AREVAEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Friday, April 26, 2013 2:07 PM
To: Snyder, Amy
Cc: Miernicki, Michael; Hearn, Peter; ANDERSON Katherine (EXTERNAL AREVA); DELANO Karen (AREVA); HONMA George (EXTERNAL AREVA); LEIGHLITER John (AREVA); LEWIS Ray (EXTERNAL AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); TOLLEY Tracey (AREVA); VANCE Brian (AREVA); KOWALSKI David (AREVA); HARRINGTON James (AREVA)
Subject: Advanced Response to U.S. EPR Design Certification Application RAI No. 534 (6227), FSAR Ch. 9, Question 09.01.04-39
Attachments: Advanced Response to RAI 534 Question 09.01.04-39 US EPR DC.pdf

Amy,

Attached is an Advanced Response to RAI No. 534, Question 09.01.04-39 in advance of the final response date of May 24, 2013.

To keep our commitment to send a final response to this question by the commitment date, we need to receive all NRC staff feedback and comments no later than **May 17, 2013**.

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

Sincerely,

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

From: WILLIFORD Dennis (RS/NB)
Sent: Tuesday, January 08, 2013 3:48 PM
To: Amy.Snyder@nrc.gov
Cc: peter.hearn@nrc.gov; DELANO Karen (RS/NB); LEIGHLITER John (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); WILLS Tiffany (CORP/QP); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 534 (6227), FSAR Ch. 9, Supplement 3

Amy,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the two questions in RAI No. 534 on January 26, 2012. Supplement 1 response to RAI No. 534 was sent on February 24, 2012 to provide a revised schedule. Supplement 2 response was sent on March 16, 2012 to provide a technically correct and complete final response to Question 09.01.04-40.

The schedule for a technically correct and complete response to the remaining question has been revised as provided below:

Question #	Response Date
RAI 534 — 09.01.04-39	**May 24, 2013**

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
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Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, March 16, 2012 3:23 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 534 (6227), FSAR Ch. 9, Supplement 2

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the two questions in RAI No. 534 on January 26, 2012. Supplement 1 response to RAI No. 534 was sent on February 24, 2012 to provide a revised schedule.

The attached file, "RAI 534 Supplement 2 Response US EPR DC.pdf" provides a technically correct and complete final response to Question 09.01.04-40.

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 534 Question 09.01.04-40.

The following table indicates the respective pages in the response document, "RAI 534 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 534 — 09.01.04-40	2	2

The schedule for a technically correct and complete response to the remaining question has not changed and is provided below:

Question #	Response Date
RAI 534 — 09.01.04-39	June 28, 2013

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
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Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, February 24, 2012 5:44 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 534 (6227), FSAR Ch. 9, Supplement 1

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the two questions in RAI No. 534 on January 26, 2012.

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

Question #	Response Date
RAI 534 — 09.01.04-39	**June 28, 2013**
RAI 534 — 09.01.04-40	**March 21, 2012**

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
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Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, January 26, 2012 9:44 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); Michael.Miernicki@nrc.gov; peter.hearn@nrc.gov
Subject: Response to U.S. EPR Design Certification Application RAI No. 534 (6227), FSAR Ch. 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 534 Response US EPR DC.pdf," provides a preliminary schedule since technically correct and complete responses to the two questions cannot be provided at this time.

The following table indicates the respective pages in the response document, “RAI 534 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 534 — 09.01.04-39	2	3
RAI 534 — 09.01.04-40	4	4

A preliminary schedule for technically correct and complete responses to these questions is provided below. This schedule is being reevaluated and a new supplement with a revised schedule will be transmitted by February 21, 2012.

Question #	Response Date
RAI 534 — 09.01.04-39	February 21, 2012
RAI 534 — 09.01.04-40	February 21, 2012

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, December 20, 2011 1:43 PM
To: ZZ-DL-A-USEPR-DL
Cc: Bernal, Sara; Schaaf, Robert; Curran, Gordon; McKenna, Eileen; Hearn, Peter; Segala, John; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 534 (6227), FSAR Ch. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on December 8, 2011, and discussed with your staff on December 20, 2011. No change is made to the draft RAI as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs, excluding the time period of **December 24, 2011 thru January 2, 2012, to account for the holiday season** as discussed with AREVA NP Inc. For any RAIs that cannot be answered **within 40 days**, it is expected that a date for receipt of this information will be provided to the staff within the 40-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: 4346

Mail Envelope Properties (554210743EFE354B8D5741BEB695E65612AA6E)

Subject: Advanced Response to U.S. EPR Design Certification Application RAI No. 534 (6227), FSAR Ch. 9, Question 09.01.04-39
Sent Date: 4/26/2013 2:06:55 PM
Received Date: 4/26/2013 2:07:08 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

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Post Office: FUSLYNCMX03.fdom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	7902	4/26/2013 2:07:08 PM
Advanced Response to RAI 534 Question 09.01.04-39 US EPR DC.pdf	566948	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal

Expiration Date:
Recipients Received:

Advanced Response to

Request for Additional Information No. 534(6227), Revision 0

Question 09.01.04-39

12/20/2011

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)
Application Section: Section 09.01.04

QUESTIONS for Health Physics Branch (CHPB)

Question 09.01.04-39:

OPEN ITEM

GDC 61 states in part that the design of the fuel storage and handling systems shall have suitable shielding for radiation protection and appropriate containment, confinement, and filtering systems. Sufficient shielding provides protection for workers from the spent fuel so that regulatory limits are not exceeded and overexposures do not occur.

10 CFR 20.1406 requires, in part, that each facility be designed so as to minimize contamination of the facility and the environment and to facilitate decommissioning.

a. In response to RAI 398 Question 9.1.4-18, the applicant provided design features which would serve to protect workers from radiation exposure to spent fuel. These include a non-safety related instrumentation and control system which monitors water level in the cask and penetration, displays alarms in case of an abnormal water level during cask loading, and closes the remote controlled valves of the Spent Fuel Cask Transfer Facility's (SFCTF) fluid systems to stop water loss. However, it is not clear which remote controlled valves are being credited. Provide additional information identifying which SFCTF fluid system valves are closed to stop water loss.

b. Figure 09.01.04-15-2 provided with RAI 9.1.4-15 response shows content of contaminated water discharging into the vent and drain system. The RAI response also says on page 12 that the lower cover is equipped with a nozzle for drip-off recovery. However, it is not clear to the staff where this drainage or any leakage of the penetration seals is discharged (i.e. floor drain, sump, etc…). Provide more information on the path the contaminated water takes, whether this water receives treatment before discharging to the environment, and how this minimizes contamination.

c. The applicant provided several examples of design features that demonstrate compliance with the requirements of 10 CFR 20.1406 for the SFCTF. Revise chapter 12 of the FSAR to include these features.

d. The response to RAI 398 Question 9.1.4-18 states that "all cask loading operations are automatically performed from the SFCTF control room. This includes automatic welding of the biological lid and its covers." It is not clear to the staff where and how the SFCTF performs welding to close the cask. FSAR Section 9.1.4 states that the biological lid flange is bolted to the cask at the cask handling opening station prior to leak-tightness checks and does not mention welding. In addition it is the staff's understanding that only the auxiliary crane has access to the cask at the handling opening station, and that the handling opening station has an open ceiling to allow the crane access. Because welding is required to ensure leak-tightness of the cask, and because the welding work itself can contribute significant occupational dose to the cask loading process, revise the FSAR to describe where and how welding occurs during the cask closing operations. In addition, clarify which lid or cover is welded versus which one may be bolted, and whether the welding or bolting of lids/covers is manual, automatic or remotely operated from the SFCTF.

e. Provide in the FSAR the location of radiation monitors around the SFCTF (in the loading hall).

f. Table 9.1.4-15-6 has as an interlock the requirement that the iodine extracting ventilation be operable prior to using the SFCTF. Revise the FSAR to include this information, with a description of how this requirement will be implemented.

Response to Question 09.01.04-39:

Item a:

In the response to RAI 525, Question 09.01.04-22, a new table and text was added to U.S. EPR FSAR Tier 2, Section 9.1.4.5, which provides a description of the interlock and emergency stop protection associated with the spent fuel cask transfer facility (SFCTF) equipment. As shown in U.S. EPR FSAR Tier 2, Table 9.1.4-2—SFCTF Non-Safety Related Interlocks and Emergency Stops, a number of fluid circuit isolation valves are closed on specific commands from the SFCTF Instrumentation and Control (I&C) system.

Table 09.01.04-39-1 in this response identifies the specific valves that are closed to isolate supporting fluid systems. For additional information, refer to the following figures as provided in the response to RAI 385, Question 09.01.04-15:

- Figure 09.01.04-15-1—Penetration Assembly Seals Monitoring Circuits shows representative compressed air circuit for monitoring the penetration assembly seals.
- Figure 09.01.04-15-2—Penetration Assembly Filling and Draining Circuits shows representative circuit for filling and draining the penetration assembly.
- Figure 09.01.04-15-3—Cask Filling, Draining and Drying Circuits on the SFCTM shows representative circuit on the SFCTM for filling, draining, and drying the cask.

Item b:

Seal leakage between the penetration assembly and upper cover will be detected by the penetration leakage monitoring system, which also routes the drainage in the detection cavity between the double O-ring seals to the nuclear island drain and vent system (NIDVS). This is also shown on Figure 09.01.04-15-2.

If the back-up seal fails, or if the penetration upper cover is open, fluid will collect within the penetration and bellows assembly. The leakage that is collected can be drained through the drip-off recovery nozzle on the penetration lower cover by a flexible hose connected to a drain line on the SFCTM (and subsequently to the NIDVS), or directly to the loading hall drains/sumps. As described in U.S. EPR FSAR Tier 2, Section 9.3.3.2, the drains/sumps in the loading hall are connected to the NIDVS for further processing.

Item c:

U.S. EPR FSAR Tier 2, Section 12.3.6.5.1, will be revised to reflect the contamination control design features of the SFCTF that were described in the response to RAI 398, Question 09.01.04-18.

Item d:

The U.S. EPR design does not include the use of automatic welding of the biological lid and its covers.

U.S. EPR FSAR Tier 2, Section 9.1.4.2.1 will be revised to provide further clarification concerning the use of welding.

Item e:

As shown in U.S. EPR FSAR Tier 2, Table 12.3-3—Radiation Monitor Detector Parameters, there is one radiation monitor in the loading hall. It is located at the +0 foot elevation.

U.S. EPR FSAR Tier 2, Section 9.1.4.3, will be revised to reflect this information.

Item f:

In the response to RAI 525, Question 09.01.04-22, a new table and text was added to U.S. EPR FSAR Tier 2, Section 9.1.4.5, which provides a description of the interlock and emergency stop protection associated with the SFCTF equipment. U.S. EPR FSAR Tier 2, Table 9.1.4-2—SFCTF Non-Safety Related Interlocks and Emergency Stops, will be revised to reflect the addition of the iodine extracting ventilation interlock.

An iodine ventilation interlock ensures that the ventilation exhaust dampers are open prior to the start of cask loading operations (or when a potential airborne radioactive hazard exists). The exhaust air is routed to the nuclear auxiliary building ventilation system (NABVS) for additional processing. If high radiation is detected in the NABVS, the air is diverted to the iodine filtration trains prior to discharge through the vent stack. Each iodine filtration train contains an iodine absorber, which uses activated carbon and a dedicated booster fan. The filtered air is then routed to the common exhaust plenum and discharged through the vent stack.

For additional information on the fuel building and nuclear auxiliary building ventilation systems, refer to U.S. EPR FSAR Tier 2, Sections 9.4.2 and 9.4.3, respectively.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.1.4.2.1, 9.1.4.3 and 12.3.6.5.1, and Table 9.1.4-2 will be revised as described in the response and indicated on the enclosed markup.

Table 09.01.04-39-1-Fluid Circuit Isolation Valves – Closed by SFCTF I&C System

Valve Designation	SSC Description	U.S. EPR Safety Class	U.S. EPR Quality Group Class	U.S. EPR Seismic Category	10 CFR 50 Appendix B Requirements	General Plant Location	Design Code
A	Filling / Rinsing / Drying Penetration Isolation Valve	S	C	I	Yes	UFA 10	ASME Section III Subsection ND
B	Valve Tools B and C Isolation Valve	S	C	I	Yes	UFA 10	ASME Section III Subsection ND
C	FPCPS Isolation Valve (for Valve Tool C)	S	C	I	Yes	UFA 10	ASME Section III Subsection ND
D	Level Measurement Isolation Valve	S	C	I	Yes	UFA 10	ASME Section III Subsection ND
E	Drain Isolation Valve #1 (from Valve Tool C)	S	C	I	Yes	UFA 10	ASME Section III Subsection ND
F	Drain Isolation Valve #2 (from Valve Tool C)	S	C	I	Yes	UFA 10	ASME Section III Subsection ND
G	Drain Isolation Valve #3 (from Valve Tool C)	S	C	I	Yes	UFA 10	ASME Section III Subsection ND
H	Penetration Drain Isolation Valve (from Valve Tool A)	S	C	I	Yes	UFA 10	ASME Section III Subsection ND
I	Cask Venting / Vacuum Isolation Valve (from Valve Tool A)	S	C	I	Yes	UFA 10	ASME Section III Subsection ND

U.S. EPR Final Safety Analysis Report Markups

- Loss of power supply.
- Seismic event.

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 8). 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 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, t~~The flange is unbolted. If necessary, cask-specific adaptors for interface with the SFCTF fluid systems are installed and the centering or

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.

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.

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. To warn operators of an unexpected increase in radiation levels, a radiation monitor is located in the loading hall at the +0 foot elevation. Area radiation monitoring instrumentation is described in Table 12.3-3. 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.

A limit switch prevents further lifting such that personnel exposure from an irradiated fuel assembly will not be > 2.5 mrem/hour. The RM is also provided with a dose rate measurement device and the 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.

Table 9.1.4-2—SFCTF Non-Safety Related Interlocks and Emergency Stops
Sheet 9 of 9

Control Function	Control Type	Description	Function	I&C Components	Mechanical/ Electrical Actuations	Alarms (Initiation)	Alarms (Means of Clearance)
CF 28	Operational	Confirm iodine extracting ventilation is operational	Prevent contamination of air in Fuel Building and an increase in dose rates.	PLC and HSI display Limit switches Position switches	N/A	Automatic - Alarm on SFCTF HSI display when iodine extracting ventilation damper position sensor trips on "off"	SFCTF HSI display (operator acknowledgement required) when the iodine extracting ventilation damper position sensor trips "on"

located in the fuel storage area for personnel and facility contamination protection. These area monitors alarm locally and in the MCR.

The concrete structure for the fuel transfer canal (and the spent fuel pool) is designed in accordance with the criteria for Seismic Category I structures. As such, it is designed to maintain leak-tight integrity to prevent the loss of cooling water from the pool. The fuel transfer canal is lined with stainless steel liner plates. Expansion joints are provided for the fuel transfer tube on the Reactor Building (RB) and FB side to accommodate the differential movement and provide leak-tight sealing. These expansion joints are equipped with a sensor for detecting leaks and providing an alarm in the MCR. In addition, to minimize potential facility contamination due to an event in the Containment Building, the fuel transfer tube between the fuel transfer canal and the spent fuel pool is equipped with a blind flange that provides containment isolation during power operations and a manual gate valve that allows isolation when the blind flange is removed during refueling operations. This fuel transfer tube consists of a stainless steel pipe installed inside a large sleeve that is anchored to the concrete of the Containment Building and welded to the containment liner plate. Bellows and water-tight seals are provided around the fuel transfer tube where it passes through the RB internal structures refueling canal concrete and the Reactor Shield Building and FB concrete. Where the potential exists for contamination, concrete surfaces are protected by a smooth epoxy.

To minimize facility contamination associated with the maintenance and replacement of contaminated fuel handling equipment, this equipment is designed for the life of the plant. In addition, the materials of construction, surface finish (for contamination prevention), and lubricant use are designed in accordance with the recommendations prescribed in ANS 57.1-1992 (Reference 12) for the fuel handling equipment.

Loading of spent fuel into casks is performed in the loading hall. The equipment and structures associated with the loading hall operation are defined as the Spent Fuel Cask Transfer Facility (SFCTF). The SFCTF has the following design features to preclude contamination of the facility. The overall design is consistent with U.S. EPR contaminant management philosophy in compliance with 10 CFR 20.1406.

- The fluid circuits have provisions to detect a leak via an abnormal pressure or level drop. The SFCTF is provided with an emergency stop pushbutton which can be actuated in case of leak detection.

- The penetration is equipped with double-seals for the upper cover of the penetration, for the double-walled bellow flange, and for the leak-tightness flange. The space between the two seals is monitored for leak tightness, as well as the space between the two walls of the bellows. The water leak sensor, connected to the plant main control room, monitors for potential leakage caused by failure of the seal at the upper cover of the penetration.

- The leak-tightness flange is connected at the upper end to the docking flange and the double walled bellows of the penetration. The lower end of the leak-tightness flange contacts the mating surface of the cask when the cask is docked to the penetration. When the transfer machine is not placed under the penetration, the leak-tightness flange is bolted with the lower cover of the penetration. The leak-tightness flange is equipped with two seals, each at the upper and lower end and an arrangement to monitor the space between the seals for leak-tightness. The leak-tightness flange is identified in Figure 9.1.4-7—Spent Fuel Cask Transfer Facility and Figure 9.1.4-8—Cask Loading Pit Penetration Assembly.

- An interlock permits opening of the upper cover of the penetration only after the correct docking has been confirmed, the anti-seismic locking of the SFCTM has been correctly engaged, and the correct water level has been attained. An accidental travel motion of the SFCTM when the penetration is docked is avoided using the interlock.

- Water level in the cask is checked before lowering the lid, before undocking the penetration, and before moving the SFCTM from the penetration.

- The geometry and surface finish of the immersed parts are selected to prevent the formation of radioactive-particle retention areas and to facilitate decontamination. Piping is designed to maintain minimum flow velocities and is installed with slopes to facilitate complete draining. The immersed parts, in particular the moving parts, are designed so that they can be easily and efficiently rinsed.

- The penetration is designed to remain leak-tight during and after a safe shutdown earthquake (SSE), except that a brief unseating of the normally leak-tight connection at the mating surface of the cask may occur resulting in some seepage around the seals, but does not result in any significant loss of water inventory from the cask loading pit or SFP.

- Effluents created by a postulated leakage of the operational fluid circuits on the SFCTM are collected by the trolley platform from where they can be drained to the NIDVS or loading hall sumps.

- The sumps in the loading hall are connected to the NIDVS, which prevents flooding of the loading hall.

- The SFCTM and the cask are checked for contamination before leaving the loading hall.

Design Provisions for Minimizing Contamination of the Environment

To minimize airborne contamination of the environment, the fuel building ventilation system provides appropriate ventilation and filtration to limit potential release of airborne radioactivity to the environment from the fuel storage facility under normal operation and in the event of a fuel handling accident in the spent fuel pool area. This ventilation system is continuously monitored by gaseous, particulate, and radio-iodine radiation monitors, which alarm locally and in the MCR. Isolation dampers isolate the