ArevaEPRDCPEm Resource

From: WELLS Russell (AREVA) [Russell.Wells@areva.com]
Sent: Monday, March 21, 2011 4:25 PM
To: BRYAN Martin (AREVA); Tesfaye, Getachew
Cc: KOWALSKI David (AREVA); BALLARD Bob (AREVA); PATTON Jeff (AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); HALLINGER Pat (EXTERNAL AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); WILLIFORD Dennis (AREVA)
Subject: Draft Response to U.S. EPR Design Certification Application RAI No. 454, FSAR Ch. 9 Question 09.01.04-19
Attachments: RAI 454 Question 09.01.04-19 Response US EPR DC - DRAFT.PDF

Getachew

Attached is a draft response to RAI No. 454, Question 09.01.04-19 in advance of the March 25, 2011 final date.

Let me know if the staff has questions or if the draft response can be sent as a final response.

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
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From: BRYAN Martin (External RS/NB)
Sent: Monday, December 06, 2010 4:45 PM
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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. 454, FSAR Ch. 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 454 Response US EPR DC," provides a schedule since a technically correct and complete response to the question is not provided.

The following table indicates the respective pages in the response document, "RAI 454 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 454 — 09.01.04-19	2	3

The schedule for a technically correct and complete response to the question is provided below.

Question #	Response Date
RAI 454 — 09.01.04-19	March 25, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, November 05, 2010 8:37 AM
To: ZZ-DL-A-USEPR-DL
Cc: Curran, Gordon; Segala, John; Lee, Samuel; Hearn, Peter; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 454(5108), FSAR Ch. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on October 27, 2010, and on November 3, 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
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Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2728

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Response to

Request for Additional Information No. 454(5108),
Question 09.01.04-19, DRAFT

11/05/2010

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)
Application Section: 9.1.4

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

Question 09.01.04-19:

For fuel transfer into and out of the fuel storage facility, some current operating reactors rely on the heavy load handling overhead crane. In most plants, the design is consistent with RG 1.13, specifying that the crane be restricted from travel over the spent fuel pool. However, some plants have the new fuel elevator located in the spent fuel pool and the overhead crane does move over a portion of the pool, similar to EPR design. In these cases, plants load fuel with auxiliary hoists on overhead cranes provided spent fuel is not stored nearby and there is reasonable assurance that a fuel assembly drop would not cause a loss of pool water that would damage or uncover fuel.

As a result of communications with the applicant, it became clear to the staff that the FSAR does not adequately describe the process that the EPR intends to use for moving new fuel above deck to the new fuel elevator and what provisions are provided to prohibit movement over spent fuel. During the call, AREVA confirmed that the fuel building (FB) auxiliary crane is primarily used for new fuel handling.

However, the details of the handling of fuel by the use of the FB aux crane are not included in Section 9.1.4 or 9.1.5 of the FSAR.

Therefore, the staff has the following questions and clarifications:

a. Clarify whether the FB aux crane (20 ton main hoist) contains multiple hoists that are used to move fuel. If so, confirm the capacity of the other hoists and whether all hoists on the FB aux crane are single-failure proof.

b. Describe how the FB Aux Hoist will be used to handle new fuel from fuel containers to fuel elevator. (RAI 9.1.4-4 response seems to include this, but the FSAR does not.)

c. Explain the safe/normal load path of new fuel and describe any provisions that are included to ensure load path is followed. In addition, describe the interlocks or other methods provided to prohibit new fuel and other loads from inadvertently traveling over spent fuel.

d. Confirm whether or not a fuel drop has been analyzed for a drop height above deck into the SFP to verify that the drop of a fuel assembly will not drain the SFP to uncover fuel or justify other means to prevent this. If not, please provide justification.

e. Provide dimensions/clearances between the new fuel elevator (NFE) in the spent fuel pool and the spent fuel assemblies/rack.

f. Since the handling tools are not described in the FSAR, describe the handling tools/devices used to move new fuel to the NFE with the appropriate hoists. In addition, provide handling tool description in the FSAR for movement of the new and spent fuel (long handling tool, short handling tool, mast) above deck, in SFP, and in reactor. Describe, in the FSAR, these handling tools and their functions for handling fuel and the tests and inspections to perform for these handling tools.

In addition to the above, the staff has general questions to clarify where content is found FSAR:

g. Provide in the FSAR the location discussing types of crane controls (Pendant, remote control, manual, etc..) for the heavy and light load handling cranes (ANSI 57.1 Section 6.3.4.1.6)

h. Section 9.1.5.2.3 indicates that, “[t]he FB auxiliary crane, located over the spent pool, is designed in accordance with ASME NOG-1…” This sentence seems to imply that this hoist is routinely used over spent fuel pool. Explain its usage over SFP.

i. Confirm the hoist capacity is capable/sized for handling a fuel assembly and its handling tool.

The staff requests the applicant to provide additional information or clarification to address the above regarding the process for new fuel movement over the spent fuel pool, above the deck, and near new fuel elevator. In addition, adequate description is needed in the FSAR to clearly define all aspects of new fuel movement and what provisions/interlocks are included for travel over spent fuel pool.

Response to Question 09.01.04-19:

a) The auxiliary hoist located over the spent fuel pool (SFP) is an overhead, top running crane, with a single hoist unit rated at 20 metric tons. This hoist is a single failure proof design. There are no other hoists located on the Fuel Building (FB) auxiliary crane.

b) New fuel containers are received in the FB loading bay. Typically, each container carries two fuel assemblies.

U.S. EPR FSAR Tier 2, Section 9.1.4.2.1 will be revised to state the following:

“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 acceptable 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.”

The new fuel assemblies placed in the new fuel dry storage will be moved to underwater storage prior to the refueling outage.

Fuel building plans for Elevations 0 feet, +49 feet, and +64 feet are provided in the following U.S. EPR FSAR Tier 2 figures, respectively:

- U.S. EPR FSAR Tier 2, Figure 3.8-41—Fuel Building Plan Elevation 0 Feet.
- U.S. EPR FSAR Tier 2, Figure 3.8-45—Fuel Building Plan Elevation +49 Feet.
- U.S. EPR FSAR Tier 2, Figure 3.8-46—Fuel Building Plan Elevation +64 Feet.

c) Regarding load handling operations of new fuel components, the auxiliary crane handles new fuel containers, covers and protection lids for new fuel containers, new fuel assemblies, new fuel storage racks, and new fuel examination covers.

After receiving new fuel, the auxiliary crane moves the new fuel containers, container covers, and protection lids from the truck bay (Elevation 0.0 feet) up to the new fuel examination area at Elevation 48.58 feet and the new fuel storage areas at Elevation 46.58 feet. Handling of the new fuel and associated components in this area (on the west end of the FB) enables the movements of the crane and associated loads to be handled at distances remote from the location of the SFP.

Following inspection and storage, the new fuel is moved from the new fuel storage racks to the new fuel elevator. The new fuel elevator is located on the south side of the SFP. Movement of the new fuel from the new fuel storage racks to the fuel elevator is administratively controlled by safe load paths designated along the southern corridor of the FB. Because of the single failure proof design of the auxiliary crane, interlocks for control of bridge and trolley travel are not required in this area.

Movement of loads directly over the SFP is not expressly prohibited when using the single failure proof auxiliary crane. However, using designated safe load paths provides an additional level of defense-in-depth (D3).

d) The handling and movement of new fuel assemblies from the new fuel storage area or new fuel examination area to the new fuel elevator is performed by the auxiliary crane with using the new fuel handling tool. The new fuel assembly is moved over the fuel pool operating floor (+64 feet) up to the new fuel elevator, which is installed on the wall of the spent fuel storage pool, and lowered into the new fuel elevator basket. During the horizontal movement over the fuel pool operating floor, the bottom of the new fuel assembly is maintained close to the floor. As stated in U.S. EPR FSAR Tier 2, Section 9.1.5.2.3, the FB auxiliary crane is designed in accordance with ASME NOG-1 as a single failure proof crane (Type I). The new fuel handling tool is designed according to ANSI/ANS-57.1-1992; R1998; R2005 (R=Reaffirmed). The new fuel handling tool is designed to avoid load drop during normal conditions and a seismic event. The new fuel handling tool gripper mechanism is designed with an internal mechanical locking feature, which prevents unlatching of the gripper under load. The new fuel handling tool has the ability to indicate the latched or unlatched status of the gripper.

To reduce the likelihood of inadvertent operation of fuel handling equipment, fuel handling operations will be performed in accordance with approved plant procedures, which are the responsibility of the COL applicant as indicated in U.S. EPR FSAR Tier 2, Section 13.5 and specified in U.S. EPR FSAR Tier 2, Table 1.8-2, COL Item No. 13.5-1.

Fuel building plans for Elevations +49 feet and +64 feet are provided in U.S. EPR FSAR Tier 2, Section 3.8.

Considering the design provisions described in this response, a drop of a new fuel assembly from the fuel pool operating floor (+64 feet) into the spent fuel storage pool during handling operations is not a credible event and is not analyzed.

e) The area that is approximately 413 inches by 74 inches adjacent to the Region 2 spent fuel storage racks in the spent fuel storage pool is free of storage racks and is utilized by the new fuel elevator and fuel reconstitution facility. This area is shown in U.S. EPR FSAR Tier 2, Figure 9.1.2-7—Spent Fuel Storage Pool Layout. The new fuel elevator is installed on the wall of the spent fuel storage pool.

Specific dimensions of the new fuel elevator will be determined later in the design process involving the equipment details. The outer profile of the fuel basket is expected to have a distance of about 41 inches from the wall of the spent fuel storage pool. Because the distance away from the storage racks is about 74 inches from the spent fuel storage pool wall at the longer side, a clearance of approximately 33 inches between the new fuel elevator basket and the longer side of Region 2 spent fuel storage racks is expected. The clearance between the new fuel elevator, when fitted with the multi-inspection basket and the shorter side of Region 2 spent fuel storage racks, is expected to be approximately 68 inches.

f) To provide additional information about the fuel handling tools, U.S. EPR FSAR Tier 2, Section 9.1.4 will be revised as described below:

- U.S. EPR FSAR Tier 2, Section 9.1.4.2.3 will be added to describe the various fuel handling tools.
- U.S. EPR FSAR Tier 2, Section 9.1.4.3.2 will be added to describe the safety provisions for the fuel handling tools.
- U.S. EPR FSAR Tier 2, Section 9.1.4.4 will be revised to include inspection and testing requirements for the fuel handling tools.

g) 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 on the Reactor Building (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 an arrangement, 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, an arrangement for an emergency stop. The new fuel elevator has a control box on the fuel pool operating floor.

The auxiliary crane is operated from a control desk located on the FB floor. The auxiliary crane has radio remote control boxes, and on the FB floor, an arrangement for an emergency stop.

U.S. EPR FSAR Tier 2, Section 9.1.4.5 will be revised to include information on the spent fuel machine, new fuel elevator, fuel transfer tube facility, and refueling machine controls. U.S. EPR FSAR Tier 2, Section 9.1.5.5 will be revised to include information on the auxiliary crane controls.

h) The auxiliary crane is located at Elevation +90.85 feet and travels over the SFP. This crane is a single failure proof design, allowing for potential movement of loads over the SFP.

Load handling operations over the SFP include movement of the fuel assemblies around the periphery of the pool. The auxiliary crane may also be used as a backup lifting device for the fuel handling machine in the event if the fuel handling machine is unavailable. When used this way, manual operations are performed.

U.S. EPR FSAR Tier 2, Section 9.1.5.2.3 will be revised to clarify the use of the hoist over the SFP.

i) The new fuel handling tool and spent fuel handling manual tool are used for fuel assembly handling, and the fuel assembly insert handling manual tool is used for fuel assembly insert handling. These tools are handled by the auxiliary crane in the FB. The auxiliary crane with a maximum load rating of 20 metric tons is capable of handling a fuel assembly handling tool with a fuel assembly and the heaviest fuel assembly insert. The auxiliary crane maximum load rating is specified in U.S. EPR FSAR Tier 2, Table 9.1.5-1—Heavy Load Handling Equipment. The spent fuel handling manual tool can be handled by the polar crane in the RB. The rated load capacity of the polar crane is sufficient for handling a fuel assembly handling tool with a fuel assembly and the heaviest fuel assembly insert. Refer to U.S. EPR FSAR Tier 2, Section 9.1.5.2.2 for rated load capacities of the polar crane hoists.

The refueling machine, spent fuel machine, new fuel elevator, and fuel transfer tube facility are capable of handling a fuel assembly with the heaviest fuel assembly insert.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.1.4, 9.1.4.2.1, 9.1.4.5, 9.1.5.2.3, and 9.1.5.5 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

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

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.

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, and the new fuel storage area. Figures showing the overall system arrangement in the Reactor Building and Fuel Building are provided in Section 3.8.

9.1.4.2.1 General Description

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

The reactor cavity, the core internal storage compartment, and the 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.

09.01.04-19(b)

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

09.01.04-19(b)

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

Refueling Procedure

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

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

RCS and Refueling System Preparation

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

Disassembly of the Reactor

Mechanical and instrumentation connections to the reactor pressure vessel are disconnected to allow removal of the vessel head. The refueling cavity is prepared for flooding by checking the underwater lights, and tools; closing the refueling cavity drain lines; and removing the blind flange from the fuel transfer tube. With the refueling cavity prepared for flooding, the vessel head is unseated and raised above the vessel flange using the reactor building polar crane (refer to Section 9.1.5 for equipment handling heavy loads). Water from the in-containment refueling water storage tank (IRWST) is directed into the reactor coolant system in order to fill the RB refueling cavity. The vessel head is lifted and placed on the head stand. When the RB refueling cavity water level reaches the specified depth for shielding and the water level in the FB transfer pit is equalized to the refueling cavity level, the fuel transfer tube isolation valve is opened. The refueling machine is positioned over the core and the control rod drive shafts are disconnected. Once the control rod shafts are disconnected, the internals lifting rig is installed. The upper internals are removed from the vessel and stored in the refueling canal in a designated area located away tilting basket, along with miscellaneous handling operations. The auxiliary crane is designed with buffers and shock-absorbing devices. The auxiliary crane bridge hoist uses the new fuel handling tool to handle new fuel assemblies for operations in air. For further details on the auxiliary crane, refer to Section 9.1.5.

Fuel Racks

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

Spent Fuel Cask Transfer Facility

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

09.01.04-19(f)

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 Fuel Building. The spent fuel handling manual tool can be handled by the polar crane in the Reactor Building. The fuel handling tools are designed in accordance with 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. The new fuel handling tool, spent fuel handling manual tool, and fuel assembly insert handling manual tool are not handled by the refueling machine hoist or the spent fuel machine hoist.

New Fuel Handling Tool

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

Spent Fuel Handling Manual Tool

The spent fuel handling manual tool performs underwater handling of a fuel assembly with or without a fuel assembly insert for positions of the underwater fuel storage

09.01.04-19(f)

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 Reactor Building. The spent fuel handling manual tool performs underwater handling of a fuel assembly with sufficient water cover to provide adequate shielding.

Fuel Assembly Insert Handling Manual Tool

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

9.1.4.3 Safety Evaluation

- The safety-related portions of the FHS are located in the RB and FB. These buildings are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other similar natural phenomena. Section 3.3, Section 3.4, Section 3.5, Section 3.7, and Section 3.8 provide the bases for the adequacy of the structural design of these buildings.

- The safety-related portions of the FHS are designed to remain intact after an SSE. Section 3.7 provides the design loading conditions that were considered. Section 3.5, Section 3.6, and Appendix 9A provide the required hazards analysis. The refueling machine, fuel transfer tube facility, NFE, and SFM 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 Reactor Building 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.

Auxiliary Crane

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

Spent Fuel Cask Transfer Facility

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

09.01.04-19(f)

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

9.1.4.3.2 Safety Provisions for the Fuel Handling Tools

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

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

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

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

9.1.4.3.3 Refueling Cavity Draindown Events

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

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 or in the fuel transfer facility, where it can be positioned horizontally to increase shielding depth or can be transferred to the Fuel Building. Weirs in the Reactor Building and Fuel Building pools limit the loss of water in pool areas separated from the drain path by the weirs.

9.1.4.4 Inspection and Testing Requirements

The safety-related components are located to permit preservice and inservice inspections. The FHS containment isolation function is testable. Refer to Section 14.2 (test abstracts #038 and #039) for initial plant testing of the FHS components. The performance and structural integrity of system components is demonstrated by continuous operation.

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

9.1.4.5 Instrumentation Requirements

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

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The spent fuel machine and new fuel elevator are remotely operated from their respective control desk on the Fuel Building floor. The refueling machine is remotely operated from a control desk located on the Reactor Building 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 Fuel Building 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.

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.

- Continued lowering of the load (other than full down position) upon receipt of a reduced load signal.
- Continued hoisting of the load upon receipt of an increased load signal (load hang-up).
- Continued upward travel of the hoist on a preset limit (two-blocking event).
- Simultaneous horizontal and vertical movement.
- Continued travel of the bridge and trolley beyond established limits.

Physical limits (hard-stops) are also provided on the bridge and trolly end of travel and on the hoist upper limit.

The RB polar crane is supported by a circular runway, which rests on brackets attached to the containment structure. The structure is a rigid assembly. The bridge framework consists of two girders and two end trucks. The two main girders are welded box sections which are attached with end ties and are supported on the crane end trucks. The end trucks consist of structural frames containing wheel assemblies (bogies). The polar crane girders are provided with full-length walkways that allow access to the associated electrical and mechanical components.

The RB polar crane is equipped with trolleys that traverse the length of the bridge. The trolleys provide structural support for the associated hoisting equipment.

The RB polar crane is provided with three electric hoists. The main hoist is supported by a single trolley and has a rated capacity of 320 metric tons. The secondary trolley supports two hoist units, one rated at 35 metric tons and another rated at five metric tons.

Special lifting devices used with this crane will satisfy the design criteria and testing specified in ANSI N14.6 (Reference 9). If special lifting devices are not used, slings will be selected that satisfy the criteria of ANSI/ASME B30.9 (Reference 10). In addition, slings for use with single-failure-proof handling systems will be constructed of metallic material (chain or wire rope). Special lifting devices and slings will have either dual independent load paths or a single load path with twice the design safety factor.

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9.1.5.2.3 Fuel Building Auxiliary Crane

The FB auxiliary crane, located over the spent pool, is designed in accordance with ASME NOG-1 as a single failure-proof crane (Type I), allowing the potential for movement of loads over the spent fuel pool (SFP). As a Type I crane, the FB auxiliary crane is capable of handling the maximum critical load (i.e., not drop the load) during an SSE. The FB auxiliary crane is designed to Seismic Category II criteria and in conformance with Reference 1, Reference 2, Reference 3 and Reference 4.

The heavy loads the FB auxiliary crane normally handles include:

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- Slot gates – 11.2 metric tons (includes lifting beam and lower load block).
- New fuel containers – 5 metric tons.
- Load handling operations over the SFP include movement of fuel assemblies around the pool periphery.

In addition, the auxiliary crane can be used to handle spent fuel assemblies in the event that the spent fuel mast bridge is not available. When used in this capacity, interlocks are provided to prevent:

- Continued lowering of the load (other than full down position) upon receipt of a reduced load signal.
- Continued hoisting of the load upon receipt of an increased load signal (load hang-up).
- Continued upward travel of the hoist on a preset limit (two-blocking event).
- Simultaneous horizontal and vertical movement.
- Continued travel of the bridge and trolley beyond established limits.

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Physical limits (hard-stops) are also provided on the bridge and trolley end of travel and on the hoist upper limit.

Special lifting devices used with this crane will satisfy the design criteria and testing specified in ANSI N14.6 ("Special Lifting Devices for Shipping Containers Weighing 10000 Pounds (4500 kg) or More"). If special lifting devices are not used, slings will be selected that satisfy the criteria of ASME B30.9 ("Slings"). In addition, slings for use with single-failure-proof handling systems will be constructed of metallic material (chain or wire rope). Special lifting devices and slings will have either dual independent load paths or a single load path with twice the design safety factor.

9.1.5.2.4 Other Overhead Load Handling Systems

Other than the RB polar crane, other major cranes in the RB include four single girder bridge cranes used for servicing heating, ventilation and air conditioning (HVAC) equipment, four jib cranes located within the steam generator cubicles and an assembly crane located near an accumulator tank. These cranes provide lifting capabilities during plant outages.

9.1.5.5 Instrumentation Requirements

Included in the crane design are devices which provide additional measures for safe operation of the crane. These devices provide protection for overtravel, overspeed, overload, unbalanced load and proper spooling of the hoisting ropes onto the hoist drums.

The hoisting motions are provided with redundant limit switches which prevent overtravel of the hoist hook in hoisting and lowering operations. The primary limit is a control circuit switch which removes power to the hoist motor and sets the brakes. Motion out of this limit is allowed in the safe direction of travel. The secondary system consists of a power circuit-limit, which when activated directly interrupts power to the hoist motor and the brakes, causing the brakes to set. Motion out of this limit is not possible without corrective action.

The hoist drum is equipped with limit switches which are used to monitor hoist over-speed and to control proper threading of the wire rope onto the drum. Activation of either of these sends a signal to the control system causing the hoist motor to stop and the brakes to set. In addition, a balanced-load limit switch is installed in the upper hoist block which monitors movement of the equalizer. Tripping of this device initiates a flashing warning light visible to the crane operator and interrupts the hoist motion upon detection of excessive movement.

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Travel limits installed at each end of the crane bridge girders control overtravel of the crane trolley. Actuation of these limits removes power from the travel motion, allowing the trolley to coast prior to engagement with the trolley bumper stops so that the kinetic energy imparted to the bumpers is within the acceptable design range.

The auxiliary crane is operated from a control desk located on the FB floor. The auxiliary crane has radio remote control boxes, and on the FB floor, a safety feature for an emergency stop.

9.1.5.6 References

1. NUREG-0554, “Single-Failure-Proof Cranes for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, 1979.

2. Generic Letter 83-042, NRC Letter to All Holders of Operating Licenses, Applicants for Operating Licenses and Holders of Construction Permits for Power Reactors, “Clarification to GL 81-07 Regarding Response to NUREG-0162, ‘Control of Heavy Loads at Nuclear Power Plants’”, U.S. Nuclear Regulatory Commission, December 19, 1983.

3. NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants Resolution of Generic Technical Activity,” U.S. Nuclear Regulatory Commission, July 1980.