ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Monday, August 22, 2011 9:07 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); HALLINGER Pat (EXTERNAL AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); KOWALSKI David (AREVA); GARDNER Darrell (AREVA); HARRINGTON James (AREVA); PATTON Jeff (AREVA); THALLAPRAGADA Pavan (AREVA); Hearn, Peter
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 US EPR DC - DRAFT Part 1 of 4.pdf

Importance: High

Getachew,

To support a final response date of August 31, 2011, an informal draft response for RAI No. 385, FSAR Ch 9, Questions 09.01.04-15, 09.01.04-16 and 09.01.04-17 is provided in the attached file, "RAI 385 Response US EPR DC – DRAFT Part 1 of 4.pdf" and in the following 3 e-mail transmittals.

I assume we will discuss further during the planned Cask Handling telecon tomorrow afternoon.

Thanks,
Dennis

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

From: WILLIFORD Dennis (RS/NB)
Sent: Wednesday, August 03, 2011 3:06 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 21
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 and Supplement 20

responses to RAI No. 385 were sent on June 10, 2011 and June 30, 2011, respectively, to provide a revised schedule.

Based on the audit of the cask handling system design held on July 19th and 20th, significant additional information was requested to be included in the final RAI responses and related FSAR markups. The resulting change in the schedule for completion of the responses to the remaining 3 questions in RAI 385 listed below was verbally communicated and discussed with NRC staff in a conference call yesterday afternoon. The schedule for technically correct and complete responses to the remaining three questions has been revised as provided below:

Question #	Response Date
RAI 385 — 09.01.04-15	August 31, 2011
RAI 385 — 09.01.04-16	August 31, 2011
RAI 385 — 09.01.04-17	August 31, 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: 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
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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

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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,

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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.
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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
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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 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
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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
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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.
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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,

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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
U.S. EPR Design Certification Licensing Manager

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: 3347

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D486CD12)

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: 8/22/2011 9:06:30 PM
Received Date: 8/22/2011 9:06:44 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

Recipients:
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
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"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
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"PATTON Jeff (AREVA)" <Jeff.Patton@areva.com>
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"THALLAPRAGADA Pavan (AREVA)" <Pavan.Thallapragada@areva.com>
Tracking Status: None
"Hearn, Peter" <Peter.Hearn@nrc.gov>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: auscharmx02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	43492	8/22/2011 9:06:44 PM
RAI 385 Response US EPR DC - DRAFT Part 1 of 4.pdf		615785

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

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:

a.

(1) Cask Loading Pit

The cask loading pit is used for the transfer of spent fuel assemblies from the spent fuel pool (SFP) area through a penetration assembly into a spent fuel cask for removal. The fuel pool cooling and purification system (FPCPS) is used for filling and draining the cask loading pit and is described in U.S. EPR FSAR Tier 2, Section 9.1.3. The FPCPS

includes a safety-related isolation capability of non-safety related fuel pool purification system (FPPS) piping from the cask loading pit. The FPPS line supplying water to the cask loading pit is also provided with a siphon breaking device. U.S. EPR FSAR Tier 2, Figure 9.1.3-2—Fuel Pool Purification System (Sheet 2 of 5) shows the piping connections with the loading pit. This figure identifies the provision for loading pit water level measurement in the loading pit. The SFCTF is also provided with an arrangement for loading pit water level monitoring during cask loading operations.

The loading pit is separated from the SFP by two gates, a swivel gate and slot gate, which are shown in U.S. EPR FSAR Tier 2, Figure 9.1.2-9—Cask Loading Pit Gates. The slot gate is equipped with dual seals and the swivel gate is equipped with one seal. These seals are made from EPDM rubber (ethylene propylene diene monomer) or other equivalent material, and are designed to resist high levels of ionizing radiation.

(2) Cask Loading Pit Seals

The cask loading pit contains a penetration assembly for connection to a spent fuel cask. To maintain the required leak-tightness, the penetration assembly is equipped with dual seals at the interfaces. These seals are an O-ring type and are made from EPDM rubber or other equivalent material, and are designed to resist high levels of ionizing radiation.

The integrity of the penetration seals is tested before loading the fuel assemblies. During the seal test, and also during the loading of fuel assemblies, any leak of the seals between the cask and the docked penetration or of the bellows is detected by a decrease in pressure of the compressed air enclosed between the two barriers. The compressed air pressure between the two barriers is maintained greater than the water column pressure in the loading pit. The leak-tightness of the penetration vent mechanism is tested separately. Maintenance of the seals is performed when the loading pit is empty and at periodic intervals recommended by the seal manufacturer.

Two concentric seals on the upper part of the supporting structure maintain double barrier leak-tightness to the upper cover of the penetration when the upper cover is closed. This provision exists to maintain the space between the two seals pressurized with compressed air at a pressure greater than the water column pressure in the loading pit to avoid any concern of water leakage due to a seal failure. This provision exists to monitor the leak-tightness of the upper cover of the penetration in the main control room when the SFCTF is not in use.

U.S. EPR FSAR Tier 2, Section 9.1.4.2.2 will be revised to include this additional information about the cask loading pit seals and a new U.S. EPR FSAR Tier 2, Figure 9.1.4-9—Loading Pit Penetration Assembly Seals.

(3) Penetration Connection Equipment

The penetration docking device is fixed on top of the spent fuel cask transfer machine (SFCTM) and is used to pull down the bellows of the penetration assembly in order to connect the leak tight flange to the mating surface of the cask. The penetration docking device consists of four identical assemblies, each of which includes a screw connected at its lower end to a bearing and whose upper end engages into a swiveled nut of the docking flange of the penetration. Each screw is moved upwards by an air cylinder and is rotated by an electric motor and reduction gear that maintains its rotation. Each assembly is irreversible and equipped with a position sensor for a high travel and a low travel. Each screw is also equipped with a revolution counter which allows the balance

of the four assemblies. The design provision maintains that all screws are equally loaded. The penetration docking device is designed so that undocking of the cask is possible even with two diametrically opposed assemblies. A manual backup is provided for operating the screws in case of loss of supply of electric power.

U.S. EPR FSAR Tier 2, Section 9.1.4.2.2 will be revised to include this description of the penetration docking device and a new U.S. EPR FSAR Tier 2, Figure 9.1.4-10—Loading Penetration Docking Mechanism.

(4) Process to Connect Spent Fuel Cask to Cask Loading Pit

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 procedures and guidance for handling the SFCTF loads will be developed in accordance with ASME B30.2-2005 (Reference 9). Operator training and procedures are developed by the COL applicant as described in Sections 13.2 and 13.5.

Receipt and Preparations

Preparations for cask loading operation include preparing the gantry crane to interface with the SFCTM 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. 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. If necessary, cask-specific adaptors for interface with the SFCTF fluid systems are installed and the centering or locking ring is placed on the SFCTM with the auxiliary crane. The cask is filled with demineralized water at this stage 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.

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 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 device 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 penetration is 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 device 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.

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. 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.

U.S. EPR FSAR Tier 2, Section 9.1.4.2.1 was revised in U.S. EPR FSAR, Revision 3 to include the description of the processes that support the operation of the SFCTF.

(5) Refer to the response to Part (a)(4) of this question for a description of the cask loading processes.

b. The spent fuel cask transfer facility employs the concept of loading the spent fuel cask by docking it underneath the loading pit, which is located adjacent to the SFP. The loading pit is connected with the SFP during cask loading operations by opening the gates between the loading pit and SFP. The spent fuel cask is not submerged in the SFP for the loading of fuel assemblies. The biological lid handling station used for handling of the biological lid, the penetration upper cover hoist, which maneuvers the upper cover, and the SFCTM are categorized as heavy load handling equipment (i.e., loads weighing more than one fuel assembly and its handling device). However, the spent fuel cask transfer facility does not involve lifting of loads over the SFP or the reactor vessel. The biological lid and upper cover of the penetration are handled at their respective position and the SFCTM moves on the loading hall floor on rails. Therefore, the spent fuel cask transfer facility does not involve an overhead horizontal movement of a load in the Fuel Building (FB) during cask loading operations.

The spent fuel cask transfer facility transports a spent fuel cask from the gantry crane to the loading hall in the FB. It is used to connect the spent fuel cask to the loading pit for the spent fuel cask loading process. The spent fuel cask transfer facility enables access to the cask and penetration during the cask preparation conditioning phases. The spent fuel cask transfer facility supports, in part, the process systems required for the spent fuel removal operations. The spent fuel machine (SFM) loads fuel assemblies into the spent fuel cask one at a time.

Tables 09.01.04-1 through 09.01.04-5 provide the results of an assessment of the design features and operation of the spent fuel cask transfer facility, including the loading pit gates, to satisfy the acceptance criteria of applicable portions of NUREG-0800 Standard Review Plan (SRP) Sections SRP 9.1.1, “Criticality Safety of Fresh and Spent Fuel Storage and Handling,” SRP 9.1.2, “New and Spent Fuel Storage,” SRP 9.1.3, “Spent Fuel Pool Cooling and Cleanup System,” SRP 9.1.4, “Light Load Handling System (Related to Refueling)” and SRP 9.1.5, “Overhead Heavy Load Handling Systems.”

The spent fuel cask is addressed under a Part 72 general license and is not included in this assessment. The spent fuel storage racks, SFM and gantry crane outside the FB that is used to load/unload the SFCTM are also not included in this assessment.

c.

U.S. EPR FSAR Tier 1, Section 2.2.8, Table 2.2.8-1—FHS Equipment Mechanical Design and Table 2.2.8-2—Fuel Handling System ITAAC will be revised to include the requirements for the SFCTF penetration assembly, SFCTM and SFCTF fluid systems.

The spent fuel cask is outside of the scope of the design certification and is subject to licensing under 10CFR72. Therefore, it is not appropriate to include cask requirements in Tier 1. Additionally, Tier 1 requirements must be satisfied prior to initial fuel loading. Procurement of a cask and removal of spent fuel is not expected until after fuel has been irradiated and sufficient time has elapsed for decay heat loads to meet cask specifications. Therefore, a COL information item has been added to address the cask design requirements to be satisfied by the COL applicant prior to spent fuel removal.

To meet the design requirements for use with the SFCTF, the cask selected for use by the COL applicant must provide the following:

- 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.
- The cask shall have provisions for connecting process lines for water filling and draining, and drying of the cask.
- The cask shall be capable of dissipating decay heat from fuel assemblies loaded in the cask without supplemental cooling.
- The cask shall be designed such that the structural and seismic analysis of the cask confirms that the loads transferred to the spent fuel cast transfer facility (SFCTF) components and Fuel Building (FB) structures under design conditions, including a site-specific SSE, are acceptable.
- The cask shall be designed such that the structural analysis of the cask confirms that the loads transferred to SFCTF components and FB structures under design conditions, including the postulated drop of a fuel assembly from the maximum handling height in the cask loading pit onto a connected cask, are acceptable.
- The materials of construction of the cask are compatible with the environment including radiation, heat, exposure to borated and demineralized water, etc.
- The dimensions of the cask conform in conjunction with the SFCTM conform to the dimensions of the FB loading hall provided in Section 3.8.4.
- The piping/valves that connect to the cask and serve as a fluid boundary to the cask loading pit shall meet the same design requirements as the piping/valves attached to the cask loading pit.

U.S. EPR FSAR Tier 2, Section 9.1.4 will be revised to include the above COL information item.

U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items will be revised to include a revised COL Information Item Number 9.1-2, which incorporates these design requirements.

d.

(1) The SFCTF control room features non-safety-related electrical and I&C components that remotely operate the SFCTM inside the FB and biological lid handling station. The SFCTM is provided with a control panel on the transfer machine primarily for operating the transfer machine outside the FB for activities such as positioning the cask on the transfer machine. The upper cover of the penetration is maneuvered from a control panel located on the operating floor, +64 Feet. A room adjacent to the control room is for the fluid module and a display located in the room monitors the water level in the cask and penetration. Refer to FSAR Figure 3.8-41—Fuel Building Plan Elevation 0 Feet for the location of the SFCTF control room.

Operation of the SFCTF is controlled by a Programmable Logic Controller (PLC) based on the information from the control devices, the encoders, load cells, mechanical

sensors, and pressure, level and flow sensors. In order to mitigate any failure of the operating PLC, the movements and the process is monitored by a second PLC. These PLCs are located in the SFCTF control room.

The video cameras fixed in the loading hall allow surveillance of loading hall operations in the SFCTF control room. An intercom system connects the operating floor, biological lid lifting station, loading hall and SFCTF control room.

A manual backup drive system can be used to activate motorized equipment and valves in case of loss of power to the equipment and valves.

The electrical brakes are designed to be engaged when de-energized on a loss of power. Similarly, the motor-operated valves are designed to close with a loss of power.

Limit switches and interlocks are opened positively.

The SFCTF is equipped with accelerometers for seismic detection that switch off the power supply when an earthquake is detected.

The SFCTF is equipped with an emergency stop provision so that it can be stopped on demand.

Alarms are provided for the following conditions in the design of the SFCTF I&C:

- Failure of one of the leak-tightness seals (i.e., leak of the penetration).
- Overheating of water in the cask.
- Overload and underload of the biological lid handling mechanism.
- Overload and underload of the upper cover of the penetration maneuvering hoist.
- Overspeed of the hoist that maneuvers the upper cover of the penetration.
- Synchronization failure of the screws of the penetration docking device.
- Insufficient water level in the loading pit.

The SFCTF I&C includes the following external interlocks:

- SFCTM cannot be operated if the loading hall door is open.
- Upper cover of the penetration cannot be maneuvered if the SFM is in the loading pit.
- Opening of the upper cover of the penetration and emptying of the penetration is possible only if the loading pit swivel gate is closed.
- Handling opening cannot be opened if the biological lid is not placed on the cask.

Non-safety-related internal interlocks in the SFCTF I&C design are shown in Table 09.04.01-6.

(2) The SFCTF I&C design is non-safety-related and is not credited for accident mitigation.

(3) Refer to the response to Part (b) of this question for the results of an assessment of the design features and operation of the SFCTF to satisfy the acceptance criteria of applicable portions of SRP Sections 9.1.1, 9.1.2, 9.1.3, 9.1.4 and 9.1.5.

e.

(1) Cask Handling Components

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 cask is handled outside the FB using the FB gantry crane to remove the cask from the transport trailer. The SFCTM is towed under the crane, and the cask is placed on the SFCTM using adapters, as necessary, to interface with the 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 spent fuel cask is transported within the FB on the SFCTM. The SFCTM is described in the response to Part (e)(4). The SFCTF is provided with fluid, pneumatic, vacuum and nitrogen systems installed in the FB and on the SFCTM. These systems consist of process modules installed in a room adjacent to the SFCTF control room, the associated piping installed in the loading hall, and the flexible hoses to connect the systems to the SFCTM. The process modules consist of pipes, valves and process sensors. The process modules installed in the room check and monitor the seals and provide connections for the water supply to fill and drain the spent fuel cask and cask loading pit penetration assembly. The process module installed on the SFCTM contributes to the filling and draining of the cask, as well as the drying of the cask. Cask specific valve tools are used for connecting the internal cavity of the cask with the process modules. The valve tool bodies are screwed to the cask. The valve tools are water and airtight. Cask specific test tools are provided to check the leak-tightness of the plugs that close the orifices of the cask and check the leak-tightness of the biological lid and upper cover of the cask. The SFCTF also includes the capability to fill the internal cavity of the spent fuel cask with nitrogen if the cask specific design warrants. The nitrogen circuit also serves as a backup for the compressed air circuit.

The portions of process module 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. The system valves providing isolation capability for the cask and penetration assembly close on a loss of power.

(2) 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-tight 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.

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 penetration assembly is shown in U.S. EPR FSAR Tier 2, Figure 9.1.4-8—Cask Loading Pit Penetration Assembly.

(3) Penetration Assembly Seals

Seals for the cask loading pit penetration assembly and loading pit gates including the seals material are described in the response to Part (a). The bellows of the penetration is double-walled, composed of an upper flange with two concentric grooves for seals, double-walled bellow convolutions and a lower flange. The portions of the penetration assembly in contact with contaminated fluid, including the bellows, are constructed of austenitic stainless steel material.

(4) Cask Loading Components

The cask loading process is described in the response to Part (a)(4).

The penetration assembly is described in the response to Part (e)(2).

Spent fuel is loaded into the spent fuel cask through the penetration assembly using the SFM, which is described in U.S. EPR FSAR Tier 2, Section 9.1.4. The design of the SFM incorporates provisions for manual operation of the machine in an emergency mode in case of power failure which would allow manually lowering the fuel assembly into the cask. The SFM has a provision for manually traveling and traversing after manually opening the brake and for manually lowering and raising the load after

manually opening the brake. The seismic classification of the SFM is Seismic Category II (refer to U.S. EPR FSAR Tier 2, Table 3.2.2-1—Classification Summary.

U.S. EPR FSAR Tier 2, Section 9.1.4.2.2 will be revised to include this additional information about the manual operation of the SFM.

Other components involved in the loading process are described below.

SFCTM

The spent fuel cask is transported within the FB on a SFCTM. The SFCTM is a Seismic Category I trolley that moves within the FB loading hall on rails and transports the spent fuel cask vertically to the handling stations of the SFCTF. Motive force is provided by an onboard electric motor controlled by an operator. The SFCTM is also equipped with brakes. The SFCTM is designed so that a cask cannot be dropped or tipped. It is designed to remain in place and maintain structural support of the spent fuel cask, including during and following an SSE. The SFCTM is provided with lateral guiding devices and anti-seismic locking devices. The lateral guiding device slides along the guiding rails, which are placed on the corbels of the loading hall.

During normal operation, the lateral guiding device along with the guiding rails and the sliding support of the traveling platform facilitates the limited lateral adjustment of the SFCTM. During an SSE, the lateral guiding device prevents tilting of the SFCTM when it is not positioned at the handling opening station, the lid handling station or the penetration station. The anti-seismic locking devices consist of movable parts fixed on each side of the spent fuel cask transfer machine structure that engage in notches fixed on the corbels of the loading hall. The movable parts are actuated by an irreversible screw/nut system connected to an electric motor, a reduction gear and a torque limiter. They are also equipped with a manual backup for operation in case of loss of power supply. Position sensors provide the position of the moveable parts (locked/unlocked). The anti-seismic locking devices secure the SFCTM to the FB at the handling opening station, the lid handling station or the penetration station. The trolley must be exactly in the axis of the station to lock anti-seismic locking devices. The anti-seismic locking devices prevent any movement of the SFCTM when it is located at these stations in the event of an SSE or spurious behavior of the traveling drive system.

SFCTM movements are stopped on a loss of power and the onboard brakes are designed to be engaged when de-energized on a loss of power.

The SFCTM is shown in U.S. EPR FSAR Tier 2, Figure 9.1.4-7—Spent Fuel Cask Transfer Facility. U.S. EPR FSAR Tier 2, Section 9.1.4.2.2 will be revised to include this additional information about the SFCTM.

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 the loading of the fuel assembly. 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. During cask handling operations, the SFCTM is maneuvered to the biological lid handling station. 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. The biological lid handling station, used for handling of the biological lid, the penetration upper cover hoist, which maneuvers the upper cover and

the SFCTM are categorized as heavy load handling equipment (i.e., loads weighing more than one fuel assembly and its handling device). However, the SFCTF does not involve lifting of loads over the SFP or the reactor vessel. The biological lid and upper cover of the penetration are handled at their respective position and the SFCTM moves on the loading hall floor on rails. Therefore, the SFCTF does not involve an overhead horizontal movement of a load during cask loading operations.

The biological lid handling station is shown in U.S. EPR FSAR Tier 2, Figure 9.1.4-7.

(5) Design Codes

There are no consensus industry codes and standards directly applicable to SFCTF components. ANSI/ANS-57.2-1983: "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants," is applicable for in pool spent fuel cask handling and loading process and the relevant design requirements from this standard are considered for the SFCTF components. Also, the relevant guidelines from Section 5.1.1 of NUREG-0612 depending on type of the components and nature of operation of the SFCTF are considered. Accordingly, the following design criteria are applicable for the SFCTF design:

- The single failure criterion applies to components providing the SFP boundary, to avoid the accidental dewatering of SFP or cask during cask loading.
- The hoisting and handling equipment in which a failure may cause a possibility of a considerable radiation exposure will be designed with conservative design factor and/or redundancy, so that the load bearing components of the handling system are considered single failure proof.

Based on the foregoing discussion the following codes and standards are applied:

- The biological lid handling station is designed in accordance with the applicable portions of ASME NOG-1-2004 Type 1 crane, ANSI N14.6- 2004 and AISC Manual of Steel Construction, 9th Edition.

  U.S. EPR FSAR Tier 2, Section 9.1.4.2.2 will be revised to include this design information for the biological lid handling station.

  U.S. EPR FSAR Tier 2, Section 9.1.4.6 will be revised to include these three references.
- The penetration assembly is designed in accordance with ANSI/ANS-57.2-1983: "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants," ANSI/ANS, 1983. The piping connected with the penetration assembly and cask up to and including the first valve (if a normally closed valve), or up to and including a second isolation valve (if a normally open valve with auto close or remote close capability) are designed in accordance with ASME Boiler and Pressure Vessel Code, Section III, Division 1, "Rules for Construction of Nuclear Facility Components," The American Society of Mechanical Engineers, 2004 Edition. The process systems beyond the second isolation provision from the cask and the loading penetration are designed consistent with the design codes for the respective plant systems.
- The hoist for the penetration assembly upper cover is designed in accordance with the applicable portions of ASME NOG-1 as a single failure-proof hoist (Type I).

- The penetration assembly upper cover and other parts providing a fluid boundary up to and including the second isolation provision on the connected piping are designed in accordance with ASME Section III, 2004 Edition. The process systems further to the second isolation provision from the cask and the loading penetration are designed consistent with the design codes for the respective plant systems. The penetration assembly upper cover hoist is designed in accordance with the applicable portions of ASME NOG-1 2004 as a single failure-proof hoist (Type I).
- The parts of the penetration assembly participating in providing SFP boundary, when the gates separating the loading pit from the SFP are open, are designed to avoid accidental dewatering of SFP or loading pit in case of a fuel assembly drop on the penetration.
- The SFCTM is designed in accordance with the applicable portions of ASME NOG-1-2004 as a single failure-proof Type I crane trolley and has protective features such as conservative design factors, redundant systems and speed limitations to make the likelihood of a tip over, collision, or uncontrolled movement extremely small.

  U.S. EPR FSAR Tier 2, Section 9.1.4.2.2 will be revised to include this design information for the SFCTM.

U.S. EPR FSAR Tier 2, Table 3.2.2-1—Classification Summary provides the seismic and other design classifications for the components in the SFCTF.

(6) Pre-operational Testing

The preoperational testing of the heavy load handling equipment (HLHE) is in accordance with the applicable portions of ASME NOG-1-2004. The required pre-operational tests include handling sequence tests, electrical circuit tests, leak tightness tests and load tests. The biological lid lifting station and penetration upper cover hoist are load-tested to 125 percent of the rated load prior to their initial use.

(7) In-service Inspection and Periodic Tests

The SFCTF is designed to enable in-service inspection and periodic testing. Before each usage campaign, the SFCTF undergoes a series of inspections and functional tests. The penetration assembly seals and moveable parts are inspected and worn parts are replaced. The in-service inspection of the HLHE is in accordance with ASME B30.2-2005, "Overhead and Gantry Cranes – Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist."

U.S. EPR FSAR Tier 2, Section 9.1.4.6 will be revised to include this reference.

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, over travel switches, and speed and position sensors.

f. Information on pre-operational testing, in-service inspection and periodic tests of the SFCTF components is provided in the response to Part (e) of this question.

   The development of operator training and detailed procedures is the responsibility of the COL applicant as described in U.S. EPR FSAR Tier 2, Sections 13.2 and 13.5 and COL Information Item Numbers 13.2-1 and 13.5-1 in U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items.

   Operator training procedures and guidance for handling the SFCTF loads will be developed in accordance with ASME B30.2-2005, “Overhead and Gantry Cranes – Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist.”

   U.S. EPR FSAR Tier 2, Sections 9.1.4.2.1 and 9.1.4.6 will be revised to include this information.

g. The U.S. EPR SFCTF employs the concept of loading the spent fuel cask by docking it underneath the loading pit, which is located adjacent to the SFP. This concept is different from that previously used in the U.S., where fuel assemblies are loaded in a spent fuel cask that is submerged in the SFP area and the spent fuel cask is moved in and out of the SFP with an overhead crane.

   The design was developed in Europe to achieve the following advantages:

   - Preclude a cask drop accident during its lifting that could damage the building, stored fuel, or safety-related equipment.
   - Limit ionizing radiation exposure for plant personnel during cask loading.
   - Limit contamination of exterior cask surfaces.
   - Reduce cask loading time.
   - Reduce effluent and low level radioactive waste during the cask loading operation.

   By transferring and loading the spent fuel cask outside of the SFP, the risks associated with dropping a cask in the SFP and causing damage to stored fuel, safety-related equipment or structures is eliminated. With an underneath cask loading design, the cask is moved horizontally to an area adjacent to the SFP in the FB. It is moved in an upright position on a stable platform close to the floor and is not lifted inside the FB. The platform is provided with design features that restrain the cask and preclude a tip over, collision or uncontrolled movement during cask loading operations, including the occurrence of an SSE.

   Availability of international operating experience in existing operating units is limited due to limited public availability of event reports. No international operating experience related to currently installed SFCTFs was found during a search of the international operating experience database of the INPO Nuclear Network and the Incident Reporting

System of IAEA/NEA. Information obtained through discussions with European colleagues concerning their operating experience is provided below.

A SFCTF used for loading the spent fuel cask without lowering it into the SFP is installed in the following P'4 and N4 series plants in France:

- Cattenom: 4 units (P'4)
- Civaux: 2 units (N4)
- Penly: 2 units (P'4)
- Golfech: 2 units (P'4)
- Chooz: 2 units (N4)
- Belleville: 2 units (P'4)
- Nogent sur Seine: 2 units (P'4)

This configuration for spent fuel cask loading is also used in Belgium (Tihange 2 and 3).

It is estimated that about 1,000 loading campaigns have been successfully performed at French nuclear power plants. The spent fuel is typically loaded into transport casks for shipment to a reprocessing facility. Based on information provided by European colleagues, no major incidents related to the operation of the facility have been reported. In 2006, an incorrect lineup between the cask transfer machine and penetration at one of the facilities resulted in damage to the penetration seal. Cask loading operations were stopped for inspection and damage assessment before filling the penetration and prior to moving spent fuel. Another event occurred where the docking mechanism jammed and had to be manually cut to undock the cask. A contamination event occurred at one plant during placement of the biological lid due to thermal expansion of the water in the cask causing it to spill over the sides of the cask. None of these incidents posed a significant safety risk.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.2.8, Tables 2.2.8-1 and 2.2.8-2; and U.S. EPR FSAR Tier 2, Table 1.8-2 and Sections 9.1.4, 9.1.4.2.1, 9.1.4.2.2 and 9.1.4.6 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Figures 9.1.4-9 and 9.1.4-10 will be added as described in the response and indicated on the enclosed markup.

Table 09.01.04-1

SRP 9.1.1–Criticality Safety of Fresh and Spent Fuel Storage and Handling

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
1	The criteria for GDC 62 are specified in American National Standards Institute (ANSI)/American Nuclear Society (ANS) 57.1, ANSI/ANS 57.2, and ANSI/ANS 57.3, as they relate to the prevention of criticality accidents in fuel storage and handling.	Subcriticality of spent fuel stored in the spent fuel cask is maintained by compliance with applicable Technical Specifications of the Part 72 general license. To maintain subcriticality during cask loading operations, spent fuel assemblies are handled one at a time by the SFM.

Table 09.01.04-2

SRP 9.1.2–New and Spent Fuel Storage

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
1	Acceptance for meeting the relevant aspect of GDC 2 is based on compliance with positions C.1 and C.2 of Regulatory Guide (RG) 1.13 and applicable portions of RG 1.29, and RG 1.117. For the spent fuel storage facility, additional guidance acceptable for meeting this criterion is found in American Nuclear Society (ANS) 57.2, 9.1.2-5 Revision 4 - March 2007 paragraphs 5.1.1, 5.1.3, 5.1.12.9, and 5.3.2. For the new fuel storage facility, additional guidance acceptable for meeting this criterion is found in ANS 57.3, paragraphs 6.2.1.3(2), 6.2.3.1, 6.3.1.1, 6.3.3.4, and 6.3.4.2.	Portions of the penetration assembly, up to and including the second isolation provision on the connected piping that are necessary for the SFP boundary during cask loading operations, are designed to Seismic Category I requirements in accordance with RG 1.13 C.1 and RG 1.29. Portions of the SFCTM, essential for maintaining the SFP boundary when the cask is docked to the loading pit, are designed to Seismic Category I requirements in accordance with RG 1.13 C.1 and RG 1.29. Other components of the spent fuel cask transfer facility that are classified Seismic Category II are designed so

Table 09.01.04-2
SRP 9.1.2–New and Spent Fuel Storage

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
		that the performance of plant safety-related functions are not adversely affected during and following an SSE. The cask loading pit is designed to Seismic Category I requirements (refer to U.S. EPR FSAR Tier 2, Section 3.8.4). The cask loading operation takes place inside the bunkered FB, which protects the facility from other natural phenomena including extreme winds and tornado missiles in accordance with RG 1.13 C.2 and RG 1.117. When outside the FB after loading, the SFCTM is transporting a sealed fuel cask, which is designed for certain conditions under its Part 72 certificate of compliance.
2	Acceptance for meeting the relevant aspect of GDC 4 is based on positions C.2 and C.3 of RG 1.13, and RG 1.115 and 1.117.	The components involved in cask loading and handling operations are designed for normal and accident environmental conditions in their locations in the FB. Safety-related components are protected from extreme winds, tornado missiles, and turbine missiles by the FB structure in accordance with RG 1.13 C.2 and C.3, RG 1.115 and RG1.117. The loading hall door is closed at all times when the cask is connected to the cask loading pit penetration and until the cask is sealed. Protection against dynamic effects associated with postulated piping ruptures is addressed through plant layout.
3	GDC 5 is met by sharing the SSCs important to safety between the units in a manner that does not degrade the performance of their safety functions.	The spent fuel cask transfer facility that is installed in the FB is not shared with other U.S. EPR units. The SFCTM can be used in multiple U.S. EPR units; however, when it is in service, it is dedicated to that unit and is not shared.

Table 09.01.04-2 SRP 9.1.2–New and Spent Fuel Storage		
Number	**Acceptance Criteria**	**Basis of Meeting Acceptance Criteria**
4	Acceptance for meeting the relevant aspect of GDC 61 for the spent fuel storage facility is based on compliance with positions C.4, C.6, C.10, C.11 and C.12 of RG 1.13 and the appropriate paragraphs of ANS 57.2. Acceptance for meeting this criterion for the new fuel storage facility is based on compliance with the appropriate paragraphs of ANS 57.3. Acceptance is also based on meeting the fuel storage capacity requirements noted in subsection III.1 of this SRP section. The following design considerations are evaluated: A. Provisions for periodic inspections of components important to safety. B. Suitable shielding for radiation protection, including adequate water levels. C. Appropriate containment and confinement systems. D. Residual heat removal capability by effective coolant flow through the storage racks for spent fuel assemblies. E. Prevention of reduction in fuel storage coolant inventory under accident conditions.	The FB is a controlled-leakage building but ESF filtration is not required to meet offsite dose consequences for the design basis fuel handling accident (RG 1.13 C.4). Cask loading and handling (until the cask is sealed) is performed with the loading hall door closed. The equipment opening, connecting the loading hall to the fuel pool operating floor, is closed prior to opening the loading hall door to avoid a direct path from the SFP to the external environment. The cask loading pit is separated from the SFP by two separate Seismic Category I gates that are normally closed. During cask loading operations when the loading pit gates are open, the integrity of the SFP is maintained by the Seismic Category I spent fuel cask transfer facility penetration assembly in conjunction with the Seismic Category I Fuel Pool Purification System piping (refer to U.S. EPR FSAR Tier 2, Section 9.1.3), which is connected at the bottom of the loading pit. The swivel gate is Seismic Category I and can be closed if needed during the cask loading operation (RG 1.13 C.6). The volume of the cask loading pit is such that if the seals of both gates fail, the coolant inventory of the SFP would not be reduced to a level less than 10 feet above the top of the fuel assemblies (RG 1.13 C.10). RG 1.13 C.11 is not relevant to the cask loading and handing facilities. Decay heat removal from spent fuel stored in the cask is maintained through compliance with applicable Technical Specifications of the Part 72

Table 09.01.04-2

SRP 9.1.2–New and Spent Fuel Storage

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
		general license. The cask loading pit is provided with pool liner leakage monitoring (RG 1.13 C.12). The components of the spent fuel cask transfer facility are designed to facilitate periodic inspection and testing. The design of the spent fuel cask transfer facility considers radiation shielding for personnel in the loading hall. In particular, the facility is designed for remote operation when fuel is being loaded and until the biological shield plug is placed over the loaded cask. Shielding features provide protection in case of abnormal conditions where personnel must enter the loading hall.
5	Acceptance for meeting the relevant aspect of GDC 63 for spent fuel storage is based on compliance with position C.7 of RG 1.13 and paragraph 5.4 of ANS 57.2. Acceptance for meeting this criterion for the dry storage of new fuel is based on radiation monitoring pursuant to 10 CFR 70.24 or acceptable prevention of an increase in effective multiplication factor (K_{eff}) beyond safe limits as described in 10 CFR 50.68.	In accordance with RG 1.13 C.7, SFP water level and temperature instrumentation are part of the fuel pool cooling and purification system. The radiation monitoring system provides radiation monitors in the SFP area and loading hall to measure increased radiation levels. ESF filtration is not required to mitigate a design basis fuel handling accident.
6	In meeting the requirements of 10 CFR 20.1101(b), positions C.2.f (2) and C.2.f (6) of RG 8.8 are the bases for acceptance with respect to provisions for decontamination. For spent fuel storage, paragraph 5.1.5 of ANS 57.2 and appropriate positions of RG 1.13 are the bases for acceptance. For new fuel storage, paragraphs 6.3.3.7 and 6.3.4 of ANS 57.3 are the bases for acceptance.	The spent fuel cask transfer facility includes design features to achieve radiation doses consistent with the ALARA principle. The spent fuel cask transfer facility employs the concept of loading the spent fuel cask, wherein the cask is not lowered in the SFP, and thus avoids contamination of the exterior surface of the cask, thereby reducing a contributor to personnel dose for the cask loading process (RG

Table 09.01.04-2

SRP 9.1.2–New and Spent Fuel Storage

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
		8.8 C.2.f(2)). The spent fuel cask transfer facility components are designed to facilitate decontamination per the requirements of ANSI/ANS-57.2-1983 as applicable (RG 8.8 C.2.f (6)).
7	10 CFR 50.68 allows the applicant to follow the guidelines of 10 CFR 70.24 for criticality monitors or the guidelines described therein for significant margins of subcriticality.	The U.S. EPR design complies with 10 CFR 50.68(b) in lieu of maintaining criticality monitors. To maintain subcriticality during the cask loading operation, spent fuel assemblies are handled one at a time. Subcriticality of spent fuel stored in the spent fuel cask is maintained through compliance with applicable Technical Specifications of the Part 72 general license.

Table 09.01.04-3

SRP 9.1.3–Spent Fuel Pool Cooling and Cleanup System

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
1	General Design Criterion (GDC) 2 contained in Appendix A to 10 CFR Part 50, as related to structures housing the system and the system itself being capable of withstanding the effects of natural phenomena such as earthquakes, tornadoes, and hurricanes. Acceptance for meeting this criterion is based on conformance to positions C.1, C.2, C.6, and C.8 of RG 1.13 and position C.1 of RG 1.29 for safety-related and position C.2 of RG 1.29 for nonsafety-related	The minimum water level in the loading pit, necessary for radiation shielding, is maintained by the FPCPS. Compliance of the SFCTF design with the requirements of GDC 2 is shown in SRP 9.1.2, Acceptance Criterion 1 by demonstrating compliance with the requirements of RG 1.13 C.1 and C.2. Compliance with the requirements of RG 1.13 C.6, concerning prevention of drainage through the SFCTF, is demonstrated in SRP 9.1.2,

Table 09.01.04-3 SRP 9.1.3–Spent Fuel Pool Cooling and Cleanup System		
Number	**Acceptance Criteria**	**Basis of Meeting Acceptance Criteria**
	portions of the system. This criterion does not apply to the cleanup portion of the system and need not apply to the cooling system if the fuel pool makeup water system and its source meet this criterion, the fuel pool building and its ventilation and filtration system meet this criterion, and the ventilation and filtration system meets the guidelines of RG 1.52. The cooling and makeup system should be designed to Quality Group C requirements in accordance with RG 1.26. However, when the cooling system is not designated Category I it need not meet the requirements of ASME Section XI for inservice inspection of nuclear plant components.	Acceptance Criterion 4. The requirement of RG 1.13 C.8, concerning make up water, is not applicable to the spent fuel cask transfer facility.
2	GDC 4 with respect to the capability of the system and the structure housing the system to withstand the effects of external missiles. Acceptance is based on meeting position C.2 of RG 1.13. This criterion does not apply to the cleanup system and need not apply to the cooling water system if the makeup system, its source, the building, and its ventilation and filtration system are tornado protected, and the ventilation and filtration system meets the guidelines of RG 1.52.	Compliance of the spent fuel cask transfer facility design with the requirements of GDC 4 is shown in SRP 9.1.2, Acceptance Criterion 2 by demonstrating compliance with the requirements of RG 1.13 C.2.
3	GDC 5 as related to shared systems and components important to safety being capable of performing required safety functions.	Compliance of the spent fuel cask transfer facility design with the requirements of GDC 5 is demonstrated in SRP 9.1.2, Acceptance Criterion 3.
4	GDC 61 as related to the system	Compliance of the spent fuel cask

Table 09.01.04-3
SRP 9.1.3–Spent Fuel Pool Cooling and Cleanup System

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
	design for fuel storage and handling of radioactive materials, including the following elements: A. The capability for periodic testing of components important to safety. B. Provisions for containment. C. Provisions for decay heat removal that reflect its importance to safety. D. The capability to prevent reduction in fuel storage coolant inventory under accident conditions. E. The capability and capacity to remove corrosion products, radioactive materials and impurities from the pool water and reduce occupational exposures to radiation.	transfer facility design with the requirements of GDC 61 is demonstrated in SRP 9.1.2, Acceptance Criterion 4.
5	GDC 63 as it relates to monitoring systems provided to detect conditions that could result in the loss of decay heat removal, to detect excessive radiation levels, and to initiate appropriate safety actions.	The cask temperature is monitored. The radiation monitoring system provides radiation monitors in the SFP area and loading hall to measure increased radiation levels.
6	10 CFR 20.1101(b) as it relates to radiation doses being kept as low as is reasonably achievable (ALARA). In meeting this regulation, RG 8.8, positions C.2.f (2) and C.2.f (3) can be used as a basis for acceptance.	Compliance with the requirements of 10 CFR 20.1101(b) is demonstrated in SRP 9.1.2, Acceptance Criterion 6.

Table 09.01.04-4

SRP 9.1.4—Light Load Handling System (Related to Refueling)

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
1	Acceptance for meeting the relevant aspects of GDC 2 is based on RG 1.29, Positions C.1 and C.2.	Load handling components of the spent fuel cask transfer facility, including the penetration upper cover hoist, the biological lid handling system, and the SFCTM, are categorized according to their functions (Seismic Category I or II) and designed according to the requirements of RG 1.29. The design of the SFCTM is described in U.S. EPR FSAR Tier 2, Section 9.1.4.
2	Acceptance for meeting the relevant aspects of GDC 5 is embodied within the other acceptance criteria.	Compliance of the spent fuel cask transfer facility design with the requirements of GDC 5 is demonstrated in SRP 9.1.2, Acceptance Criterion 3.
3	Acceptance for meeting the relevant aspects of GDC 61 is based in part on the guidelines of American National Standards Institute/American Nuclear Society (ANSI/ANS) 57.1-1992.	Applicable guidance from ANS 57.1 is applied to the design of the spent fuel cask transfer facility.
4	Acceptance for meeting the relevant aspects of GDC 62 is based in part on ANSI/ANS 57.1-1992.	Compliance of the spent fuel cask transfer facility design with the requirements of GDC 62 is demonstrated in SRP 9.1.1, Acceptance Criterion 1.

Table 09.01.04-5

SRP 9.1.5–Overhead Heavy Load Handling Systems

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
1	Acceptance for meeting the relevant aspects of GDC 1 is based in part on NUREG-0554 for overhead handling systems and ANSI N14.6 or ASME B30.9 for lifting devices.	The biological lid handling station used for handling the biological lid, the penetration upper cover hoist, which maneuvers the upper cover, and the SFCTM are categorized as heavy load handling equipment (i.e., loads weighing more than one fuel assembly and its handling device). However, the spent fuel cask transfer facility does not involve lifting of loads over the SFP or the reactor vessel. The biological lid and upper cover of the penetration are handled at their respective position and the SFCTM moves on the loading hall floor on rails. Therefore, the spent fuel cask transfer facility does not involve an overhead horizontal movement of a load in the FB during cask loading operations. The biological lid handling station is designed in accordance with the applicable portions of ASME NOG-1 - 2004 Type 1 crane, ANSI N14.6 - 2004 and AISC Manual of Steel Construction, 9th Edition. The penetration assembly upper cover hoist is designed in accordance with the applicable portions of ASME NOG-1 as a single failure-proof hoist (Type I). The SFCTM is designed in accordance with the applicable portions of ASME NOG-1 - 2004 as a single failure-proof Type I crane trolley.
2	Acceptance for meeting the relevant aspects of GDC 2 is based in part on position C.2 of RG 1.29 and Section 2.5 of NUREG-0554.	Components of the spent fuel cask transfer facility meet seismic design criteria according to the safety functions they are required to perform.
3	Acceptance for meeting the relevant aspects of GDC 4 is based in part on	The spent fuel cask transfer facility heavy load handling components are

Table 09.01.04-5

SRP 9.1.5–Overhead Heavy Load Handling Systems

Number	Acceptance Criteria	Basis of Meeting Acceptance Criteria
	position C.5 of RG 1.13.	designed to provide single failure proof handling of heavy loads. The portions of the penetration assembly that maintain the SFP boundary when the gates separating the loading pit from the SFP are open, are designed to avoid accidental dewatering of SFP or loading pit, for a postulated drop of a fuel assembly on the penetration.
4	Acceptance for meeting the relevant aspects of GDC 5 is embodied within the other acceptance criteria.	Compliance of the spent fuel cask transfer facility design with the requirements of GDC 5 is demonstrated in SRP 9.1.2, Acceptance Criterion 3.

Table 09.01.04-6

SFCTF Non-Safety-Related I&C Interlocks

Operation	Required Condition
Transfer of the SFCTM under the biological lid handling station for removing the lid	• door of the loading hall closed • handling opening closed • iodine extracting ventilation in operating condition • gripper of the biological lid handling station in upper position • anti-seismic locking devices unlocked • penetration docking device in lower position • sliding support of the platform of the transfer machine unlocked • no alarms
Gripping of the biological lid when it is placed on the cask	• SFCTM positioned under the biological lid handling station • brakes of the transfer machine actuated • no alarms • gripper in lower position • claws of the gripper opened • anti-seismic locking devices locked
Lifting of the biological lid when it is placed on the cask	• claws of the gripper closed • spent cask transfer machine positioned under the biological lid handling station • brakes of the spent cask transfer machine actuated • no alarms • anti-seismic locking devices locked
Removal of the bottom cover of the penetration	• spent cask transfer machine positioned under the biological lid handling station • brakes of the spent cask transfer machine actuated • anti-seismic locking devices locked • no alarms
Transfer of the SFCTM under the loading penetration	• gripper of the biological lid handling station locked in upper position • biological lid removed from the cask (i.e. hung on the gripper of the biological lid handling station) • power supply of motorization of the biological lid handling station switched off • loading penetration in upper position

Operation	Required Condition
	• anti-seismic locking devices unlocked • door of the loading hall closed • iodine extracting ventilation in operating condition • penetration docking device in lower position • sliding support of the platform of the transfer machine unlocked • no alarms
Lowering of the biological lid on the transfer machine	• SFCTM placed under the penetration • anti-seismic locking devices locked • brakes of the transfer machine actuated • no alarms
Docking to the penetration	• SFCTM placed under the penetration • the power supply of the traveling drive is switched off • anti-seismic locking devices locked • brakes of the transfer machine actuated • no alarms
Switching off of the power supply of the penetration docking device (leak-tightness flange of the penetration locked to the SFCTM)	• spent cask transfer machine placed under the penetration • the power supply of the traveling drive is switched off • anti-seismic locking devices locked • brakes of the spent cask transfer machine actuated • no alarms • leak-tightness flange in lower position • load required on the screws reached
Filling of the loading penetration with water	• leak-tightness flange of the penetration locked to the SFCTM • power supply circuits of the following equipment switched off: traveling drive, motorization of the biological lid handling station, motorization of the penetration docking device, motorization of the elevator, motorization of the anti-seismic locking device
Opening of the upper cover of the penetration	• pressure on each side of the upper cover balanced • counterweight unlocked • leak-tightness flange of the penetration locked to the transfer machine • penetration filled with water • spent cask transfer machine placed under the penetration • anti-seismic locking devices locked • brakes of the SFCTM actuated

Operation	Required Condition
	• loading pit gate closed • cask “isolated” (accidental emptying not possible) • penetration “isolated” (accidental emptying not possible) • no alarms • the SFM is not in the loading pit
Closing of the upper cover of the penetration	• the spent fuel mast bridge is not in the loading pit • no alarms
Emptying of the penetration	• upper cover of the penetration closed • counterweight locked • loading pit gate closed • the SFCTM is under the loading penetration • brakes of the SFCTM actuated • anti-seismic locking devices locked • pressure balancing pipe of the penetration closed • vent of the loading penetration opened • fulfillment of the leak-tightness criteria of the loading penetration checked • dose rates in the loading hall and close to the loading penetration checked
Undocking and raising of the leak-tightness flange of the penetration	• loading penetration empty • upper cover of the penetration closed • counterweight locked • fulfillment of the leak-tightness criteria of the upper cover of the penetration checked • no alarms • anti-seismic locking devices locked • brakes of the transfer machine actuated • cask “isolated” (i.e. accidental emptying not possible) • water level in the cask below the mating surface of the leak-tightness flange of the loading penetration
Lifting of the biological lid from the SFCTM	• claws of the gripper closed • SFCTM positioned under the penetration • brakes of the transfer machine actuated • no alarms • anti-seismic locking devices locked
Transfer of the SFCTM to the biological lid handling station	• anti-seismic locking devices unlocked • leak-tightness flange of the penetration in upper position • biological lid removed from the SFCTM

Operation	Required Condition
	• door of the loading hall closed • iodine extracting ventilation in operating condition • gripper of the biological lid handling station in upper position • penetration docking device in lower position • sliding support of the platform of the SFCTM unlocked • no alarms
Lowering of the biological lid on the cask	• SFCTM placed under the biological lid handling station • anti-seismic locking devices locked • brakes of the SFCTM actuated • water level in the cask below the mating surface of the biological lid • no alarms
Lifting of the bottom cover of the penetration	• SFCTM positioned under the biological lid handling station • brakes of the SFCTM actuated • anti-seismic locking devices locked • no alarms
Transfer of the SFCTM under handling opening	• door of the loading hall closed • handling opening closed • iodine extracting ventilation in operating condition • gripper of the biological lid handling station in upper position • anti-seismic locking devices unlocked • penetration docking device in lower position • sliding support of the platform of the SFCTM unlocked • no alarms

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 SFM 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:

The following potential failure scenarios involving cask loading operations have been evaluated:

(1) Fuel Assembly Drop

A fuel assembly drop onto the penetration or into the cask is prevented by design of the SFM. The SFM is designed to hold the fuel assembly during and following an SSE, but is not qualified to operate under seismic conditions. An interlock prevents opening of the fuel assembly gripper while under load or at an improper elevation. The SFM is designed to preclude a load drop due to a single failure of a load bearing component.

A fuel assembly drop onto the upper cover is not postulated since the SFM is prevented by interlock from entering the cask loading pit unless the gates are open and the penetration upper cover is open. The upper cover is prevented from moving if the SFM is in the loading pit. Therefore, this event has no impact on the SFP water inventory or cooling.

The penetration assembly is designed to maintain leak tightness due to impact of a fuel assembly drop. The penetration assembly is designed with an inner and outer shell that protects the bellows. In the event of a dropped fuel assembly, the leak tightness of the penetration assembly is not affected and there is no impact on the SFP water inventory or cooling. The results of the FB fuel handling accident analysis, which is provided in U.S. EPR FSAR Tier 2, Section 15.0.3.10, envelopes the radiological consequences of a fuel handling accident in the cask loading pit. The operation of the ventilation system in the event of a fuel handling accident is described in U.S. EPR FSAR Tier 2, Section 9.4.2.

(2) Cask Drop or Tip

The spent fuel cask is transported within the FB on a SFCTM. The SFCTM is a Seismic Category I trolley that moves within the FB on rails and transports the spent fuel cask vertically to the handling stations of the SFCTF. The SFCTM is designed to carry a maximum weight of 253,530 lbs (115,000 kg). The SFCTM is designed to remain in place and maintains structural support of the spent fuel cask during and following an SSE. The cask is adjusted and secured to the SFCTM with screw jacks and trunions. The SFCTM also includes provisions (i.e., the chassis is equipped with pads close to the ground) to prevent tilting in case of a broken axle. 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. A lateral guiding device runs along the loading hall and limits the lateral movement of the SFCTM relative to the rails. 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.

(3) Improper Cask Docking

The swivel gate between the cask loading pit and SFP remains closed during docking and undocking operations and precludes draining of the SFP due to an improperly docked cask. The spent fuel cask is transported to the cask loading pit docking station on the SFCTM. The cask is adjusted and secured to the SFCTM with screw jacks and trunions. The penetration assembly has alignment slots that accept the alignment screws built into the SFCTM to maintain proper cask alignment. Leak tightness checks are performed after docking and are continuously monitored during operations to confirm a leak tight seal. A control interlock precludes opening of the upper cover of the penetration assembly until the cask and penetration assembly are properly docked and full of water. A control interlock is also provided that precludes the undocking of the cask unless the water level in the cask is within the required range (internal interlock), the penetration assembly upper cover is closed, and the swivel gate in the cask loading pit is in the closed position (external interlock). Since fuel handling operations can not commence until the cask is properly docked and control interlocks satisfied, there are no failure scenario consequences.

(4) Operator Error

Interlocks and alarms are provided to monitor SFCTF operations and avoid operator error. A control interlock permits opening the penetration assembly upper cover only after verification of leak tightness of the seals, the anti-seismic locking of the SFCTM, and the correct cask water level. An interlock also prevents undocking the cask from the penetration assembly unless the upper cover is closed, the swivel gate is closed, and the water level in the cask is reduced to the proper level.

If piping connected to the cask loading pit were to be inadvertently opened during cask loading operations, the water level in the SFP would begin to drop. A level alarm in the SFP would detect a loss of water. At that point, the operator would isolate the piping or the fuel assembly in transit would be placed in the cask or returned to the spent fuel storage rack and the penetration upper cover or the cask loading pit swivel gate could be closed to isolate the SFP.

To prevent damage to equipment, the SFCTM is prevented by interlock from 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 on the SFCTM is in the lower position, the penetration assembly is in the upper position

(movements to/from the penetration station), and the handling opening is closed (movements to/from the handling station). Mechanical stops are used to prevent inadvertent contact of the SFCTM with the loading hall door or wall. The biological lid handling station uses a screw design that prevents lid drop on a loss of power.

To prevent damage to the fuel assemblies in transit in the cask loading pit, the SFM is prevented by interlock from entering the cask loading pit unless the gates are open and the penetration upper cover is open. The upper cover is also prevented from moving by an interlock if the SFM is in the cask loading pit.

(5a) Penetration Seal Failure

When spent fuel is not being loaded through the penetration assembly, the penetration assembly opening is closed by an upper cover at the bottom of the cask loading pit and by a bottom cover below the leak-tightness flange. The upper cover is a thick plate with a pressurization device for maintaining a leaktight seal. Two concentric seals provide leak tightness between the upper cover and the penetration assembly supporting structure. Compressed air is supplied between two O-rings to monitor and prevent leakage. The pressurization device provides uniform pressure on the upper cover and locks the cover in place so that leak tightness is maintained. The bottom cover is a thick disk bolted to the leak-tightness flange of the penetration with two concentric O-rings providing leak tightness. For defense in depth, it is designed to support the weight of the water column in the cask loading pit.

When the penetration opening is opened and the cask is connected (docked) to the cask loading pit, the pool boundary is extended to include the penetration assembly structure, the double-barrier bellows assembly, the leak-tightness flange, and the cask body. The penetration assembly, including the bellows and the leak-tightness flange, is a passive safety-related, Seismic Category I component. Two concentric seals provide leak tightness between the flange and the cask. A brief unseating of the leak-tight connection between the cask and the penetration is possible during a seismic event. This unseating would only exist for the brief period of the seismic event and may result in seepage around the sealing surfaces; however, it will not result in insufficient water inventory in the SFP. The connection will return to a leaktight seal after the event.

A failure of one concentric seal will not cause leakage since a redundant seal is provided. A beyond design basis failure of both seals could result in leakage in the area between the top of the cask and the leak tightness flange; however, because the cask is supported in place by the trolley, the gap from a failure of both seals would be very small. The leak rate would be slow enough to allow sufficient time for the operator to remove any fuel assembly in transit from the cask loading pit (lowering into the cask or returning it to the SFP) and to close the swivel gate between the SFP and the cask loading pit.

The postulated maximum flowrate from a beyond design basis failure of both seals is approximately 340 gpm. At this rate, it would take in excess of nine hours to drain the SFP and cask loading pit water volume to 10 ft above the top of the fuel assemblies, assuming no make-up capacity, initial operating water level of 62.3 ft, and no operator action. However, upon a visual detection of the seal failure or through the seal pressurization monitor, the operator would move any in transit fuel assemblies to a safe location in the SFP or cask and close the cask loading pit swivel gate. The operator actions could be completed within 30 minutes and would terminate the loss of SFP inventory. Make-up water is available via the in-containment refueling water storage tank (IRWST) and the SFP

purification pump, which has a make-up capacity of 400 gpm. Therefore, there is sufficient time for operator intervention with minimal impact on SFP inventory and cooling.

U.S. EPR FSAR Tier 2, Section 9.1.4.3.4 will be revised to include this description of a beyond design basis failure of both penetration seals.

The flooding analysis for the failure of both seals is bounded by the piping failures described in the response to Part (5)(c).

(5b) Gate Seal Failure

Two safety-related, Seismic Category I stainless steel gates separate the SFP from the cask loading pit: a slot gate, which is handled by the auxiliary crane, and a swivel gate, which pivots manually on hinges to open. The slot gate is removed and the swivel gate opened prior to loading the fuel into the SFCTF. The gates do not depend on active equipment, such as inflatable seals, to maintain leak tightness.

Refer to the response to Question 09.01.04-17 for additional information.

(5c) Failure of Piping Attached to the Cask Loading Pit

There are four piping connections to the cask loading pit:

- Overflow piping (4 in line).
- Inlet purification piping (6 in line).
- Outlet purification piping (6 in line).
- Penetration structure piping (2 in line).

The overflow piping and the inlet purification piping enter the top of the cask loading pit. The inlet purification piping is 4.3 ft below the normal SFP level of 62.3 ft. If the cask loading pit were to drain to the 58 ft elevation, there would be 24.7 ft of water above the top of the fuel assemblies in the SFP.

The outlet purification piping and the penetration structure piping are moderate energy lines. Per BTP 3-4, a pipe crack is assumed in each of these lines. The sum of the flowrate through these lines is approximately 75 gpm. Therefore, it would take >24 hours to drain the SFP to 10 ft above the top of the fuel assemblies, assuming no make-up capacity, initial operating water level of 62.3 ft, and no operator action. However, upon a visual detection of the piping failure or through level indicators in the pool, the operator would move any fuel assemblies in transit to a safe location in the SFP or cask and close the cask loading pit swivel gate. The operator actions could be completed within 30 minutes and would terminate the loss of SFP inventory. Make-up water is available via the IRWST and the SFP purification pump, which has a make-up capacity of 400 gpm. Therefore, there is sufficient time for operator intervention with minimal impact on SFP inventory and cooling.

The FB flooding analysis postulates a 6-inch pipe failure at the bottom of the cask loading pit. The release of water from this postulated failure would be detected by the operators performing the fuel transfer, as well as by level measurements. The released water volume is defined by a time period of 30 minutes. Since the FB flooding analysis assumes a 6-inch pipe failure, it bounds the postulated cracks in the 6-inch attached piping. Refer to U.S. EPR FSAR Tier 2, Section 3.4.3.5 for a description of the FB flooding analysis.

U.S. EPR FSAR Tier 2, Section 9.1.4.3.4 will be revised to include this description of a postulated failure of piping attached to the cask loading pit.

(6) Failure of the Cask Handling Machine

The SFCTM is seismically designed and qualified to retain the cask during and following an SSE and support the cask at the penetration station to maintain a leak tight seal with the cask loading pit. Interlocks prevent movement of the SFCTM when interference with the biological lid handling station or the penetration assembly could result. Mechanical stops prevent collision with the loading hall wall or door.

In case of a loss of failure of motive power, the SFCTF can be manually operated with hand wheels.

(7a) Seismic Events

The SFCTM, the penetration assembly, and the pool boundary isolation components of the connected piping systems are designed and qualified to Seismic Category I requirements to perform their safety-related functions during and following an SSE. A brief unseating of the leak-tight connection between the cask and the penetration assembly is possible during a seismic event resulting in some seepage around the seals, but will not result in insufficient water inventory in the cask loading pit. The response of the penetration seals to a seismic event is discussed in the response to Part (5)(a).

The SFM is designed to hold its load during and after a SSE, but is not qualified to operate under seismic conditions. Therefore, a fuel assembly in transit at the time of an earthquake may be suspended in the cask loading pit or partially inserted into the penetration. In this case, the upper cover cannot be closed until the fuel assembly is removed. However; the swivel gate can be closed by the operator to isolate the SFP from the cask loading pit. Because the penetration assembly is designed to remain leaktight following an SSE, adequate water inventory remains available above the fuel assembly for shielding and cooling until manual recovery operations can lower the fuel assembly into the cask, move the SFM and close the upper cover to the penetration assembly.

The lateral guiding device on the SFCTM consists of four pads fixed to the frame structure that slide along the guiding rails which are placed on the corbels of the loading hall. During an SSE, the lateral guiding device prevents tilting of the SFCTM when not positioned at the handling opening station, the lid handling station or the penetration station. Two anti-seismic locks fixed to the frame structure interface with openings in the guide rails. The anti-seismic locks prevent any movement of the SFCTM at these stations in case of an earthquake.

Fluid and pneumatic systems are provided in the SFCTF for filling, draining 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 SFP and cask loading pit during and following an SSE that could result in a potential offsite exposure.

(7b) Loss of Power

If a loss of power occurred, the SFCTF would remain in its current position. Due to the design of the various operational interlocks of the SFCTF, it is configured in such a manner that if the operational processes stopped, there would be no risk of equipment failure. If the trolley were in motion during a loss of power event, the brakes are designed to engage the wheel assemblies (required to have power to disengage the brakes from the wheel

assemblies) and the trolley would come to a stop. The biological lid handling station uses a screw design that prevents lid drop on loss of power. Fluid and pneumatic system valves required to isolate the cask and penetration assembly are closed on a loss of power.

(7c) Radiological Release in the Loading Hall

The SFCTF has an interlock with the external door of the loading hall and consequently the SFCTM can not be operated if the external door is open. The external door remains closed during cask loading operations. 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 space above the SFP, cask loading pit, and FB transfer pit are supplied by a common fuel pool room ventilation arrangement. The loading hall is provided with a separate supply and exhaust duct. The FB ventilation system is provided with isolation provisions which can isolate the SFP room and loading hall from the rest of the building when needed. In the event iodine is present in the FB during normal operation, the affected cell(s) are switched to iodine filtration through the nuclear auxiliary building ventilation system (NABVS). Information on the NABVS is provided in U.S. EPR FSAR Tier 2, Section 9.4.3.

(8) <u>Leakage Detection</u>

The cask loading pit has a similar leakage detection system as described in U.S. EPR FSAR Tier 2, Section 9.1.2.2.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.1.4.3.4 will be revised as described in the response and indicated on the enclosed markup.

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 gates separating the SFP and FB transfer compartment/cask loading pit are safety-related, Seismic Category I components. The failure of both gates separating the SFP and FB transfer compartment, and both gates between the SFP and cask loading pit, is a beyond design basis event and would result in leakage between the three FB 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 51.7 ft, assuming the SFP is initially at its normal water level of 62.3 ft. This equilibrium level provides approximately 18.4 ft of water above the top of the stored fuel assemblies, accounting for evaporation over a seven day period. According to SRP 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 ft) above the top of the fuel assemblies." This criterion is met without

taking credit for the Seismic Category I design of the gates or the water initially in the adjacent pits (i.e., FB transfer compartment and cask loading pit), and therefore, the proposed Technical Specification does not meet the criteria in 10 CFR 50.36 and is not required.

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

Additional details regarding the design, operation and safety evaluation of the SFCTF are provided in the response to Question 09.01.04-15 and are also contained in U.S. EPR FSAR Tier 2, Section 9.1.4.

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

   The SFCTM provides seismic support for the cask and the 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 an SSE.

   Additional details regarding the design, operation and safety evaluation of the SFCTF are provided in the response to Question 09.01.04-15 and are also contained in U.S. EPR FSAR Tier 2, Section 9.1.4.

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
Sheet 22 of 40

Item No.	Description	Section
8.3-2	A COL applicant that references the U.S. EPR design certification will describe inspection, testing and monitoring programs to detect the degradation of inaccessible or underground power cables that support EDGs, offsite power, ESW and other systems that are within the scope of 10 CFR 50.65.	8.3.1.1.8
8.4-1	A COL applicant that references the U.S. EPR design certification will provide site-specific information that identifies any additional local power sources and transmission paths that could be made available to resupply the power plant following a loss of offsite power (LOOP).	8.4.1.3
~~8.4~~-2	A COL applicant that references the U.S. EPR design certification will address the RG 1.155 guidance related to procedures and training to cope with SBO.	8.4.2.6.4
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 ~~a~~ [spent fuel] cask ~~design~~ acceptable for ~~interfacing~~ [use] 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.~~ [INSERT 8]	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

INSERT 8

- The cask shall have provisions for connecting process lines for water filling and draining, and drying of the cask.
- The cask shall be capable of dissipating decay heat from fuel assemblies loaded in the cask without supplemental cooling.
- The cask shall be designed such that the structural and seismic analysis of the cask confirms that the loads transferred to the spent fuel cast transfer facility (SFCTF) components and Fuel Building (FB) structures under design conditions, including a site-specific SSE, are acceptable.
- The cask shall be designed such that the structural analysis of the cask confirms that the loads transferred to SFCTF components and FB structures under design conditions, including the postulated drop of a fuel assembly from the maximum handling height in the cask loading pit onto a connected cask, are acceptable.
- The materials of construction of the cask are compatible with the environment including radiation, heat, exposure to borated and demineralized water, etc.
- The dimensions of the cask in conjunction with the SFCTM conform to the dimensions of the FB loading hall provided in Section 3.8.4.
- The piping/valves that connect to the cask and serve as a fluid boundary to the cask loading pit shall meet the same design requirements as the piping/valves attached to the cask loading pit.

2.2.8 Fuel Handling System

1.0 Description

The fuel handling system (FHS) provides for handling of fuel assemblies from the time new fuel assemblies are received at the plant site until the spent fuel assemblies are stored in the spent fuel pool and removed through the spent fuel cask transfer facility (SFCTF). The FHS handles and transfers fuel assemblies across the containment. The system provides a means of receiving, inspecting, and storing new fuel assemblies. The spent fuel assemblies are stored in the underwater storage racks in the spent fuel pool. The main pieces of equipment used for fuel handling operations are the refueling machine, fuel transfer tube facility, new fuel elevator, spent fuel machine, auxiliary crane, and fuel storage racks. After sufficient decay, spent fuel assemblies may be removed from the spent fuel pool for loading into the spent fuel cask using the SFCTF. The main pieces of equipment in the SFCTF are the spent fuel cask transfer machine (SFCTM) for movement of the spent fuel cask within the loading hall of the Fuel Building and a penetration assembly for connection of the spent fuel cask to the cask loading pit.

The FHS provides the following safety related functions:

- Maintains fuel assemblies in a subcritical array.

- ~~Facilitates cooling of the irradiated fuel assemblies to avoid overheating.~~

- Provides for safe handling of heavy loads (i.e., loads weighing more than one fuel assembly and its handling device) to prevent a load drop in a critical area.

- Maintains its portion of the containment isolation.

- Maintains the fluid boundary with the penetration assembly to avoid draining the spent fuel pool.

- Prevents tipping or dropping of a spent fuel cask using the SFCTM.

2.0 Arrangement

2.1 The location of the FHS equipment is as listed in Table 2.2.8-1—FHS Equipment Mechanical Design.

3.0 Mechanical Design Features

3.1 Deleted.

3.2 Components identified as Seismic Category I in Table 2.2.8-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.2.8-1.

3.3 Deleted.

3.4 Components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements.

3.5 Components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III are fabricated in accordance with ASME Code Section III requirements.

3.6 Pressure boundary welds on components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III are in accordance with ASME Code Section III requirements.

3.7 Components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III retain pressure boundary integrity at design pressure.

3.8 The new and spent fuel storage racks maintain the effective neutron multiplication factor less than the required limits during normal operations, during and after design basis seismic events, and during and after design basis dropped fuel assembly accidents.

3.9 Components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III are installed in accordance with ASME Code Section III requirements.

4.0 System Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.2.8-2 lists the FHS ITAAC.

Table 2.2.8-1—FHS Equipment Mechanical Design

Description	Tag Number[1]	Location	ASME Code Section III	Function	Seismic Category
New Fuel Elevator	FCD10	Fuel Building (UFA)	N/A	N/A	N/A
Spent Fuel Machine	FCD01	Fuel Building (UFA)	N/A	N/A	N/A
Transfer Tube and Blind Flange (Fuel Transfer Tube Facility)	FCJ05	Fuel Building (UFA) and Reactor Building (UJA)	Yes	Containment isolation	I
Transfer Tube gate valve and expansion joints	FCJ05	Fuel Building (UFA) and Reactor Building (UJA)	Yes	Leak tightness	I
Mechanism (Fuel Transfer Tube Facility)	FCJ01	Fuel Building (UFA) and Reactor Building (UJA)	N/A	N/A	N/A
Refueling Machine	FCB01	Reactor Building (UJA)	N/A	N/A	II
~~Spent Fuel Cask Transfer Facility p~~Penetration Assembly ~~including loading pit bottom cover.~~	FCJ12	Fuel Building (UFA)	N/A	Leak tightness	I
New Fuel Storage Racks	FAA01	Fuel Building (UFA)	N/A	Fuel storage	I
Spent Fuel Storage Racks	FAB02	Fuel Building (UFA)	N/A	Fuel storage	I
Spent Fuel Cask Transfer Machine	FCJ10	Fuel Building (UFA)	N/A	Prevent tipping or dropping of spent fuel cask	I
SFCTF isolation valves connected to the spent fuel cask and Penetration Assembly	FCJ15/16	Fuel Building (UFA)	Yes	Isolation	I

1) Equipment tag numbers are provided for information only and are not part of the certified design.

Table 2.2.8-2—Fuel Handling System ITAAC (4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
2.1	The location of the FHS equipment is as listed in Table 2.2.8-1.	An inspection will be performed~~ of the location of the equipment listed in Table 2.2.8-1~~.	The FHS equipment listed in Table 2.2.8-1 is located as listed in Table 2.2.8-1.
3.1	Deleted.	Deleted.	Deleted.
3.2	Components identified as Seismic Category I in Table 2.2.8-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.2.8-1.	a. Type tests, analyses, or a combination of type tests and analyses will be performed on the components identified as Seismic Category I in Table 2.2.8-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements. b. Inspections will be performed of the Seismic Category I components identified in Table 2.2.8-1 to verify that the components, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses).	a. Seismic qualification reports (SQDP, EQDP, or analyses) exist and conclude that the Seismic Category I components identified in Table 2.2.8-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.2.8-1 including the time required to perform the listed function. b. Inspection reports exist and conclude that the Seismic Category I components identified in Table 2.2.8-1, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses).
3.3	Deleted.	Deleted.	Deleted.
3.4	Components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements.	Inspections of ASME Code Section III Design Reports and associated reference documents will be performed.	ASME Code Section III Design Reports (NCA-3550) exist and conclude that components and connecting piping listed as ASME Code Section III in Table 2.2.8-1 comply with ASME Code Section III requirements.

Table 2.2.8-2—Fuel Handling System ITAAC (4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
3.5	Components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III are fabricated in accordance with ASME Code Section III requirements.	An analysis will be performed to verify that deviations to the components and connecting piping design reports (NCA-3550) have been reconciled.	ASME Code Section III Design Reports (NCA-3550) exist and conclude that components and connecting piping listed as ASME Code Section III in Table 2.2.8-1 comply with ASME Code Section III requirements and any deviations to the design report have been reconciled.
3.6	Pressure boundary welds on components listed in Table 2.2.8-1 as ASME Code Section III are in accordance with ASME Code Section III requirements.	Inspections of pressure boundary welds verify that welding is performed in accordance with ASME Code Section III requirements.	ASME Code Section III Data Reports (NCA-8000) exist and conclude that pressure boundary welding for components and connecting piping listed as ASME Code Section III in Table 2.2.8-1 has been performed in accordance with ASME Code Section III.
3.7	Components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III retain their pressure boundary integrity at their design pressure.	Hydrostatic tests will be performed on the components and connecting piping.	For components and connecting piping listed as ASME Code Section III in Table 2.2.8-1, ASME Code Section III Data Reports exist and conclude that hydrostatic test results comply with ASME Code Section III requirements.

Table 2.2.8-2—Fuel Handling System ITAAC (4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
3.8	The new and spent fuel storage racks maintain the effective neutron multiplication factor less than the required limits during normal operations, during and after design basis seismic events, and during and after design basis dropped fuel assembly accidents.	Inspections will be performed to verify key design features of the fuel storage racks.	Inspection reports and poison plate manufacturer reports verify the following as-built fuel storage racks features: • Region 1 rack cell pitch is consistent with rack model inputs of the criticality evaluation. • Region 2 rack cell pitch is consistent with rack model inputs of the criticality evaluation. • The configuration of the neutron absorber plates for Region 1 racks is consistent with rack model inputs of the criticality evaluation. • The configuration of the neutron absorber plates for Region 2 racks is consistent with rack model inputs of the criticality evaluation. • The number of neutron absorber plates installed between storage cells in Region 1 racks agrees with design drawings. • The number of neutron absorber plates installed between storage cells in Region 2 racks agrees with design drawings. • The layout of fuel storage racks in the spent fuel pool agrees with design drawings.

Table 2.2.8-2—Fuel Handling System ITAAC (4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
			• The layout of fuel storage racks in the new fuel storage vault agrees with design drawings.
3.9	Components and connecting piping listed in Table 2.2.8-1 as ASME Code Section III are installed in accordance with ASME Code Section III requirements.	An inspection of ASME Code Data Reports will be performed.	ASME Code Section III N-5 Data Reports exist and conclude that components and connecting piping listed as ASME Code Section III in Table 2.2.8-1 have been installed in accordance with ASME Code Section III requirements.

Next File

Table 3.2.2-1—Classification Summary
Sheet 68 of 188

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
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~~)~~ [markup: "valves connected to the loading pit fluid volume up to and"; "s"; "operated"]	S	C	I	Yes	UFA	ASME Class ~~1~~ [markup: "3"; "Section III"]
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 Pipe and Valves	NS	E	NSC	No	UFA	ANSI/ASME B31.1[6], ANSI/ASME B16.34[7], ASME VIII[8]

9.1.4 Fuel Handling System

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), 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.

spent fuel

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:

use

- 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.~~

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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.
- Cask loading pit penetration assembly.
- 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).

The design of the FHS includes the safe handling, 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 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~~ SFP 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~~ SFP 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.
- 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 RB and FB are provided in Section 3.8.

9.1.4.2.1 General Description

The fuel handling equipment can handle a fuel assembly underwater 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 reactor building pool transfer compartment 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 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~~ SFP 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 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.

Spent Fuel Cask Transfer Facility Operation

SFP

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.

Operator training procedures and guidance for handling the SFCTF loads will be developed in accordance with ASME B30.2-2005 (Reference 9).

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.

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.

If necessary,

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.

SFCTF

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

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~~ device 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~~ device 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.

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.

9.1.4.2.2 Component Description

The major components of the FHS are described in the following paragraphs. Table 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 RB side to provide containment isolation during power operations and with a manual gate valve on the FB 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.

The design of the SFM incorporates provisions for manual operation of the machine in an emergency mode in case of power failure which would allow manually lowering of the fuel assembly. The SFM has a provision for manually traveling and traversing after manually opening the brake and for manually lowering and raising the load after manually opening the brake.

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 underwater 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.

Spent Fuel Cask Transfer Facility

SFCTM

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

Motive force is provided by an onboard electric motor. The SFCTM is designed to carry a maximum load of 253,530 lbs (115,000 Kg).

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~~ SFP 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 is provided with lateral guiding devices and anti-seismic locking devices. The lateral guiding device slides along the guiding rails, which are placed on the corbels of the loading hall. During normal operation, the lateral guiding device along with the guiding rails and the sliding support of the traveling platform facilitates the limited lateral adjustment of the SFCTM. During an SSE, the lateral guiding device prevents tilting of the SFCTM when it is not positioned at the handling opening station, the lid handling station or the penetration station.

The anti-seismic locking devices consist of movable parts fixed on each side of the spent fuel cask transfer machine structure that engage in notches fixed on the corbels of the loading hall. The movable parts are actuated by an irreversible screw/nut system connected to an electric motor, a reduction gear and a torque limiter. They are also equipped with a manual backup for operation in case of loss of power supply. Position sensors provide the position of the moveable parts (locked/unlocked). The anti-seismic locking devices secure the SFCTM to the FB at the handling opening station, the lid handling station or the penetration station. The trolley must be in the axis of the station to lock anti-seismic locking devices. The anti-seismic locking devices prevent any movement of the SFCTM when it is located at these stations in the event of an SSE or spurious behavior of the traveling drive system.

SFCTM movements are stopped on a loss of power and the onboard brakes are designed to be engaged when de-energized on a loss of power.

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.

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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 designed in accordance with the applicable portions of ASME NOG-1-2004 (Reference 5) as a single failure-proof Type I crane trolley.

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 penetration docking device is fixed on top of the SFCTM and is used to pull down the bellows of the penetration assembly in order to connect the leak tightness flange to the mating surface of the cask. The penetration docking device consists of four identical assemblies, each of which includes a screw connected at its lower end to a bearing and whose upper end engages into a swiveled nut of the docking flange of the penetration. Each screw is moved upwards by an air cylinder and is rotated by an electric motor and a reduction gear that maintains its rotation. Each assembly is irreversible and equipped with a position sensor for a high travel and a low travel. Each screw is also equipped with a revolution counter which allows the balance of the four assemblies. This design provision provides for equal loading on the screws. The penetration docking device is designed so that undocking of the cask is possible even with two diametrically opposed assemblies. A manual backup is provided for operating the screws in case of loss of electric power. The docking mechanism is shown in Figure 9.1.4-10—Loading Penetration Docking Mechanism.

INSERT 2 ~~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~~ SFP 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~~ SFP.

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 equipped with dual seals at the interface locations shown in Figure 9.1.4-9—Loading Pit Penetration Assembly Seals. These seals are an O-ring type and are made from EPDM rubber or other equivalent material, and are designed to resist high levels of ionizing radiation. The integrity of the penetration seals is tested before loading the fuel assemblies. During the seal test, and also during the loading of fuel assemblies, any leak of the seals between the cask and the docked penetration or of the bellows is detected by a decrease in pressure of the compressed air enclosed between the two barriers. The compressed air pressure between the two barriers is maintained greater than the water column pressure in the loading pit. The leak-tightness of the penetration vent mechanism is tested separately.

Two concentric seals on the upper part of the supporting structure maintain double barrier leak-tightness to the upper cover of the penetration when the upper cover is closed. The space between the two seals is pressurized with compressed air at a pressure greater than the water column pressure in the loading pit to avoid any concern of water leakage due to a seal failure. This provision exists to monitor the leak-tightness of the upper cover of the penetration in the main control room when the SFCTF is not in use.

The penetration assembly non pressure retaining, safety-related structures are designed in accordance with the applicable portions of ANSI/AISC N690-1994 (Reference 8), including Supplement 2. The penetration assembly upper cover and other parts providing a fluid boundary up to and including the second isolation provision on the connected piping are designed in accordance with ASME Section III (Reference 4). The penetration assembly upper cover hoist is designed in accordance with the applicable portions of ASME NOG-1 2004 as a single failure-proof hoist (Type I).

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.

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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.

The piping and valves up to the second isolation provision are designed to ASME Section III (Reference 4).

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 designed in accordance with the applicable portions of ASME NOG-1-2004 Type 1 crane (Reference 5), ANSI N14.6- 2004 (Reference 6) and AISC Manual of Steel Construction, 9th Edition (Reference 7).

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

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.

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These systems consist of process modules installed in a room adjacent to the SFCTF control room, the associated piping installed in the loading hall, and the flexible hoses to connect the systems to the SFCTM. The process modules consist of pipes, valves and process sensors. The process modules installed in the room check and monitor the seals and provide connections for the water supply to fill and drain the spent fuel cask and cask loading pit penetration assembly. The process module installed on the SFCTM contributes to the filling and draining of the cask, as well as the drying of the cask. Cask specific valve adapters are used for connecting the internal cavity of the cask with the process modules. The valve adapter bodies are screwed to the cask. The valve adapters are water and airtight. Cask specific test adapters are provided to check the leak-tightness of the plugs that close the orifices of the cask and check the leak-tightness of the biological lid and upper cover of the cask. The SFCTF also includes the capability to fill the internal cavity of the spent fuel cask with nitrogen if the cask specific design warrants. The nitrogen circuit also serves as a backup for the compressed air circuit.

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, 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.

- The portions of the FHS that provide containment boundary and containment isolation functions are safety-related. The fuel transfer tube penetrates the primary containment and is equipped with a blind flange in the 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.

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.

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~~ SFP. 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.

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~~.

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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.

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 óthe 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.

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 FB. Weirs in the RB and FB 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

Draindown Events During Non-Cask Loading Operations

The two gates separating the ~~spent fuel pool~~ SFP 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 9.1.2-9—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 9.1.4-8—Cask Loading Pit Penetration Assembly, limit the displacement of the bottom cover.

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.

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~~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.~~

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~~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.

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.

Refueling cavity ring and refueling cavity door seals will be inspected for leakage after filling the refueling cavity and before moving fuel to detect potential loss of refueling cavity water through passive barriers.

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. 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.

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.

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When the penetration assembly is opened and the cask is connected (docked) to the cask loading pit, the pool boundary is extended to include the penetration assembly structure, the double-barrier bellows assembly, the leak-tightness flange, and the cask body. The penetration assembly, including the bellows and the leak-tightness flange, is a passive safety-related, Seismic Category I component. Two concentric seals provide leak tightness between the flange and the cask. A brief unseating of the leak-tight connection between the cask and the penetration is possible during a seismic event. This unseating would only exist for the brief period of the seismic event and may result in seepage around the sealing surfaces; however, it will not result in insufficient water inventory in the SFP. The connection will return to a leak tight seal after the event.

A failure of one concentric seal will not cause leakage since a redundant seal is provided. A beyond design basis failure of both seals could result in leakage in the area between the top of the cask and the leak tightness flange; however, because the cask is supported in place by the trolley, the gap from a failure of both seals would be very small. The leak rate would be slow enough to allow sufficient time for the operator to remove any fuel assembly in transit from the cask loading pit (lowering into the cask or returning it to the SFP) and to close the swivel gate between the SFP and the cask loading pit.

The postulated maximum flow rate from a beyond design basis failure of both seals is approximately 340 gpm. At this rate, it would take in excess of nine hours to drain the SFP and cask loading pit water volume to 10 ft above the top of the fuel assemblies, assuming no make-up capacity, initial operating water level of 62.3 ft, and no operator action. However, upon a visual detection of the seal failure or through the seal pressurization monitor, the operator would move any in transit fuel assemblies to a safe location in the SFP or cask and close the cask loading pit swivel gate. The operator actions could be completed within 30 minutes and would terminate the loss of SFP inventory. Make-up water is available via the in-containment refueling water storage tank (IRWST) and the SFP purification pump, which has a make-up capacity of 400 gpm. Therefore, there is sufficient time for operator intervention with minimal impact on SFP inventory and cooling.

INSERT 5

5. ASME NOG-1, “Rules for Construction of Overhead and Gantry Cranes,” The American Society of Mechanical Engineers, 2004.

6. ANSI N14.6, “Special Lifting Devices for Shipping Containers Weighing 10,000Pounds (4500 Kg) or More,” American National Standards Institute, 2004.

7. AISC Manual of Steel Construction, 9th Edition.

8. ANSI/AISC N690-1994 (R2004), “Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities”

9. ASME B30.2-2005, “Overhead and Gantry Cranes – Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist.”

INSERT 7

There are four piping connections to the cask loading pit:

- Overflow piping (4 in line).
- Inlet purification piping (6 in line).
- Outlet purification piping (6 in line).
- Penetration structure piping (2 in line).

The overflow piping and the inlet purification piping enter the top of the cask loading pit. The inlet purification piping is 4.3 ft below the normal SFP level of 62.3 ft. If the cask loading pit were to drain to the 58 ft elevation, there would be 24.7 ft of water above the top of the fuel assemblies in the SFP.

The outlet purification piping and the penetration structure piping are moderate energy lines. Per BTP 3-4, a pipe crack is assumed in each of these lines. The sum of the flow rate through these lines is approximately 75 gpm. Therefore, it would take >24 hours to drain the SFP to 10 ft above the top of the fuel assemblies, assuming no make-up capacity, initial operating water level of 62.3 ft, and no operator action. However, upon a visual detection of the piping failure or through level indicators in the pool, the operator would move any fuel assemblies in transit to a safe location in the SFP or cask and close the cask loading pit swivel gate. The operator actions could be completed within 30 minutes and would terminate the loss of SFP inventory. Make-up water is available via the IRWST and the SFP purification pump, which has a make-up capacity of 400 gpm. Therefore, there is sufficient time for operator intervention with minimal impact on SFP inventory and cooling.

The FB flooding analysis postulates a 6-inch pipe failure at the bottom of the cask loading pit. The release of water from this postulated failure would be detected by the operators performing the fuel transfer as well as by level measurements. The released water volume is defined by a time period of 30 minutes. Since the FB flooding analysis assumes a 6-inch pipe failure, it bounds the postulated cracks in the 6-inch attached piping.