 2010
RAI 385 — 09.01.04-16	October 28, 2010
RAI 385 — 09.01.04-17	October 28, 2010
RAI 385 — 09.01.05-20	October 22, 2010
RAI 385 — 09.01.05-21	October 28, 2010
RAI 385 — 09.01.05-22	October 22, 2010
RAI 385 — 09.01.05-23	October 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 (External RS/NB)
Sent: Wednesday, September 15, 2010 4:06 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. 385, FSAR Ch. 9, Supplement 4

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1, Supplement 2 and Supplement 3 responses to RAI No. 385 were sent on June 24, 2010, July 28, 2010 and August 24, 2010, respectively, to provide a revised schedule.

Since the remaining responses are being processed, a revised 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 385 — 09.01.04-15	October 28, 2010
RAI 385 — 09.01.04-16	October 28, 2010
RAI 385 — 09.01.04-17	October 28, 2010
RAI 385 — 09.01.05-20	September 22, 2010
RAI 385 — 09.01.05-21	October 28, 2010
RAI 385 — 09.01.05-22	September 22, 2010
RAI 385 — 09.01.05-23	October 28, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
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From: BRYAN Martin (External RS/NB)
Sent: Tuesday, August 24, 2010 9:49 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. 385, FSAR Ch. 9, Supplement 3

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1 and Supplement 2 responses to RAI No. 385 were sent on June 24, 2010 and July 28, 2010, respectively, to provide a revised schedule.

On July 28, 2010, DRAFT responses to Questions 09.01.05-20 and 09.01.05-22 were submitted to the NRC staff. To allow additional 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 385 — 09.01.04-15	September 15, 2010
RAI 385 — 09.01.04-16	September 15, 2010
RAI 385 — 09.01.04-17	September 15, 2010
RAI 385 — 09.01.05-20	**September 22, 2010**
RAI 385 — 09.01.05-21	September 15, 2010
RAI 385 — 09.01.05-22	**September 22, 2010**
RAI 385 — 09.01.05-23	September 15, 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 6:14 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. 385, FSAR Ch. 9, Supplement 2

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010. Supplement 1 response to RAI No. 385 was sent on June 24, 2010 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 385 — 09.01.04-15	September 15, 2010
RAI 385 — 09.01.04-16	September 15, 2010
RAI 385 — 09.01.04-17	September 15, 2010
RAI 385 — 09.01.05-20	August 25, 2010
RAI 385 — 09.01.05-21	September 15, 2010
RAI 385 — 09.01.05-22	August 25, 2010
RAI 385 — 09.01.05-23	September 15, 2010

Sincerely,

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

From: BRYAN Martin (EXT)
Sent: Thursday, June 24, 2010 4:52 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. 385, FSAR Ch. 9, Supplement 1

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the seven questions in RAI No. 385 on May 19, 2010.

To allow time for interaction between AREVA and the NRC staff, a revised schedule is provided in this e-mail. With respect to Questions 09.01.04-15, 09.01.04-16, 09.01.04-17, and 09.01.04-22, AREVA anticipates having draft responses available during July to support interaction with the NRC staff to review the responses prior to the formal submittal.

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

Question #	Response Date
RAI 385 — 09.01.04-15	August 13, 2010
RAI 385 — 09.01.04-16	August 13, 2010

RAI 385 — 09.01.04-17	August 13, 2010
RAI 385 — 09.01.05-20	July 28, 2010
RAI 385 — 09.01.05-21	July 28, 2010
RAI 385 — 09.01.05-22	August 12, 2010
RAI 385 — 09.01.05-23	July 28, 2010

Sincerely,

Martin (Marty) C. Bryan
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AREVA NP Inc.
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From: BRYAN Martin (EXT)
Sent: Wednesday, May 19, 2010 5:57 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. 385, FSAR Ch. 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 385 Response US EPR DC," provides a schedule since technically correct and complete responses to the seven questions are not provided. With respect to Questions 09.01.04-15, 09.01.04-16 and 09.01.04-17, AREVA anticipates having draft responses in late July to support interaction with the NRC staff to review the responses prior to the formal submittal. Additional time is included in the response date below to allow for these interactions.

The following table indicates the respective pages in the response document, "RAI 385 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 385 — 09.01.04-15	2	3
RAI 385 — 09.01.04-16	4	5
RAI 385 — 09.01.04-17	6	6
RAI 385 — 09.01.05-20	7	7
RAI 385 — 09.01.05-21	8	8
RAI 385 — 09.01.05-22	9	10
RAI 385 — 09.01.05-23	11	11

The schedule for technically correct and complete responses to these questions is provided below.

Question #	Response Date
RAI 385 — 09.01.04-15	August 13, 2010
RAI 385 — 09.01.04-16	August 13, 2010
RAI 385 — 09.01.04-17	August 13, 2010
RAI 385 — 09.01.05-20	June 18, 2010
RAI 385 — 09.01.05-21	June 18, 2010

RAI 385 — 09.01.05-22	July 14, 2010
RAI 385 — 09.01.05-23	June 18, 2010

Sincerely,

Martin (Marty) C. Bryan
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AREVA NP Inc.
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Monday, April 19, 2010 9:46 AM
To: ZZ-DL-A-USEPR-DL
Cc: Curran, Gordon; Lee, Samuel; Segala, John; Hearn, Peter; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 385 (4524, 4515),FSAR Ch. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 31, 2010, and on April 15, 2010, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. 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: 3179

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D47AF4FC)

Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 385, FSAR Ch. 9 ,Questions 09.01.04-15,-16 & -17 (Part 1 of 4)
Sent Date: 6/30/2011 8:23:42 PM
Received Date: 6/30/2011 8:24:49 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

Recipients:
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
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"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
Tracking Status: None
"KOWALSKI David (AREVA)" <David.Kowalski@areva.com>
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"PATTON Jeff (AREVA)" <Jeff.Patton@areva.com>
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"BALLARD Bob (AREVA)" <Robert.Ballard@areva.com>
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"HARRINGTON James (AREVA)" <James.Harrington@areva.com>
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"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: auscharmx02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	40940	6/30/2011 8:24:49 PM
RAI 385 Response Questions 09.01.04-15,-16 & -17 US EPR DC - DRAFT - Part 1 of 4.pdf	4433816	

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

Response to

Request for Additional Information No. 385(4524, 4515), DRAFT
Questions 09.01.04-15, 09.01.04-16 and 09.01.04-17

4/19/2010

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.04 - Light Load Handling System (Related to Refueling)
SRP Section: 09.01.05 - Overhead Heavy Load Handling Systems

Application Section: 9.1

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

Question 09.01.04-15:

Follow-up to RAI 131, Questions 09.01.04-5 and 09.01.04-7

In response to RAI 9.1.4-05 (RAI #131, Supplement 4) and RAI 9.1.4-07 (RAI #131, Supplement 5), the applicant proposed to remove the general description and details regarding operation of the spent fuel cask loading and spent fuel cask transfer facility from the FSAR and redefine the scope of U.S. EPR design certification to include only the cask loading pit penetration assembly (part of the spent fuel cask transfer facility) and covers. The response stated that U.S. EPR FSAR Tier 1, Section 2.2.8 and Table 2.2.8-1, and Tier 2, Section 9.1.4, and Section 14.2.12.3.16, will be revised accordingly, including deletion of Tier 2, Figure 9.1.4-7 that showed a simplified sketch of the spent fuel cask transfer facility. The RAI response also stated that the cask handling operations will be covered under a 10 CFR Part 72 license application once a cask design is selected.

The staff considers the applicant's response to RAI 9.1.4-05 and RAI 9.1.4-07 to be unacceptable. Spent fuel cask loading is considered a major portion of fuel handling system (FHS) to demonstrate the safe handling of spent fuel. The applicant has not provided sufficient details to verify that the light load handling system (LLHS), cask handling and pool design meets the guidance of SRP Section 9.1.2, 9.1.3, 9.1.4 and applicable portions of SRP Section 9.1.5. In accordance with SRP Section 9.1.4, the LLHS is acceptable if the integrated design of the structural, mechanical, and electrical elements, the manual and automatic operating controls, and the safety interlocks and devices provide adequate system control for the specific procedures of handling operations, if the redundancy and diversity needed to protect against malfunctions or failures are provided, and if the design complies with applicable regulations. As indicated in SRP Section 9.1.4, the area of review includes review of the LLHS from receipt of new fuel to loading of spent fuel into the shipping cask, for compliance with requirements of GDC 2, 5, 61 and 62.

The applicant's RAI responses stated that the cask handling operations will be covered under a 10 CFR Part 72 license application once a cask design is selected. However, the use of 10 CFR Part 72, applies to receipt, transfer, packaging and possession of power reactor spent fuel. Part 72 does not apply to the safe movement of spent fuel within the fuel building. Since the U.S. EPR's spent fuel cask transfer facility connects to the Part 52 cask loading pit and the improper operation/design of the spent fuel cask transfer facility could potentially adversely impact Part 52 structures, systems and components (SSCs), the staff concluded that the spent fuel cask transfer facility is included in the review scope of Part 52. Therefore, the staff requests the applicant to address all the questions that the staff previously asked in RAI 9.1.4-05 and RAI 9.1.4-07 and submit the revised RAI responses accordingly.

In accordance with 10 CFR 52.47 (a)(24), the applicant should either provide a full description of the spent fuel cask loading and spent fuel cask transfer facility in Chapter 9 of the FSAR or revise FSAR Section 1.8, "Interfaces with Standard Designs and Early Site Permits," to indicate that the spent fuel cask loading and spent fuel cask transfer facility is outside the scope of the EPR standard design and provide conceptual design information (CDI) of the spent fuel cask loading and spent fuel cask transfer facility in Chapter 9 of the FSAR.

The FSAR should specifically include as a minimum:

a. design and operational information of: (1) the cask loading pit, (2) the cask loading pit seals, (3) the penetration connection equipment, (4) the procedures and process to connect the transfer cask to the cask loading pit and (5) the cask loading procedures and process, in order for the staff to complete its evaluation of the spent fuel pool, the cask loading pit, and the fuel handling machine,

b. a description of the capability of the spent fuel cask loading and spent fuel cask transfer facility to comply with the applicable portions of NUREG-0800 Standard Review Plan (SRP) Sections 9.1.4, "Light Load Handling System (Related to Refueling)", SRP 9.1.2, "New and Spent Fuel Storage," SRP 9.1.3, "Spent Fuel Pool Cooling and Cleanup System," and 9.1.5, "Overhead Heavy Load Handling Systems." This includes design features to meet General Design Criterion (GDC) 2, 4, 5, 61, 62 and 63,

c. the appropriate Inspection, Testing, Analyses and Acceptance (ITAAC) requirements. For a spent fuel cask loading and spent fuel cask transfer facility that is outside the scope of the EPR standard design, in accordance with 10 CFR 52.47 (a)(25), the FSAR Tier 1 should include the necessary interface requirements for the CDI portions. The CDI should be sufficiently detailed to allow the staff to reach a safety conclusion,

d. a description of capability of the cask handling integrated design of the structural, mechanical, and electrical elements, the manual and automatic operating controls, and the safety interlocks and devices to provide: (1) adequate system control for fuel handling operations, (2) redundancy and diversity to protect against malfunctions or failures, and (3) compliance with applicable regulations, and

e. a detailed description of the (1) design, maintenance and operation for the cask handling components, including the gates (slot gate and swivel gate) used to isolate cask loading pit from the SFP, (2) penetration at the base of the cask pit (including lower and upper cover), (3) penetration seals (including details such as seals and bellows materials), and (4) cask transfer machine and other components needed to safely perform the cask loading process.

f. a detailed description of operator training, guidance on rigging and lifting devices, crane inspection and well defined procedures. Historically, deficiencies in these elements have been principal causes of historical crane load drop or handling accidents.

g. an evaluation, in accordance with 10 CFR 52.47(a)(22), of relevant international operating experience insights and an explanation of how the spent fuel cask loading and spent fuel cask transfer facility is designed and/or operating to prevent design deficiencies and/or undesirable operating events.

The applicant is requested to address in the FSAR all the information discussed above, as well as the information requested in RAI 9.1.4-05 and 9.1.4-07 and submit a revised response.

Response to Question 09.01.04-15:

Additional details regarding the design, operation and safety evaluation of the Spent Fuel Cask Transfer Facility (SFCTF) have been added to U.S. EPR FSAR Tier 2, Section 9.1.4 to address the requested information. A specific cask design is not identified for design certification; therefore, COL requirements for the cask interface with the design of the SFCTF are identified in U.S. EPR FSAR Tier 2, Section 9.1.4.

U.S. EPR FSAR Tier 2, Tables 3.2.2-1 and 1.8-2, and Section 9.1.2.2.2 will also be revised to address the requested information.

FSAR Impact:

U.S. EPR FSAR Tier 2, Tables 3.2.2-1 and 1.8-2; and Sections 9.1.2.2.2 and 9.1.4 will be revised as described in the response and indicated on the enclosed markup.

Question 09.01.04-16:

Follow-up to RAI 131, Question 09.01.04-7

In RAI 9.1.4-7, the staff asked the applicant to provide the methodology for preventing draining of the SFP, when the shipping cask is connected to the bottom of the cask loading pit, assuming a single failure. The response to RAI 9.1.4-7 proposed a markup indicating that the gates and weirs are arranged so that the bottoms of the gates are higher than the top of the stored fuel assemblies.

Based on the information provided in the FSAR and the RAI responses, the staff finds that the applicant has not provided sufficient information to complete the evaluation for movement of spent fuel in accordance with 10CFR52.47, GDC 61, GDC 62 and GDC 63. SRP Section 9.1.4 states that the objective of the review is to confirm that the LLHS design precludes system malfunctions or failures that could cause criticality accidents, a release of radioactivity, or excessive personnel radiation exposures. For the entire cask handling operation, failure of any component that could have an adverse impact on the spent fuel, SSCs and operating personnel should be addressed. The applicant has not provided sufficient information to assess all potential failure scenarios of the cask loading pit gates, the penetration connection between the cask and the cask loading pit, the seals relied upon to maintain leak tightness and SFP water inventory, and any other failure that could potentially impact the SSCs, SFP integrity or personnel.

The applicant's evaluation in the FSAR should address all potential failure scenarios such as, but not limited to (1) the drop of a fuel assembly on the cask loading pit penetration, the cask loading pit cover, or into the cask, (2) the drop or tipping of the cask, (3) the improper connection/alignment of the cask and the penetration, (4) operator error at any point in the cask loading operation (such as, improper operation, derailment, load or crane collision, track condition, etc…), (5) the failure of the penetration seals, (6) the failure of the cask handling machine, and (7) the effect of a seismic event at any stage of the cask loading process. The scenarios described above are some of the possible failure scenarios of the cask loading system. The applicant should also discuss any other potential failure scenario.

The applicant's evaluation of all the failure scenarios in the FSAR needs to address how these failures impact:

a. the SFP water inventory,
b. the cooling of stored spent fuel assemblies and casks,
c. the cooling of a suspended fuel assembly (when the scenario occurs while a fuel assembly is in movement),
d. the radiation dosage from a suspended fuel assembly (when the scenario occurs while a fuel assembly is in movement),
e. the radiation dosage from the fuel stored in the pool, and the fuel stored in the cask,
f. steps necessary to restore cask loading pool integrity, the time required to complete these actions, the capability to implement these actions during and/or following situations that cause the cask loading pit to drain, and controls that will be established to ensure that cask loading pool integrity can be restored as described (after a seismic event only seismic Category I SSCs can be credited to remain operational),

g. the flooding considerations,

h. the operator actions that are credited, including indication and alarms that are available to alert operators of the problem, and the time needed for operators to complete the required actions,

i. cask handling pit and loading hall ventilation, and

j. the effects on SSCs important to safety as a result of dropped or tipped cask during movement from all applicable events (i.e. seismic event, machine malfunction, etc…).

The applicant's evaluation should take into consideration that the gates between the SFP and the cask loading pit are not Seismic Category I and therefore cannot be credited to maintain operational after a seismic event. The cover and penetration at the bottom of the cask loading pit are seismic Category I, and are credited to prevent draining of the SFP, only when they are closed. The spent fuel machine is not seismic Category I and therefore cannot be credited to remain operational after a seismic event.

The cask loading pit should include a system for detecting and containing pool liner leaks. Segmented leak channels, proper drainage, and sumps for collecting and containing such leakage should be used. Provide, in the FSAR, the details of the system to be used to detect and collect leakage from the cask loading pit and the penetration at base of the cask loading pit. Provide, in the FSAR, the details of system to be used to detect and collect leakage while the cask loading pit penetration is closed and during cask loading operation.

Response to Question 09.01.04-16:

Additional details regarding the design, operation and safety evaluation of the Spent Fuel Cask Transfer Facility (SFCTF) have been added to U.S. EPR FSAR Tier 2, Section 9.1.4 and is provided with the Response to Question 09.01.04-15.

FSAR Impact:

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

Question 09.01.04-17:

Follow-up to RAI 131, Question 09.01.02-13

In RAI 9.1.2-13, the staff requested the applicant to determine the reduction in SFP water level if leakage into the adjacent fuel-handling areas were to occur. In the RAI response dated October 27, 2008, the applicant stated that 29,000 gal (111,000 L) of water will be maintained in the transfer compartment and/or the cask loading pit, therefore a seismic induced failure of both gates separating the SFP and transfer compartment and both gates between the SFP and the cask loading pit would reduce the SFP water level to 57.2 ft (17.4 m), which is 24 ft (7.3 m) above the active fuel and two feet above the top of the fuel pool cooling suction pipes, in order to prevent the SFP cooling pumps from tripping at low-low level setpoint.

The staff evaluated the applicant's response and noted that the applicant credits the adjacent pools to the SFP will be maintained flooded with a minimum of 29,000 gal (111,000 L) of water. The applicant has not proposed a technical specification (TS) that will ensure that the adjacent pools maintain the minimum water inventory credited to prevent the SFP water level to drop to an unacceptable level. This TS should also prevent the fuel movement in the SFP if the combine water inventory of the adjacent pools do not have the required water inventory.

Additionally, the applicant has stated that the cask loading pit penetration cover is a seismic Category 1 that will remain leak tight during and after a seismic event. However, the applicant has not address the consequences of a seismic event while this cover is open. The applicant should evaluate in the FSAR this situation during normal operations, maintenance, and inspections.

The staff requests the applicant to:

a. include in the FSAR a technical specification (TS) that will ensure that the adjacent pools maintain the minimum water inventory credited to prevent the SFP water level to drop to an unacceptable level,
b. address, in the FSAR, consequences of a seismic event while the cask loading pit penetration cover is open, describe the actions that are required to close the cover, provide the time required to close it, the amount of water lost through the open penetration and the plans that the applicant proposes to recover from the event.

Response to Question 09.01.04-17:

a. The failure of both gates separating the spent fuel pool and transfer compartment and both gates between the spent fuel pool (SFP) and the cask loading pit would result in leakage between the three Fuel Building pool compartments until an equilibrium level is reached. Assuming the cask loading pit and transfer compartment are initially empty, the equilibrium level of the three pool compartments is 53.3 feet, assuming the spent fuel pool is initially at its normal water level of 62.3 feet. This equilibrium level provides approximately 20.0 feet of water over the tops of the stored fuel assemblies. According to Standard Review Plan Section 9.1.2, "the volume of adjacent fuel-handling areas should be limited so that leakage into these areas while drained would not reduce the coolant inventory to less than 3 meters (10 feet) above the top of the fuel assemblies." This criterion is met without taking credit for water initially in the adjacent pits and therefore the proposed technical specification is not required.

To reduce the equilibrium water level to 10 feet above the tops of the stored fuel assemblies, the initial water level in the spent fuel pool would have to be approximately 49.3 feet, or 16 feet above the tops of the fuel assemblies, with the adjacent pits empty. This initial condition is prevented during fuel movement by Technical Specification LCO 3.7.14, which requires the spent fuel pool water level to be greater than or equal to 23 feet over the top of irradiated fuel assemblies seated in the storage racks. Therefore the proposed technical specification to prevent fuel movement in the SFP if the combined water inventory of the adjacent pools is insufficient is not required.

Additional details regarding the design, operation and safety evaluation of the Spent Fuel Cask Transfer Facility (SFCTF) have been added to U.S. EPR FSAR Tier 2, Section 9.1.4 and is provided with the Response to Question 09.01.04-15.

b. The Seismic Category I cask loading pit penetration assembly is seismically qualified to maintain the fluid boundary of the cask loading pit during and following a safe shutdown earthquake, both when the upper cover is closed and when it is open and connected to a spent fuel cask. A brief unseating of the normally leak-tight connection at the mating surface of the connected cask may occur during the SSE resulting in some seepage around the seals but does not result in any significant water inventory loss in the cask loading pit or spent fuel pool.

   The spent fuel cask transfer machine provides seismic support for the cask and connected piping is seismically qualified up to the safety-related pool boundary. The Seismic Category I equipment is not postulated to fail and therefore the pool boundary is maintained following the safe shutdown earthquake.

   Additional details regarding the design, operation and safety evaluation of the Spent Fuel Cask Transfer Facility (SFCTF) have been added to U.S. EPR FSAR Tier 2, Section 9.1.4 and is provided with the Response to Question 09.01.04-15.

FSAR Impact:

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

U.S. EPR Final Safety Analysis Report Markups

Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section
9.1-1	A COL applicant that references the U.S. EPR design certification will provide site-specific information on the heavy load handling program, including a commitment to procedures for heavy load lifts in the vicinity of irradiated fuel or safe shutdown equipment, and crane operator training and qualification.	9.1.5.2.5
9.1-2	A COL applicant that references the U.S. EPR design certification will provide information for operating and maintenance procedures related to refueling cavity integrity. These procedures will include periodic maintenance and inspection of the refueling cavity ring, leakage testing and maintenance of the refueling cavity door seals, administrative controls to prevent draindown events through connected piping, and actions required in response to a detected loss of refueling cavity water.	9.1.4.3.3 09.04.01-15
9.1-3	A COL applicant that references the U.S. EPR design certification will provide a cask design acceptable for interfacing with the SFCTF prior to initial cask loading operations. The design of the spent fuel cask must meet the following interface requirements: ● The mating surface of the cask maintains a leak-tight connection with the penetration assembly when the cask is connected to the penetration. ● The dose rates from a loaded cask during cask handling operations does not exceed those identified in Section 12.3. ● A structural and seismic analysis of the SFCTM and cask demonstrates that the fluid boundary between the penetration assembly and connected cask is maintained to preclude the loss of significant inventory in the spent fuel pool during cask loading operations, including safe shutdown earthquake (SSE), and the postulated drop of a fuel assembly from the maximum handling height in the cask loading pit onto a connected cask.	9.1.4
9.2-1	A COL applicant that references the U.S. EPR design certification will provide site specific information for the UHS support systems such as makeup water, blowdown, and chemical treatment (to control biofouling).	9.2.5.2
9.2-2	A COL applicant that references the U.S. EPR design certification will provide site-specific details related to the sources and treatment of makeup to the potable and sanitary water system along with a simplified piping and instrument diagram.	9.2.4.2.1
9.2-3	The raw water supply system (RWSS) and the design requirements of the RWSS are site-specific and will be addressed by the COL applicant.	9.2.9

Table 3.2.2-1—Classification Summary
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KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
30FAB12 KB001	Loading Pit Slot Gate	S	N/A	I	Yes	UFA	Manufacturer's standard
30FAB12 KB002	Loading Pit Swivel Gate	S	N/A	I	Yes	UFA	Manufacturer's standard
FCJ08	Up-Ender and Track (Fuel Building)	NS-AQ	~~D~~N/A	II	Yes	UFA	ANS 57.1-1992; Located in close proximity to safety-related equipment
FCJ07	Up-Ender and Track (Reactor Building)	NS-AQ	~~D~~N/A	II	Yes	UJA	ANS 57.1-1992; Located in close proximity to safety-related equipment
FCJ03	Up-Ender Hoist (Fuel Building)	NS-AQ	~~D~~N/A	II	Yes	UFA	ANS 57.1-1992; Located in close proximity to safety-related equipment
FCJ02	Up-Ender Hoist (Reactor Building)	NS-AQ	~~D~~N/A	II	Yes	UJA	ANS 57.1-1992; Located in close proximity to safety-related equipment
FCJ12 09.01.04-15	Spent Fuel Cask Transfer Facility Penetration Assembly ~~including Loading Pit Bottom Cover~~	S	~~C~~N/A	I	Yes	UFA	ANS 57.2-1983

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Table 3.2.2-1—Classification Summary
Sheet 68 of 191

KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
FCJ10	Spent Fuel Cask Transfer Machine	S	N/A	I	Yes	UFA	ANS 57.2-1983
FCJ11	Biological Lid Handling Station	NS-AQ	N/A	II	Yes	UFA	ANS 57.2-1983
FCJ15/16	Spent Fuel Cask Transfer Facility Piping (up to and including the first normally closed valve, second automatically closed valve, or second remotely closed valve)	S	C	I	Yes	UFA	ASME Class 1
KBB	**Coolant Supply & Storage System**						
30KBB11/12/13/14/15/16 BB001	Storage Tanks	NS	D	NSC	No	UKA	ASME VIII[8]
KBB	All KBB System Piping	NS	D	NSC	No	UKA	ANSI/ASME B31.1[6]
KBC	**Reactor Boron & Water Makeup System**						
KBC	Boric Acid Mixing Tank, Feed Pump and their Connected ~~Equipment~~Pipe and Valves	NS	E	NSC	No	UFA	ANSI/ASME B31.1[6], ANSI/ASME B16.34[7], ASME VIII[8]

checkerboard or other pattern that confirms that adequate cooling can be maintained consistent with Technical Specification restrictions.

Figure 9.1.2-6 provides an illustration of a typical spent fuel rack array with the spent fuel storage rack layout as shown in Figure 9.1.2-7. The spent fuel storage rack modules are composed of a rectangular grid of connected cells, each cell designed to store a single fuel assembly. Center-to-center spacing of the assemblies in the spent fuel racks is provided in Reference 3. Section 9.1.1.1 provides the design basis quantities of fuel to be stored.

The design of the SFP is such that inadvertent draining of water from the pool is prevented (see Section 9.1.3). The concrete structures for the SFP, SFP liner, and fuel transfer canal are designed in accordance with the criteria for Seismic Category I structures contained in Section 3.7 and Section 3.8. As such, they are designed to maintain leak-tight integrity to prevent the loss of cooling water from the pool. In addition, all piping penetrations into the pool are designed to preclude draining the pool down to an unacceptable limit, as described in Section 9.1.3.

The spent fuel pool liner leak chase system consists of half pipes, structural steel or concrete channels, or similar configurations embedded in the concrete, segregated into sectors, and interconnected to the exterior side of the pool liner. Leakage, if any, from the stainless steel pool liner is monitored and routed to collection areas to determine the amount of leakage, its leakage channel location, and proper disposal. The design of the system is such that it provides accessibility for inspections, removal of blockages, and testing. The stainless steel liner plate welds are inspected during fabrication and tested for leak-tightness after erection. The liner plates and fuel racks are arranged so that the maximum horizontal displacement of the fuel racks under all loading conditions, including the safe shutdown earthquake, will not result in the rack bearing plates contacting an area of the pool liner that is backed by a leak chase channel.

Borated demineralized reactor makeup water is used to fill and to supplement water inventory in the spent fuel pool.

Adjacent to the SFP is a separate spent fuel cask loading pit. This pit is used when the spent fuel is to be shipped offsite. Figure 9.1.2-8—Fuel Storage and Handling Areas Layout illustrates the fuel storage and handling areas layout. Also adjacent to the SFP is a transfer compartment. The transfer compartment is used to transfer fuel assemblies between the Fuel Building and the Reactor Building. The fuel transfer tube is fitted with a blind flange on the Reactor Building side and a gate valve on the Fuel Building side.

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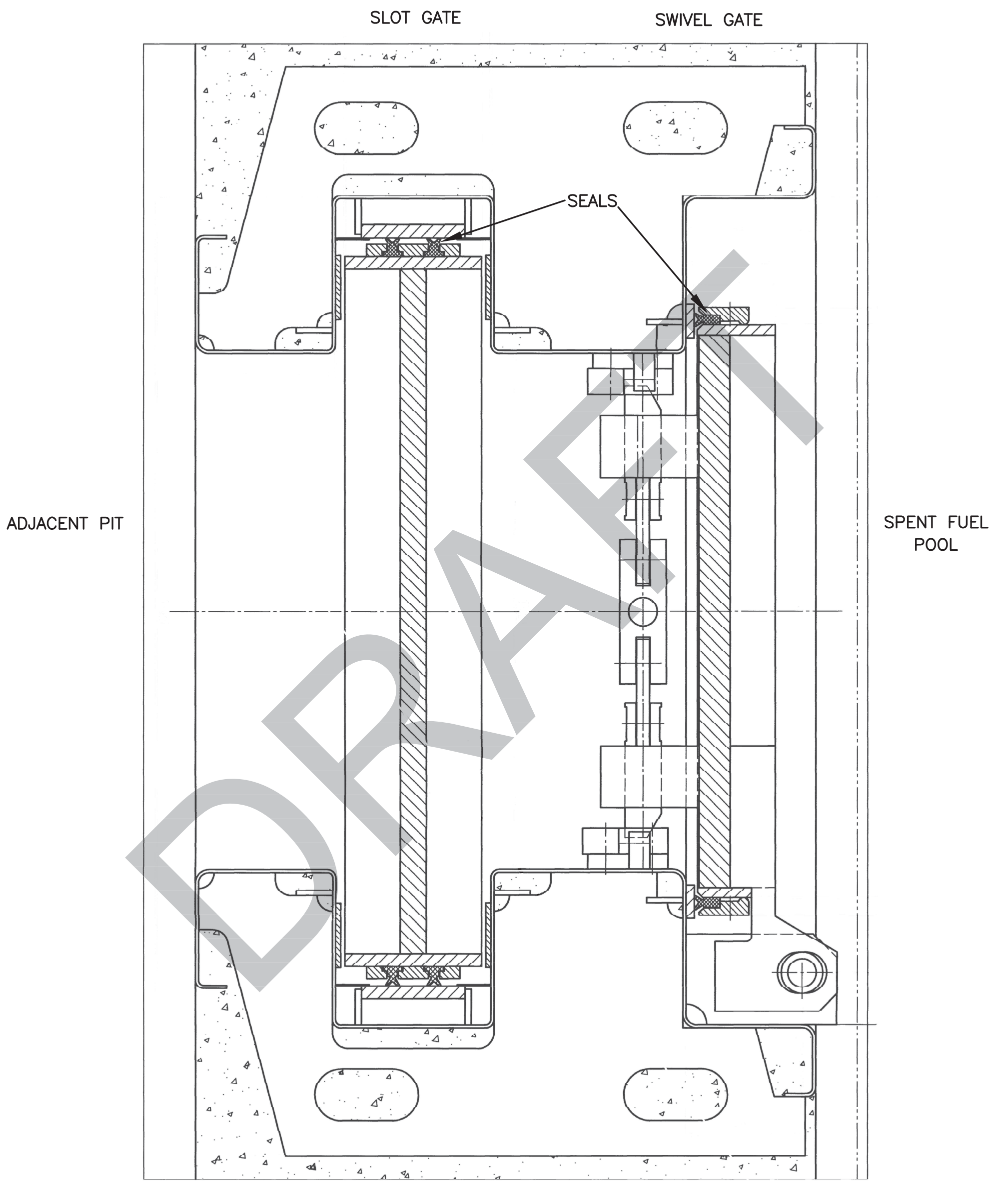
Two stainless steel gates separate the cask loading pit from the SFP and two stainless steel gates separate the transfer compartment from the SFP. Figure 9.1.2-9—Cask Loading Pit Gates shows the cask loading pit gates. The gates allow isolation of the

Figure 9.1.2-9—Cask Loading Pit Gates



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9.1.4 Fuel Handling System

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The fuel handling system (FHS) provides a safe means for handling and performance monitoring of fuel assemblies and control components from the time of receipt of new fuel assemblies to the storage and removal of spent fuel. This includes installing and removing fuel assemblies in the reactor vessel, transferring irradiated fuel assemblies from the reactor vessel to the spent fuel pool (SFP), and storage of irradiated fuel assemblies, and removal of irradiated fuel assemblies through the Spent Fuel Cask Transfer Facility (SFCTF). The system also provides a means of safely receiving, inspecting, storing, and handling new fuel.

The FHS design maintains occupational radiation exposures as low as is reasonably achievable (ALARA) during transportation and handling.

The specific cask design is not part of the FHS or SFCTF. A COL applicant that references the U.S. EPR design certification will provide a cask design acceptable for interfacing with the SFCTF prior to initial cask loading operations. The design of the spent fuel cask must meet the following interface requirements:

- The mating surface of the cask maintains a leak-tight connection with the penetration assembly when the cask is connected to the penetration.
- The dose rates from a loaded cask during cask handling operations do not exceed those identified in Section 12.3.
- A structural and seismic analysis of the SFCTM and cask demonstrates that the fluid boundary between the penetration assembly and connected cask is maintained to preclude the loss of significant inventory in the spent fuel pool during cask loading operations, including safe shutdown earthquake (SSE), and the postulated drop of a fuel assembly from the maximum handling height in the cask loading pit onto a connected cask.

9.1.4.1 Design Bases

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

- New and spent fuel storage racks.
- Transfer tube, isolation devices, and expansion joints.
- Spent Fuel Cask Transfer Facility loading pit penetration and coverassembly.
- Spent fuel cask transfer machine (SFCTM).
- SFCTF fluid and pneumatic systems isolation devices.

The design basis requirements and design criteria are as follows:

The FHS components are located inside the Reactor Building (RB) and Fuel Building (FB) structures, which are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods and external missiles (GDC 2).

The seismic design of the system components meets the guidance of RG 1.29 (Position C1 for safety-related portions and Position C2 for non-safety-related portions).

The FHS components are not shared among nuclear power units (GDC 5).

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The design of the FHS includes the safe handling, ~~and~~ storage, and removal of fuel under both normal and accident conditions (GDC 61).

The design of the FHS prevents inadvertent criticality (GDC 62). The fuel racks (FR) are designed to store fuel assemblies in an appropriate manner during normal operation and the safe shutdown earthquake (SSE) so that criticality accidents are avoided, and the fuel ~~racks~~assemblies are not damaged by overloading or overheating.

The FHS is designed and arranged so that dropped loads do not result in fuel damage that would release radioactivity in excess of 10 CFR 100 guidelines or impair the safe shutdown of the plant.

The fuel transfer tube facility (FTTF) provides containment isolation so that offsite dose limits are not exceeded during a design basis accident (DBA).

The cask loading pit penetration assembly maintains its portion of the cask loading pit fluid boundary to avoid draining the spent fuel pool to a level that prevents decay heat removal from the stored fuel.

The safety-related components of the SFCTF are designed to maintain the fluid boundary between the penetration assembly and connected cask to preclude the loss of significant inventory in the spent fuel pool during cask loading operations, including SSE, and the postulated drop of a fuel assembly from the maximum handling height in the cask loading pit onto a connected cask.

The SFCTM is designed to prevent tipping or dropping of the fuel cask during cask handling operations, including a SSE.

The SFCTF is designed to maintain operational doses as low as reasonably achievable (ALARA).

The SFCTF is designed so that the cask loading operation is reversible in case spent fuel needs to be unloaded from the cask to the spent fuel storage racks.

9.1.4.2 System Description

FHS equipment is needed to perform the following functions:

- New fuel handling and storage.
- Refueling.
- Spent fuel storage and activities during plant normal operation.

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- SFCTF operations.

This equipment consists of fuel assembly handling devices such as the refueling machine, FTTF, new fuel elevator, spent fuel machine, auxiliary crane, Spent Fuel Cask Transfer Facility, and fuel racks. The areas associated with the fuel handling equipment are the refueling cavity consisting of the reactor cavity, the core internal storage area and the reactor building transfer compartment, and the fuel pool consisting of the transfer pit, the loading pit and the spent fuel storage pool, loading hall, and the new fuel storage area. Figures showing the overall system arrangement in the Reactor BuildingRB and Fuel BuildingFB are provided in Section 3.8.

9.1.4.2.1 General Description

The fuel handling equipment can handle a fuel assembly under-water from the time a new fuel assembly is lowered into the underwater fuel storage area until the irradiated fuel assembly is placed in a spent fuel cask for shipment from the site. Underwater transfer of spent fuel assemblies provides radiation shielding and cooling for removal of decay heat. The boric acid concentration in the water is sufficient to preclude criticality.

The reactor cavity, the core internal storage compartment, and the Rreactor Bbuilding Ppool Ttransfer Ccompartment are flooded only for refueling during plant shutdowns. The SFP remains full of water and is always accessible to operating personnel.

New Fuel Handling and Storage

New fuel containers are received in the FB loading bay. Typically, each container carries two fuel assemblies. New fuel containers are raised one at a time through a floor opening to the new fuel examination area located at Elevation +48 feet, 6.75 inches with the use of the auxiliary crane. The new fuel assemblies are removed from the container for individual examination using the auxiliary crane and new fuel handling tool. The new fuel assembly is raised through the floor opening until the fuel assembly lower end clears the fuel pool operating floor level (+64 feet) and is then moved and either lowered in the new fuel dry storage area or in the new fuel elevator basket. This process is repeated for the remaining new fuel containers. The new fuel elevator lowers the fuel assembly into the spent fuel storage pool for underwater storage. Administrative controls prevent movement of a new fuel assembly over the spent fuel racks while it is moved from the new fuel storage rack or new fuel examination area to the new fuel elevator. The new fuel assemblies are moved from the loading bay to the new fuel assembly examination facility. After examination, the

~~accepted new fuel assemblies are placed either in the new fuel dry storage area or lowered into the spent fuel storage pool for underwater storage via the new fuel elevator.~~ The new fuel assemblies placed in the new fuel dry storage will be moved to underwater storage prior to the refueling outage. From the spent fuel storage racks, the fuel assemblies are transferred under water until loaded into the reactor.

Refueling Procedure

Refueling operations are started after the reactor coolant system (RCS) is borated as specified in the Technical Specifications and cooled down to refueling shutdown conditions.

The refueling operation is divided into five major evolutions: (1) RCS and refueling system preparation, (2) disassembly of the reactor, (3) fuel handling during refueling operations, (4) reassembly of the reactor, and (5) preoperational checks and startups. A general description of a typical refueling operation through these evolutions is provided below.

RCS and Refueling System Preparation

The reactor is shut down, borated, and cooled to refueling conditions. After an initial radiation survey, access to the reactor vessel head is allowed. The coolant level in the reactor vessel is lowered to a point slightly below the vessel flange. The fuel transfer tools and equipment are checked, inspected and tested for operation.

Disassembly of the Reactor

Mechanical and instrumentation connections to the reactor pressure vessel are disconnected to allow removal of the vessel head. The refueling cavity is prepared for flooding by checking the underwater lights, and tools; closing the refueling cavity drain lines; and removing the blind flange from the fuel transfer tube. With the refueling cavity prepared for flooding, the vessel head is unseated and raised above the vessel flange using the reactor building polar crane (refer to Section 9.1.5 for equipment handling heavy loads). Water from the in-containment refueling water storage tank (IRWST) is directed into the reactor coolant system in order to fill the RB refueling cavity. The vessel head is lifted and placed on the head stand. When the RB refueling cavity water level reaches the specified depth for shielding and the water level in the FB transfer pit is equalized to the refueling cavity level, the fuel transfer tube isolation valve is opened. The refueling machine is positioned over the core and the control rod drive shafts are disconnected. Once the control rod shafts are disconnected, the internals lifting rig is installed. The upper internals are removed from the vessel and stored in the refueling canal in a designated area located away from the fuel load path. The refueling machine is indexed over the core and tested underwater. The core is ready for refueling when all fuel handling prerequisites have been met.

Fuel Handling during Refueling Operations

The refueling sequence begins in the RB with the refueling machine. Spent fuel assemblies are removed; and partially irradiated fuel assemblies are relocated in the core per the refueling plan and new fuel assemblies are added to the core. The general fuel handling sequence for a full core off load or a core fuel shuffle are essentially the same, except for the number of fuel assemblies removed from the reactor vessel.

The general fuel handling sequence for refueling involving moving the fuel assembly from the reactor vessel to the SFP is as follows:

1. The refueling machine is automatically or manually positioned over a fuel assembly in the core. Once the refueling machine mast is positioned over the selected fuel assembly; the fuel assembly gripper is lowered and engages the fuel assembly.

2. The refueling machine withdraws the selected fuel assembly from the core and raises it to a predetermined height sufficient to clear the vessel flange. The maximum height of the fuel assembly is limited to provide sufficient water covering the fuel assembly. The fuel assembly is then transported to the fuel transfer tube facility area of the reactor building refueling cavity.

3. The fuel transfer system conveyor car is positioned in the fuel transfer tube facility area of the refueling cavity, and the fuel container is in the vertical position.

4. The refueling machine is positioned to line up the fuel assembly over the empty fuel container. The fuel assembly is lowered and placed into the empty fuel container of the conveyor car. The upender pivots the fuel container to the horizontal position and is transported by the conveyor car to the SFP side of the fuel transfer tube facility. The upender then pivots the fuel container to the vertical position.

5. The spent fuel machine is positioned over the fuel assembly then it latches and withdraws the assembly from the fuel container. The spent fuel machine then transports the fuel assembly to a predetermined location in the SFP where it is lowered into the fuel rack location and unlatched.

The general fuel handling sequence for refueling involving moving the fuel assembly from the SFP to the reactor vessel is as follows:

1. A fuel assembly is taken from a specified location in the SFP storage rack and loaded into the empty fuel container of the conveyor car by the spent fuel machine.

2. The upender pivots the fuel container to the horizontal position and the conveyor car moves the fuel assembly through the fuel transfer tube to the fuel transfer tube facility area in the RB. The upender then pivots the fuel container back to the vertical position.

3. The refueling machine is then located over the fuel assembly and withdraws it from the fuel container. The refueling machine then transports the fuel assembly over the core area and inserts it into a specified location in the core.

The foregoing procedures are repeated until the reactor vessel refueling is completed.

Reassembly of the Reactor

After the core mapping is complete, the reactor vessel is reassembled. The spent fuel pool is isolated from the refueling cavity and the RB refueling cavity water level is lowered to just below the reactor vessel flange and the vessel head is installed. The mechanical and instrumentation connections are reinstalled.

Pre-operational Checks and Startup

In the final phase, the blind flange on the fuel transfer tube is re-installed and the fuel handling areas inside the ~~reactor building~~RB are cleaned and restored.

Spent Fuel Storage and Activities During Plant Normal Operation

Spent fuel is stored in the fuel storage racks in the spent fuel storage pool. The fuel pool cooling system removes the decay heat from the spent fuel assemblies stored in the pool (refer to Section 9.1.3). After sufficient decay, spent fuel assemblies may be removed from the SFP.

During normal operation, handling activities related to rearrangement and inspection of the spent and new fuel assemblies in the fuel storage pool and in the new fuel dry storage area take place. The spent fuel machine and auxiliary crane are used to relocate fuel and fuel assembly inserts.

Prior to initiating these activities in the SFP, the following checks are made:

- Verification of the SFP readiness, including lighting.
- Verification that the fuel pool cooling and purification system and support systems are available and capable of handling the expected spent fuel heat load.
- Verification of SFP boron concentration to maintain subcriticality of the fuel assemblies.
- Verification of water level in the SFP to keep the radiation levels within acceptable limits when the fuel assemblies are relocated in SFP.
- Verification of the SFP gates integrity to make sure there is no unexpected loss of SFP water level during fuel movement operations.

Other than the handling of fuel and fuel assembly inserts, the inspection and testing of the fuel handling tools and accessible components and equipment are also carried out during the plant normal operation. The calibration of instruments and circuits, and the testing of electrically operated equipment and components, including the checking for proper operation of interlocks, are accomplished.

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Spent Fuel Cask Transfer Facility Operation

After sufficient decay, spent fuel assemblies may be removed from the spent fuel pool for loading into spent fuel storage casks using the SFCTF. The SFCTF includes equipment for receipt and preparation of a spent fuel cask, transfer of the cask within the loading hall, connection of the cask to the loading pit, and removal of the loaded cask from the FB.

The following four workstations perform their respective cask loading and supporting operations:

- Lifting station is where the cask is placed on the SFCTM by the gantry crane (not a part of the SFCTF) outside the FB prior to cask loading, and is removed from the SFCTM by the gantry crane after loading.
- Handling opening station (loading hall) is where empty casks are prepared for fuel loading and loaded casks are prepared for final removal from the FB. Lifting operations are performed by the fuel building auxiliary crane (not a part of the SFCTF) through the handling opening.
- Biological lid handling station (loading hall) is where the biological lid is removed from the empty cask prior to fuel loading, and is placed back on the cask after loading.
- Penetration station (loading hall) is where the cask is connected to the loading pit penetration assembly and spent fuel is loaded using the spent fuel machine. The spent fuel machine and loading pit are not part of the SFCTF.

The SFCTF is designed to be remotely operated during normal operation, with no personnel in the loading hall, from the time the cask is connected to the penetration assembly and to be leak tested (prior to fuel movement) until the biological lid is placed back on the loaded cask. Shielding is provided on the SFCTM, and by the close tolerances between the cask and the loading hall ceiling, so that occupational doses are minimized if an operator is required to enter the loading hall for abnormal conditions. The under-pool loading configuration precludes contamination of the exterior surface of the cask, which minimizes occupational dose during cask loading operations. The anticipated dose rates for operators in the loading hall during cask handling operation are identified in Figure 12.3-33—Fuel Building +0 Ft Elevation Radiation Zones.

A general description of the SFCTF operations is described in this section. Operator training and procedures are developed by the COL applicant as described in Sections 13.2 and 13.5.

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Receipt and Preparations

Preparations for cask loading operation include preparing the gantry crane to interface with the SFCTM, equipping the SFCTM with adaptors to accommodate the specific cask, and performing regular inspections and checks of the SFCTM.

After arrival of the spent fuel cask on the transport trailer, a visual and radiological inspection of the cask is performed. The cask is lifted using the fuel building gantry crane. The SFCTM is towed under the crane, and the cask is placed on the SFCTM using adapters, as necessary, to interface with the specific cask design. The positioning of the cask is performed with screw jacks and position measurement equipment and the cask is locked in place on the SFCTM.

The design of the SFCTF does not require the cask to be lifted inside the FB, thus precluding concerns about dropping the cask onto stored fuel or safety-related equipment.

The SFCTM is towed into the FB. The SFCTM is automatically centered using a lateral guiding device sliding against guiding rails on the loading hall walls. The SFCTM brakes are secured. The towing equipment is then removed from the loading hall and the loading hall door closed. The SFCTM is then connected to the fluid systems and the electrical power supply. The SFCTM is moved into the handling area opening and the anti-seismic locking devices are engaged.

The cask is prepared for loading in the handling area. The specific preparation steps depend on the cask design. The following process is considered representative. The handling opening above the cask is opened. Leak-tightness and radiation checks are performed, and lids (except the biological lid) are removed by the auxiliary crane. If a bolted biological lid is used, the flange is unbolted. Cask-specific adaptors for interface with the fluid systems are installed and the centering or locking ring is placed on the SFCTM with the auxiliary crane. The cask may be filled with demineralized water at this stage, depending on the cask design, and then the handling opening is closed.

The cask loading pit area is also prepared to begin cask loading operations. The cask loading pit is filled and the leak-tightness of the penetration assembly is confirmed. The penetration assembly is equipped with adaptors, if necessary, to accommodate the specific cask design with the leak-tightness flange and the bottom cover plate. The biological lid handling station is equipped with adaptors, if necessary, to interface with the specific cask lid.

Cask Loading Operations

After the cask and loading pit preparations are completed, the anti-seismic locking devices on the SFCTM are unlocked and the SFCTM is moved to the biological lid handling station. The anti-seismic locking devices are re-engaged prior to handling

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activities. The biological lid handling station gripper is lowered, and the lid is lifted and held in the ceiling recess. The lifting screw is locked to prevent movement. While the SFCTM remains in this location, the penetration assembly lower cover is removed by raising the elevator on the SFCTM until it is against the cover. Operations personnel are required in the area to unbolt the lower cover. The lower cover is removed, stored on the SFCTM, and the elevator is lowered.

After completion of activities at the biological lid handling station, the anti-seismic locking devices are unlocked and the SFCTM is moved to the penetration station. The SFCTM is guided into place with the assistance of video monitoring and proximity detectors. The anti-seismic locking devices are re-engaged. The biological lid is lowered and placed on a support storage location on the SFCTM. Inspections of the biological lid may be performed, if necessary.

The penetration assembly is connected to the cask by engaging the penetration assembly docking flange with the docking system on the SFCTM. The leak-tightness flange of the penetration assembly is centered on the cask via the centering/locking ring. After the cask is docked, adjustments may be made by operations personnel to the cask-SFCTM interface to allow for thermal expansion of the cask while maintaining seismic integrity. The leak-tightness of the seals between the penetration assembly and the cask is checked by a compressed air circuit between the seals.

After docking activities are completed, the penetration assembly vent is opened and the cask and penetration assembly are filled with borated water until the pressure is equalized across the penetration upper cover with the previously filled cask loading pit. The penetration upper cover may then be opened.

To begin loading fuel assemblies, the cask loading pit swivel gate is opened (loading pit slot gate has been removed prior to this step), and fuel assemblies are transferred one at a time by the spent fuel machine from the spent fuel storage racks to the cask. Upon completion of cask loading operations, the loading pit swivel gate is closed.

After the cask has been loaded, the penetration assembly upper cover is closed, pressurized, and locked. Seal leak-tightness is controlled by the compressed air circuit between the seals. The penetration assembly is emptied, rinsed with demineralized water, and dried with compressed air. The cask is disconnected from the penetration assembly by reversing the screws of the docking system until the penetration assembly is at its upper-most position. The biological lid is lifted from its support on the SFCTM prior to travel to the biological lid handling station.

Cask Closing Operations

After the cask has been disconnected from the penetration assembly, the anti-seismic locking devices are unlocked at the penetration station and the SFCTM is moved to the biological lid handling station, where the anti-seismic locking devices are engaged.

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The biological lid is lowered on the cask with the gripper. After radiological checks, personnel may enter the loading hall to install the penetration bottom cover. The bottom cover is lifted by the SFCTM elevator and bolted in place.

The anti-seismic locking devices are unlocked at the biological lid handling station and the SFCTM is moved to the handling opening station. The anti-seismic locking devices are engaged and cask closure activities are initiated. Specific cask closure activities are dependent on the cask design, so the following steps are representative. The biological lid flange is bolted to the cask and leak-tightness checks are performed. The cask is drained and vacuum-dried. The fluid systems are rinsed and cask-specific adaptors removed. The handling opening is opened and the centering/locking ring is removed with the auxiliary crane. Additional lids are placed on the cask and bolted or welded as required. Radiological activity checks are performed.

Cask Removal Operations

After the cask closure activities have been completed, the anti-seismic locking devices are unlocked, and the SFCTM is disconnected from the fluid systems and electrical power supply. The loading hall door is opened and towing equipment is connected to the SFCTM. The SFCTM is towed to the gantry crane. The cask is unlocked from the SFCTM, lifted with the gantry crane, and the SFCTM is towed away. The cask is placed on the transport trailer for disposition.

Fuel Handling Administrative Controls and Programs

The fuel handling operations are performed per approved plant procedures, which cover administrative, operating, emergency, testing and maintenance aspects.

The administrative control procedure and checklists are developed from a review of fuel handing related safety analysis and the fuel handling operations. The checklists assist in providing assurance that fuel handing safety analysis assumptions and initial conditions are not violated during the refueling and other fuel handling operations.

Administrative controls for fuel handling operations include the following:

1. Movement of the fuel assemblies from the core shall be started only after allowing for sufficient decay after the reactor shutdown.

2. The spent fuel cask loading pit gate shall be retained closed during refueling operations.

3. Manual control of the handling equipment, such as, Refueling Machine, Spent Fuel Machine, New Fuel Elevator, and Auxiliary Crane shall be put under administrative control.

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4. ~~The spent fuel cask loading pit penetration cover shall be kept closed.~~

9.1.4.2.2 Component Description

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The major components of the FHS are described in the following paragraphs. Refer to Section 3.2 for the seismic and system quality group classification of these componentsTable 3.2.2-1 provides the seismic and other design classifications for the components in the FHS. The FHS is designed in accordance with ANS 57.1 (Reference 1), ANS 57.2 (Reference 2), and ANS 57.3 (Reference 3). The transfer tube components are designed per ASME Boiler and Pressure Vessel Code, III (Reference 4).

Refueling Machine

The refueling machine (RM) moves fuel assemblies both within the reactor vessel and between the reactor vessel and the fuel transfer tube facility during outages. The RM is primarily designed for the underwater handling of fuel assemblies between the FTTF and the core during outages. The RM also provides access to fuel assemblies for detecting fuel cladding ruptures, visual core mapping, an operational platform for handling control rod drive shafts and instrumentation, and access to the upper internals of the reactor vessel.

The main components of the RM are shown in Figure 9.1.4-1—Refueling Machine.

A conceptual drawing of the fuel assembly hoisting mechanism is shown in Figure 9.1.4-2—Fuel Assemblies Hoisting Mechanism.

Fuel Transfer Tube Facility

The main purpose of the FTTF is to transfer fuel between the SFP and the refueling cavity. The fuel transfer tube is fitted with a blind flange on the Reactor BuildingRB side to provide containment isolation during power operations and with a manual gate valve on the Fuel BuildingFB side to allow isolation of the SFP from the refueling cavity. The fuel transfer tube is provided with expansion joints on the RB and FB side to accommodate the differential movement and provide leak tight sealing. An underwater conveyor car carries the fuel assemblies in a fuel container through the tube. Upenders provide the capability to tilt the fuel container.

The main components of the FTTF are shown in Figure 9.1.4-3—Fuel Transfer Tube Facility, Reactor Building and Figure 9.1.4-4—Fuel Transfer Tube Facility, Fuel Building.

New Fuel Elevator

The primary purpose of the new fuel elevator (NFE) is to lower new fuel assemblies to the bottom of the spent fuel storage pool for transfer via the spent fuel machine. The NFE supports and rotates the fuel assemblies, protects them from shock, and provides a means to inspect fuel assemblies when they are underwater.

The main components of the NFE are shown in Figure 9.1.4-5—New Fuel Elevator.

Spent Fuel Machine

The spent fuel machine (SFM) is primarily designed for the underwater handling of fuel assemblies between the SFP and the FTTF. The SFM permits access to the fuel assemblies to detect fuel cladding ruptures. It also enables the loading of spent fuel into the shipping casks.

The main components of the SFM are shown in Figure 9.1.4-6—Spent Fuel Machine.

Auxiliary Crane

The auxiliary crane is used to handle new fuel containers, container covers, protection lids, new fuel assemblies, erection opening covers, canisters, slot gates, swivel gates, tilting basket, along with miscellaneous handling operations. The auxiliary crane is designed with buffers and shock-absorbing devices. The auxiliary crane bridge hoist uses the new fuel handling tool to handle new fuel assemblies for operations in air. For further details on the auxiliary crane, refer to Section 9.1.5.

Fuel Racks

The fuel racks are located under-water for irradiated fuel storage, and above water for new fuel storage. The racks are designed to store fuel in a manner that precludes criticality and maintains the irradiated fuel in a coolable geometry. Refer to Section 9.1.2 for the design of the new and spent fuel storage racks.

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Spent Fuel Cask Transfer Facility

The SFCTF is functionally separated into four major parts: the spent fuel cask transfer machine, the penetration assembly, the SFCTF fluid and pneumatic systems, and the biological lid handling station.

Spent Fuel Cask Transfer Machine

The SFCTM is a trolley that moves on rails and transports the spent fuel cask vertically within the stations of the SFCTF. Instrumentation and controls (I&C) are provided to support safe operation, as described in Section 9.1.4.5. The SFCTM interfaces with the plant fluid systems that are required to support cask operations, such as filling and draining.

The SFCTM is designed to remain in place and support the cask while the cask is attached to the loading pit penetration and prevent a loss of water from the spent fuel pool during a SSE that could result in potential offsite exposures. The SFCTM also provides structural support to a cask containing spent fuel to preclude fuel damage or a criticality accident.

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The SFCTM includes a device to dock and undock the cask from the penetration, an elevator to lift and lower the penetration bottom cover, and a support to hold the biological lid during cask loading.

The SFCTM provides shielding for operators in abnormal conditions when loading hall entry is required before the biological lid is inserted into the cask to minimize occupational dose. The shielding is placed around the top of the cask and around equipment that may contain contaminated water or gas.

The SFCTM has an interlock with the external door of the loading hall, which precludes operation if the external door is open. The external door remains closed during cask loading operations. Mechanical stops are used to prevent inadvertent contact of the SFCTM with the loading hall door or wall.

To prevent damage to the penetration assembly seal, the SFCTM is interlocked to prevent moving within the loading hall. Unless the gripper of the biological lid handling station is in the upper position, the anti-seismic devices are unlocked, the penetration docking device is in the lower position, the penetration assembly is in the upper position (movements to and from the penetration station), and the handling area opening is closed (movements to and from the handling station).

The SFCTM is shown in Figure 9.1.4-7—Spent Fuel Cask Transfer Facility.

Penetration Assembly

The penetration assembly provides a leaktight connection between the loading pit and the internal cavity of the cask, an upper cover at the bottom of the loading pit, and a lower cover at the lower end of the penetration. The penetration assembly consists of a supporting structure, internal and external shells, double walled bellows, a leak-tightness flange, and a docking flange.

The upper cover of the penetration is equipped with a mechanism to maneuver and set the cover on the supporting structure seals, and a hoist for operation of the maneuvering mechanism. The hoist is provided above the loading pit. With the upper cover in the closed position, it forms a leak-tight closure of the penetration assembly. In the open position, it allows the loading of fuel assemblies into a connected cask.

The lower cover is bolted to the leak-tight flange of the penetration assembly. It is equipped with a nozzle for the recovery of drip-offs. The lower cover is designed to support the weight of the water in the loading pit in the event of an inadvertent opening of the upper cover of the penetration. The lower cover is manually unbolted and removed by the operators using the elevator of the SFCTM when performing cask loading operations.

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The supporting structure is equipped with two seals on its upper part that provides the leak-tightness with the upper cover of the penetration assembly. The space between the seals is monitored for leak-tightness and an alarm is generated in the SFCTF control room upon detection of a leak.

The internal and external shells are fixed to the supporting structure and provide protection for the bellows. The internal shell directs the flow of water and air in the penetration and the external shell guides the docking flange.

The double-walled bellows are provided with a flange at each end. The lower flange is connected to the docking flange and leak-tight flange, while the upper flange is connected to the supporting structure. The upper flange connection is equipped with two seals and the capability to monitor the space between the seals for leak-tightness.

The leak-tight flange is connected to the docking flange and the double-walled bellows flange at the upper end. The lower end of the leak-tight flange contacts the mating surface of the cask when the cask is docked to the penetration assembly. When the SFCTM is not in place under the penetration, the leak-tight flange is bolted with the lower cover of the penetration. The leak-tight flange is equipped with two seals each at the upper and the lower end and the capability to monitor the space between the seals for leak-tightness.

The docking flange is hung from the supporting structure by an arrangement that keeps the bellows in the upper position when it is in the storage position.

The penetration assembly maintains a leak tight boundary of the loading pit when the penetration is closed, and when the penetration is open and connected to a cask. The boundary serves as part of the safety-related cask loading pit fluid boundary to prevent drainage from the spent fuel pool and is maintained during and following an SSE to prevent a loss of water from the loading pit that could result in potential offsite exposures. A brief unseating of the normally leak-tight connection at the mating surface of the cask may occur during the SSE resulting in some seepage around the seals, but does not result in any significant loss of water inventory from the cask loading pit or spent fuel pool.

An interlock precludes opening the penetration upper cover before the correct docking of the cask is checked, the anti-seismic locking of the SFCTM, and the correct cask water level. Likewise, an interlock prevents undocking the cask from the penetration unless the upper cover is closed.

To prevent damage to equipment or fuel in transit, the spent fuel machine is prevented, by interlock, from entering the loading pit unless the gates are open and the penetration upper cover is open. The upper cover is prevented from moving if the spent fuel machine is in the loading pit.

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The penetration assembly is shown in Figure 9.1.4-8—Cask Loading Pit Penetration Assembly.

SFCTF Fluid and Pneumatic Systems

Fluid and pneumatic systems are provided in the SFCTF for filling, draining, cooling, and drying the cask and penetration assembly. These SFCTF systems are connected with the respective plant systems: compressed air system, demineralized water system, nuclear island drain/vent system, and fuel pool cooling and purification system.

The portions of SFCTF fluid and pneumatic systems piping directly connected to the penetration assembly, and cask are designed with isolation capability to prevent a loss of water from the spent fuel pool and loading pit during and following an SSE that could result in potential offsite exposure.

Fluid and pneumatic system valves required to isolate the cask and penetration assembly are closed on a loss of power.

Biological Lid Handling Station

The biological lid handling station is used for handling the biological lid from the cask to its support on the SFCTM and back to the cask after fuel assembly loading. The biological lid handling station consists of a supporting structure and a lifting mechanism. The biological lid handling station uses an irreversible screw design that prevents lid drop on a loss of power.

The biological lid handling station is remotely controlled from the SFCTF control room.

The biological lid handling station is shown in Figure 9.1.4-7.

~~**Spent Fuel Cask Transfer Facility**~~

~~A penetration is located in the bottom of the cask loading pit to enable loading of spent fuel assemblies into a spent fuel cask after a sufficient decay period in the spent fuel pool. The penetration assembly maintains leak-tightness during fuel loading into the cask to maintain fuel integrity. A Seismic Category I penetration cover with double seals in the bottom of the loading pit seals the penetration to maintain the water inventory in the loading pit when the cover is closed. The cover is maintained closed.~~

9.1.4.2.3 Fuel Handling Tools Description

The new fuel handling tool and spent fuel handling manual tool are used to handle fuel assemblies one at a time, with or without a fuel assembly insert. The fuel assembly insert handling manual tool is used to handle fuel assembly inserts one at a time. The new fuel handling tool, spent fuel handling manual tool, and fuel assembly insert handling manual tool are manually operated, but handled by the auxiliary crane in the FB. The spent fuel handling manual tool can be handled by the polar crane in the RB. The fuel handling tools are designed in accordance with ANSI/ANS 57.1-1992, R1998, R2005 (R=Reaffirmed) (Reference 1). The new fuel handling tool, spent fuel handling manual tool, and fuel assembly insert handling manual tool are not handled by the refueling machine hoist or the spent fuel machine hoist.

New Fuel Handling Tool

The new fuel handling tool performs handling of a new fuel assembly in air with or without a fuel assembly insert between the new fuel container, new fuel examination area, new fuel storage racks, and new fuel elevator.

Spent Fuel Handling Manual Tool

The spent fuel handling manual tool performs underwater handling of a fuel assembly with or without a fuel assembly insert for positions of the underwater fuel storage racks, which are not accessible by the spent fuel machine and in case of a spent fuel machine failure. The spent fuel handling manual tool can be handled by the polar crane for underwater handling of fuel assemblies in the RB. The spent fuel handling manual tool performs underwater handling of a fuel assembly with sufficient water cover to provide adequate shielding.

Fuel Assembly Insert Handling Manual Tool

The fuel assembly insert handling manual tool performs underwater handling of fuel assembly insert in the spent fuel storage pool in case of a spent fuel machine failure. The fuel assembly insert handling manual tool is designed to handle different types of inserts, such as the rod cluster control assembly, thimble plug assembly, and neutron sources. The fuel assembly insert handling manual tool performs underwater handling of a fuel assembly insert with sufficient water cover to provide adequate shielding.

9.1.4.3 Safety Evaluation

- The safety-related portions of the FHS are located in the RB and FB. These buildings are 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 safety-related portions of the FHS are designed to remain intact after an SSE. Section 3.7 provides the design loading conditions that were considered. Section 3.5, Section 3.6, and Appendix 9A provide the required hazards analysis. The refueling machine, fuel transfer tube facility, NFE, ~~and~~ SFM, SFCTM, penetration upper cover handling hoist, and biological lid handling hoist are designed to hold their maximum load during an SSE. See Section 9.1.5.2.3 for auxiliary crane design requirements.

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- The portions of the FHS that provide containment boundary and containment isolation functions are ~~safety related~~safety-related. The fuel transfer tube penetrates the primary containment and is equipped with a blind flange in the ~~Reactor Building~~RB that is closed during power operations. The leak-tight function of the fuel transfer tube is tested in accordance with 10 CFR 50, Appendix J programmatic requirements (refer to Section 6.2.6).

- The spent fuel assemblies and their inserts are handled with sufficient water cover to provide adequate shielding. Movement of fuel assemblies that could result in assembly grid contact or contact with other fuel assemblies takes place at low speed. Details regarding the specific assumptions, sequences, and analyses of fuel handling accidents are provided in Section 15.0.3.10.

Details regarding criticality prevention measures for new and spent fuel storage are provided in Section 9.1.1. The fuel handling equipment is designed to handle one single fuel assembly at a time to protect against a criticality event during fuel handling operations.

The FHS is designed and arranged so that there are no loads which, if dropped, could result in damage leading to the release of radioactivity in excess of 10 CFR 100 guidelines, or impair the capability to safely shut down the plant. All spent fuel cask handling activities are performed below the SFP in the loading hall located at the ground elevation of the FB. Any lifting of a spent fuel cask is performed outside of the FB using appropriate handling equipment and lifting height limitations. At all times during spent fuel cask handling inside the FB, the cask height will not exceed 30 feet based on the design of the FB. The cask drop accident is addressed in Section 15.0.3.10. Details regarding new and spent fuel storage are provided in Section 9.1.1 and Section 9.1.2. Details regarding the specific assumptions, sequences, and analyses of fuel handling accidents are provided in Section 15.0.3.10.

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The fuel storage pool, loading pit, and transfer pit are supplied by the fuel building ventilation system (FBVS) (Section 9.4.2). The loading hall is provided with a separate supply and exhaust duct. The FBVS is provided with isolation provisions which can isolate the fuel pool room and the loading hall from the rest of the building, if necessary. In the event radioactivity above limits is present in the FB during normal operation, the system is switched to filtration through the nuclear auxiliary building ventilation system (NABVS). Information on the NABVS is provided in Section 9.4.3.

Doses to operators are maintained ALARA by remote operation of the SFCTM. This precludes the need for operators to enter the loading hall containing a loaded cask until the biological lid is placed on the cask. The underpool loading design also precludes the need to decontaminate the outer surface of the cask after loading.

9.1.4.3.1 Safety Provisions for the Major Fuel Handling System Components

Refueling Machine

The refueling machine (RM) hoisting mechanism is equipped with an operational brake, an auxiliary brake, and a safety brake which acts on the drum in case of overspeed detection, chain failure, or reverse rotation. The brakes are designed to engage when de-energized. They engage in case of a malfunction of the loop drive train configuration.

The gripper mast assembly is suspended via two cables, with an equalizing system and break detector. A limit switch stops the lifting movement when the telescopic gripper mast reaches its upper end position. A load cell measures the weight of the suspended load and control circuits associated with the load cell allow for the brake actuation.

A load limiting device protects the fuel assembly during normal lifting movements in the core when contact occurs between two fuel assemblies. It limits the loads applied to the grids of the fuel assemblies and to the nozzles of the fuel assemblies.

During normal operation, the refueling machine can only travel within a defined "travel route", thereby avoiding the possibility of inadvertent contacts. This route is determined by encoders and limit switches.

The RM is provided with a dose rate measurement device, and lifting is stopped in case of exceeding the allowable dose rate limit.

The RM is provided with interlocks related to:

- Traveling or traversing.
- Lowering or lifting.
- Engaging or disengaging of the latches.
- Travel from one compartment of the pool to another.
- Preventing interference with the FTTF.

Fuel Transfer Tube Facility

The transfer tube is attached to the RB internal containment wall by means of a rigid and leak tight connection so as not to affect containment integrity. A metal expansion bellows welded to the transfer tube and to the frames of the building structure is provided at each end of the transfer tube. The bellows form close concentric volumes, which are equipped with a sensor for detecting leaks from the expansion joints. The sensors provide an alarm in the main control room.

The fuel transfer tube facility hoisting mechanism is equipped with an operational brake and a safety brake, which acts on the drum in case of overspeed, chain failure or reverse rotation. The winch is equipped with redundant cables that preclude the falling of a lifting frame to its horizontal position in the event of a cable failure. The brakes are designed to engage when de-energized. They engage in case of malfunction of the loop drive train configuration.

In case of an abnormal situation during fuel assembly transfer, the fuel assembly can be placed in a safe position. The fuel assembly can be moved by using either manual devices (hand wheels at the drives) or via the backup horizontal movement system of the conveyor car in case of an electrical or mechanical failure to place it in a safe state. The backup horizontal movement system can be used to return the conveyor car to the FB from any position in its normal travel in the event of control system malfunction. After returning the conveyor car, the fuel transfer tube gate valve can be closed manually.

A load cell is also provided, which prevents operation in the event of overloading or in case of a slack cable.

Each control desk is equipped with a manual switch which trips the main circuit breakers should the operator note a malfunction.

In addition to limit switches, the fuel transfer tube facility is provided with the following interlocks related to:

- Horizontal movement of the FTTF conveyor car.
- Tilting of the fuel container.

Spent Fuel Machine

The SFM hoisting mechanism is equipped with an operational brake, an auxiliary brake, and a safety brake, which acts on the drum in case of overspeed, chain failure or reverse rotation. The brakes are designed to be engaged when de-energized. They engage in case of malfunction of the loop drive train configuration.

The gripper mast assembly is suspended via two cables with an equalizing system and break detector. A limit switch stops the lifting movement when the telescopic gripper mast reaches the upper end position. A load cell prevents hoisting operation in the event of overload.

The spent fuel machine travel is limited to avoid a fuel assembly contacting the SFP walls, the FB transfer pit walls, and the loading pit walls.

The limit switch prevents further lifting such that personnel exposure from an irradiated fuel assembly will not be >2.5 mrem/hour. The SFM is provided with a dose rate measurement device and the lifting is stopped in case of exceeding the allowable dose rate limit.

The SFM is provided with interlocks related to:

- Traveling or traversing.
- Lowering or lifting.
- Engaging or disengaging of the latches.
- Functioning of the FTTF, auxiliary crane, and NFE.
- Access to the fuel pool transfer pit.

New Fuel Elevator

The NFE hoisting mechanism is equipped with an operational brake, and a safety brake on the drum. The brakes are designed to be engaged when de-energized. The hoisting mechanism is provided with a cable equalizing system and a cable break detector. The movement is stopped if a cable break is detected. The hoisting mechanism is equipped with a load detection device and the movement is stopped in the event of a threshold overrun.

The NFE is designed to accommodate only one fuel assembly at a time and is provided with a radiation monitor that stops the NFE in the event of exceeding the radiation limits.

The NFE is provided with interlocks related to:

- Lowering or lifting.
- Functioning of the SFM.

Auxiliary Crane

Refer to Section 9.1.5 for safety provisions incorporated in the auxiliary crane.

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Spent Fuel Cask Transfer Machine

The SFCTM is designed to remain in place and maintain structural support of the spent fuel cask, including during and following an SSE to prevent draining of the spent fuel pool. The supporting structure and other load bearing items of the machine are designed conservatively to maintain leak-tight integrity of the penetration assembly under design conditions, including the drop of the fuel assembly from the maximum handling height onto a connected cask.

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A cask handling accident inside the FB is prevented by the design of the SFCTM. Anti-seismic locking devices engage the SFCTM with the walls of the loading hall when located at process stations to prevent movement during a seismic event. The lateral guiding device prevents tilting of the SFCTM when between stations in the loading hall. Brakes are designed to be engaged when de-energized on a loss of power.

SFCTM movements are stopped and fluid and pneumatic system valves required to isolate the cask and penetration assembly are closed on a loss of power.

Penetration Assembly

The penetration assembly is designed to maintain its leak-tight integrity following the drop of a fuel assembly from the maximum handling height of the spent fuel machine (Elevation 37' 7"). The double-walled bellows of the penetration is protected from impact by a protective shell. The radiological consequences of a fuel handling accident in the loading pit are bounded by the fuel handling accident analyzed in Section 15.0.3.10.

The penetration assembly is designed to perform safety-related functions during and following a SSE. The penetration assembly is designed to serve as part of the safety-related cask loading pit fluid boundary to prevent drainage of the spent fuel pool, both when the penetration is closed and when the penetration is connected to the cask. A brief unseating of the normally leak-tight connection at the mating surface of the cask may occur during the SSE, resulting in some seepage around the seals, but does not result in any significant loss of water inventory from the cask loading pit or spent fuel pool.

SFCTF Fluid and Pneumatic Systems

The portions of the SFCTF fluid and pneumatic systems connected to the cask and penetration up to the isolation provisions are designed to serve as part of the safety-related cask loading pit fluid boundary to prevent draining of the spent fuel pool including during and following a safe shutdown earthquake.

~~Spent Fuel Cask Transfer Facility~~

~~When the Spent Fuel Cask Transfer Facility is not operated, the loading pit is isolated from the SFP by two gates. The loading pit may be empty or contain water for SFP makeup, as described in Section 9.1.3. The leak tightness of the SFP loading pit penetration is monitored and an alarm is transmitted to the main control room.~~

~~The single failure criterion is applied to the components of the facility performing safety functions, failure of which may lead to abnormal levels of occupational radiation exposure. The safe position is assured by the mechanical components in case of electrical failure.~~

9.1.4.3.2 Safety Provisions for the Fuel Handling Tools

The new fuel handling tool is equipped with the ability to indicate proper resting of the tool on the fuel assembly top nozzle and the latched or unlatched status of the gripper. The new fuel handling tool is equipped with a mechanical locking system, which prevents unlatching of the gripper under load.

The spent fuel handling manual tool is equipped with means to indicate proper resting of the tool on the fuel assembly top nozzle and the latched or unlatched status of the gripper. The spent fuel handling manual tool is equipped with a mechanical locking system, which prevents unlatching of the gripper under load. The spent fuel handling manual tool is suspended from the crane by means of an extension piece, which confirms an acceptable amount of water shielding is present when the crane hook is in the upper position.

The fuel assembly insert handling manual tool is equipped with a mechanical locking system, which prevents unlatching of the gripper under load. The fuel assembly insert handling manual tool has an arrangement for guiding the fuel assembly insert during handling to avoid potential damage. The fuel assembly insert handling manual tool is equipped with means to indicate proper resting of the tool on the fuel assembly top nozzle. The fuel assembly insert handling manual tool is suspended from the auxiliary crane by means of an extension piece, which confirms an acceptable amount of water shielding is present when the crane hook is in the upper position.

Refer to Section 9.1.5 for safety provisions incorporated in the design of the auxiliary crane and polar crane for fuel handling.

9.1.4.3.3 Refueling Cavity Draindown Events

Rapid draindown of the refueling cavity resulting in fuel uncovery during refueling is not a credible event. The reactor vessel cavity ring is a permanently installed stainless steel assembly welded to the reactor vessel and the refueling cavity liner to prevent water leakage from the refueling cavity. The passive cavity ring design does not rely on active components such as pneumatic seals and is not susceptible to gross failure. Seals for openings in the refueling cavity liner do not rely on active components and do not pose a risk for rapid cavity draining.

The residual heat removal system and fuel pool cooling and purification system are potential paths for inadvertently draining the refueling cavity. For credible system misalignments, sufficient time is available to detect and isolate the drain path and to place a handled fuel assembly, if necessary, in a safe storage location.

A COL applicant that references the U.S. EPR design certification will provide information for operating and maintenance procedures related to refueling cavity integrity. These procedures will include periodic maintenance and inspection of the refueling cavity ring, leakage testing and maintenance of the refueling cavity door seals, administrative controls to prevent draindown events through connected piping, and actions required in response to a detected loss of refueling cavity water. Inadvertent draining of the refueling cavity is addressed by plant procedures. Refer to Section 13.5 for plant procedure information.

Any credible drainage from the refueling cavity will be detected visually or by installed instrumentation in adequate time to place a handled fuel assembly, if necessary, in a safe storage location. The safe storage location is either in the reactor core if an acceptable location is available or in the fuel transfer facility, where it can be positioned horizontally to increase shielding depth or can be transferred to the Fuel BuildingFB. Weirs in the Reactor BuildingRB and Fuel BuildingFB pools limit the loss of water in pool areas separated from the drain path by the weirs.

9.1.4.3.4 Cask Loading Pit Draindown Events

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Draindown Events During Non-Cask Loading Operations

The two gates separating the spent fuel pool from the cask loading pit are described in Section 9.1.2.2.2. The gates do not rely on active equipment, such as inflatable seals, to maintain leak-tightness. The slot gate seals are compressed by the weight of the gate to create a leak tight barrier. The swivel gate has a locking mechanism which equally distributes pressure on the seal to create a leak tight barrier. The swivel gate is locked in both the open and closed positions. The gates are shown in Figure 9.2.1-9 - Cask Loading Pit Gates. Unless spent fuel is being moved to the cask loading pit, both gates are closed. Failure of a single gate does not impact the water inventory in the spent fuel pool. During cask loading operations, the slot gate is removed, and the swivel gate is open to allow fuel movement into the cask loading pit.

The penetration assembly between the cask loading pit and the loading hall beneath the pit remains closed when cask handling operations are not occurring. The penetration assembly is closed by an upper cover at the bottom of the cask loading pit and a lower cover below the leak-tightness flange. The upper cover is a thick plate with a pressurization mechanism that pressurizes the cover uniformly and locks it closed for maintaining a leak tight seal. Two seals are provided to maintain leak-tightness between the upper cover and the supporting structure and compressed air is supplied between the two seals to monitor leak-tightness. A seismic locking device holds the upper cover in the closed position during an SSE. The lower cover is a thick disk bolted to the leak-tightness flange of the penetration assembly with two seals providing leak-tightness. It is designed to support the weight of the water in the cask loading pit without the upper cover, which is an abnormal condition. In this condition, mechanical stops on the spring mounted devices shown in Figure 9.4.1-8, Cask Loading Pit Penetration Assembly, limit the displacement of the bottom cover.

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Draindown Events During Cask Loading Operations

During cask loading operations, the cask loading pit is flooded, the slot gate is removed and the swivel gate is open to allow fuel movement into the cask loading pit. In this case, the spent fuel pool and cask loading pit are connected volumes. The cask loading pit is filled prior to opening the penetration assembly upper cover. The upper cover is prevented, by design, from opening if there is a pressure difference across the cover, thus preventing inadvertent opening before the penetration is filled. The docking system uses an irreversible screw design that prevents undocking on a loss of power.

When the penetration assembly is opened and the two gates separating the cask loading pit from the spent fuel pool are open with a cask connected to the cask loading pit, the penetration assembly and the cask with the connected fluid systems up to the isolation boundary become part of the spent fuel pool and cask loading pit boundary. Catastrophic failure of the penetration assembly is not postulated. The penetration assembly is a safety-related, Seismic Category I component designed to serve as part of the safety-related cask loading pit fluid boundary to prevent drainage of the fuel pool during and following an SSE. A brief unseating of the normally leak-tight connection at the mating surface of the cask may occur during the SSE, resulting in some seepage around the seals, but does not result in any significant loss of water inventory from the cask loading pit or spent fuel pool. The penetration bellows are double-walled with the capability to monitor the space between the two walls for leak-tightness. The connected fluid and pneumatic systems piping up to, and including, the isolation boundary are also safety-related. The penetration assembly is designed to maintain its leak-tight integrity following the drop of a fuel assembly from the maximum handling height from the spent fuel machine (Elevation 37' 7"). The double-walled bellows of the penetration are protected from impact by a protective shell. For defense-in-depth, the seals are monitored during cask loading operation and if a leak is detected, the fuel assembly may be moved to a safe location and the upper cover can be closed to prevent draining of the loading pit before there is any impact on spent fuel pool water inventory or fuel cooling.

Should piping connected to the loading pit volume be inadvertently opened during cask loading, the water level in the loading pit would begin to drop slowly. The fuel pool cooling and purification system has the capability to monitor water level in the cask loading pit and to display an alarm in case of an abnormal water level. At that point, the piping could be isolated, the fuel assembly in transit would be placed in the cask or back in the spent fuel storage racks and the penetration upper cover or swivel gate could be closed to isolate the spent fuel pool.

9.1.4.4 Inspection and Testing Requirements

The safety-related components are located to permit preservice and inservice inspections. The FHS containment isolation function is testable. Refer to Section 14.2

(test abstracts #038 and #039) for initial plant testing of the FHS components. The performance and structural integrity of system components is demonstrated by continuous operation.

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The fuel handling tools are load tested to 125 percent of the rated load prior to their initial use. Visual inspections are recommended for the fuel handling tools prior to use.

The biological lid lifting station and the penetration upper cover hoist are load-tested to 125 percent of the rated load prior to their initial use.

Tests of the SFCTF equipment are performed before each cask loading campaign and include functional tests, overload protection tests, and leak tests. The tests include the following:

- The upper cover of the loading penetration assembly is tested for leak-tightness.
- Check of the geometry of the various components and functional clearances:
  - Straightness and alignment of the different components.
  - Position of guiding rails.
- Check of the motive parts (motors, brakes).
- Check of overload thresholds.
- Check of limit switches, overtravel switches, and speed and position sensors.

9.1.4.5 Instrumentation Requirements

In general, mechanical or electrical interlocks are provided, when required, to provide reasonable assurance of the proper and safe operation of the fuel handling equipment. The intent is to prevent a situation which could endanger the operator or damage the fuel assemblies and control components. The interlocks, setpoints, rules for handling fuel assemblies, and other devices that restrict undesired or uncontrolled movement are incorporated in the design. ~~The RM, SFM and NFE are provided with an arrangement, on the respective control desk, for an emergency shutdown of movements.~~ As a minimum, the interlocks specified in Table 1 of Reference 1 will be provided.

The spent fuel machine and new fuel elevator are remotely operated from their respective control desk on the FB floor. The refueling machine is remotely operated from a control desk located on the RB operating floor. The fuel transfer tube facility is provided with two control desks, one on the FB side and the other on the RB side. The refueling machine, spent fuel machine, new fuel elevator, and fuel transfer tube facility are provided with a safety feature, on their respective control desk, for an emergency shutdown of fuel movements. The spent fuel machine and refueling machine are equipped with an emergency stop provision on the equipment. The fuel transfer tube facility on the FB side has, on the fuel pool operating floor, a safety feature for an emergency stop. The new fuel elevator has a control box on the fuel pool operating floor.

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SFCTF I&C Description

The SFCTF includes the following control panels:

- Main control panel in the SFCTF control room.
- Control panel on the SFCTM.
- Control panel on the operating floor for maneuvering the upper cover of the penetration assembly.
- Digital display for monitoring the water level in the cask and penetration assembly.

Operation of the SFCTF is controlled by a non-safety-related operating programmable logic controller (PLC) based on information from the control devices, encoders, load cells, mechanical sensors, and pressure, level and flow sensors. Movements and process status are monitored by a second monitoring PLC. Both PLCs are connected via a network, allowing data transfer from monitoring PLC to operating PLC.

Sensors and actuator are installed in the FB and on the SFCTM.

9.1.4.6 References

1. ANSI/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.
2. ANSI/ANS-57.2-1983: “Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants,” American National Standards Institute/American Nuclear Society, 1983
3. ANSI/ANS-57.3-1983: “Design Requirements for New Fuel Storage Facilities at Light Water Reactor Plants,” American National Standards Institute/American Nuclear Society, 1983.
4. ASME Boiler and Pressure Vessel Code, Section III, “Rules for Construction of Nuclear Facility Components,” The American Society of Mechanical Engineers, 2004.