ArevaEPRDCPEm Resource

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Subject: U.S. EPR Design Certification Application RAI No. 385 (4524, 4515), FSAR Ch. 9
Attachments: RAI_385_SBPA_4524_4515.doc

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,
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Request for Additional Information No. 385(4524, 4515), Revision 0

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)

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.

09.01.04-16

Follow-up to RAI 131, Question 09.01.04-7

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

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

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

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

a. the SFP water inventory,
b. the cooling of stored spent fuel assemblies and casks,
c. the cooling of a suspended fuel assembly (when the scenario occurs while a fuel assembly is in movement),
d. the radiation dosage from a suspended fuel assembly (when the scenario occurs while a fuel assembly is in movement),
e. the radiation dosage from the fuel stored in the pool, and the fuel stored in the cask,
f. steps necessary to restore cask loading pool integrity, the time required to complete these actions, the capability to implement these actions during and/or following situations that cause the cask loading pit to drain, and controls that will be established to ensure that cask loading pool integrity can be restored as described (after a seismic event only seismic Category I SSCs can be credited to remain operational),
g. the flooding considerations,
h. the operator actions that are credited, including indication and alarms that are available to alert operators of the problem, and the time needed for operators to complete the required actions,
i. cask handling pit and loading hall ventilation, and
j. the effects on SSCs important to safety as a result of dropped or tipped cask during movement from all applicable events (i.e. seismic event, machine malfunction, etc…).

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

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

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.

09.01.05-20

Follow-up to RAI 173, Question 09.01.05-10

The staff asked the applicant in RAI 9.1.5-10 to describe the protection of the non-safety related, non-seismic heavy load handling equipment (HLHE) identified in FSAR Tier 2 Table 9.1.5-1 and the HLHE in the ultimate heat sink/essential service water structure from common mode failures. Provide the means to prevent the total loss of a safety function if multiple load drops are postulated to occur.

The applicant replied in RAI #173, Supplement 3. The applicant stated that the FSAR was updated to classify the cranes in the safeguard buildings, emergency power generating buildings, and the ultimate heat sink/essential service water structures as Seismic Category II and in accordance with American Society of Mechanical Engineers (ASME) NOG-1 or NUM-1 (Type II). However, the diesel hall cranes are located in the emergency power generating building and are classified as non-seismic in Table 3.2.2-1. Therefore, the RAI response regarding the diesel crane seismic classification is inconsistent with the Table 3.2.2-1. The

applicant should justify the non-seismic classification for the diesel cranes located in the emergency power generating building and clarify the FSAR accordingly.

In addition, the RAI response provided additional clarification stating, “If one division is unavailable because of maintenance, load handling over in-service safety-related equipment and systems of other divisions is prohibited. During a seismic event, the design of Type II cranes results in the cranes remaining in place and not impacting safety-related equipment and systems below the cranes. The design of Type II cranes requires electrical power to enable the crane hoist brakes to open. In the event of a common mode failure causing a loss of electrical power, the hoist brakes close enabling the load to be placed in a safe condition.” The staff finds this statement acceptable. However, the applicant should incorporate this response to RAI 9.1.5-10 into the FSAR.

09.01.05-21

Follow-up to RAI 173, Question 09.01.05-13

The applicant replied to RAI 9.1.5-13 in RAI 173, Supplement 3. The applicant stated that handling loads over equipment that is not completely divisionally separated will be performed only when that equipment is not required to be in service (i.e., outage conditions) and cranes in these areas are Seismic Category II. As indicated by the applicant’s response, for conditions when load handling by non-single-failure proof cranes is identified over equipment in non-divisionally separated areas, analyses will be performed later in the design process to determine if a simultaneous loss of more than one redundancy of a system is possible and acceptable, due to a postulated load drop, . The applicant’s RAI response further clarified that “Non-single failure proof cranes will not be used to handle critical loads.”

The applicant should incorporate the RAI 9.1.5-13 response into the FSAR, regarding the handling of loads only when equipment is not required to be in service (i.e., outage conditions) and clearly define (per RAI 9.1.5-13 response) when non-single failure proof cranes will not be used to handle critical loads in the FSAR. In addition, the applicant is asked to provide an additional COL Item or ITAAC for applicant to indentify conditions of load handling by non-single failure proof cranes over SSC in non-divisionally seperate areas and to provide the load drop analysis accordingly.

09.01.05-22

Follow-up to RAI 173, Question 09.01.05-18

The applicant replied to RAI 9.1.5-18 in their response to RAI #173, Supplement 2. The applicant proposed to revise FSAR Tier 2, Table 3.2.2-1 to identify the reactor building (RB) polar crane and fuel building (FB) auxiliary crane as ASME NOG-1 “single-failure-proof” lifting systems meeting the guidance provided in NUREG-0554. The applicant also proposed to review FSAR Tier 1, Section 2.10.1 to add an ITAAC for the “single-failure-proof” RB polar crane and FB auxiliary crane. The following design commitments were proposed to be added to FSAR Tier 1, Section 2.10.1:

3.2. The containment polar crane main hoist is equipped with a dual load path reeving system and redundant holding brakes.

3.3. The auxiliary crane is equipped with a dual load path reeving system and redundant holding brakes.

The staff considers an ITAAC to verify only dual reeving and redundant brakes an insufficient confirmation for a single failure proof design. As a minimum, a single failure proof crane needs to withstand a single failure of any component in the hoist load path from the hoist motor mount to the hook, with the exception that the drum shell and certain hooks have sufficient design margin that their failure is not postulated. In addition to redundancy in some components, protection against some component failures may require instrumentation to detect the failure (i.e., overspeed or drive train continuity monitors) and set the holding brakes. Also, the non-redundant structural components (e.g., bridge structure, trolley structure, and drum shell) should be designed with substantial design margin. Finally, protection against two-blocking and load hang-up, which can be provided by either instrumentation or overload protection devices, is necessary for a single-failure-proof crane per NUREG-0554.

For the single failure proof cranes, the ITAAC should be used to verify certain key attributes of the single failure proof crane using acceptance criteria from the licensing standard (i.e., NUREG-0554 or ASME NOG-1).

As a minimum the ITAAC should address a set of tests that include:

a. Non-destructive evaluation (NDE) of critical welds in the crane structure (Paragraph 4251.4 of ASME NOG-1 or Article 2.6 of NUREG-0554) with acceptance criteria from American Welding Society (AWS) D1.1;
b. Static and dynamic load testing (Paragraph 7422 of ASME NOG-1 or Articles 8.2 and 8.4 of NUREG-0554) with acceptance criteria related to bridge design deflection under load, ability to manually lower load, ability of holding brakes to individually stop and hold rated load, and proper operation of limiting and safety devices; and
c. No-load test of two-blocking protection (either independent tests of redundant upper limit switches or test of energy absorbing device) (Paragraph 7421 of ASME NOG-1 or Article 8.3 of NUREG-0554).

In addition to ITAAC for the crane, there should be ITAAC for critical special lifting devices, which could be limited to the acceptance test in American National Standards Institute/American Nuclear Society (ANSI/ANS) 14.6 (150% load test for 10 minutes followed by NDE of critical welds per Article 5.5).

In addition to single failure criteria above, the applicant also replied that as described in U.S. EPR FSAR Tier 2, Section 14.3, safety-significant design features are included in U.S. EPR FSAR Tier 1 based on SRP Section 14.3 guidance. SRP Section 14.3 does not identify Seismic Category II as criteria for safety-significant design features. The applicant stated that since Seismic Category II is not criteria for ITAAC, the Seismic Category II entries in FSAR Tier 1, Table 2.10.1-1 are to be changed to “N/A”. Similar entries in FSAR Tier 1, Table 2.2.8-1 (Fuel Handling System) are proposed to be changed from Seismic Category II to “N/A” in the response to RAI 201 (RAI 3.2.1-10).

The staff does not agree with deletions and changes from the “Seismic Category II” entries to “N/A” in FSAR Tier 1, Section 2.10.1, Table 2.10.1-1, and Table 2.10.1-2. Even though the response to RAI 201 (RAI 3.2.1-10) generically suggests that there is no ITAAC required for Seismic Category II SSCs, the staff considers the seismic classification of the OHLHS appropriate, based on the safety significance of a dropped load. Therefore, the original FSAR

content should not be changed relative to “Seismic Category II” ITAAC. Furthermore, incorporation of the proposed change to Table 2.10.1-1, by revising the seismic classification to “N/A”, results in an inconsistency with Tier 2 classification. Therefore, the applicant should:

a. Provide additional justification for removing or changing the seismic classification from Tier 1 and subsequently resolve any inconsistencies.

b. Provide additional criteria to verify cranes are single failure proof in accordance with NUREG-0554 and other applicable codes. Resubmit the proposed ITAAC with a more defined acceptance criteria and details.

09.01.05-23

Table 1.8-2 "US-EPR Combined License Inforamtion Items" contains COL Item 9.1-1 requesting the applicant to provide heavy load handling program and includes a reference to Section 9.1.5.2.5 for details. In accordance with RG 1.206 C.I.9.1.5, the COL applicant is to include specific information in the heavy load handling program. However, COL Item 9.1-1 and Section 9.1.5.2.5 does not contain all the specific items, outlined in C.I.9.1.5 of RG 1.206, that the applicant is to include into the handling program . The staff requests the applicant to revise Table 9.1-1 or Section 9.1.5.2.5 to include all the elements, as indicated in RG 1.206 C.I.9.1.5, needed for the COL applicant to include in the heavy load handling program.