Request for Additional Information No. 131 (1537, 1510, 1560), Revision 0

12/2/2008

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: 09.02.01 - Station Service Water System
SRP Section: 09.05.06 - Emergency Diesel Engine Starting System
Application Section: FSAR Ch. 9

QUESTIONS for Balance of Plant Branch 2 (ESBWR/ABWR) (SBPB)
QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

09.01.04-1

Regulatory Position C2 of Regulatory Guide 1.29, "Seismic Design Classification" describes the guidance for Seismic Category II systems, structure and components (SSC). This guidance states, in part, that Seismic Category II SSC are designed to preclude structural failure during a safe shutdown earthquake to preclude interaction with safety related SSC.

a. Some fuel handling system equipment (e.g. control rod drive shaft and instrumentation tooling and video mapping equipment) shown in FSAR Tier 2, Table 3.2.2-1 "Classification Summary," are classified as non-safety related and non-seismic (NSC). The applicant is requested to explain the NSC classification of these components and whether these components have been evaluated for their impact on safety-related SSCs following a safe shutdown earthquake (SSE).

b. The cranes and hoists listed in FSAR Tier 2, Table 3.2.2-1 are classified as Seismic Category II. In addition to not failing structurally, such that safety related equipment would not be degraded, the applicant is requested to verify that these components will continue to hold their maximum load (not drop the load) during an SSE. The applicant needs to revise the FSAR to clarify the ability of this equipment to hold its maximum load during an (SSE).

c. Component FCD30 and FCB30 in FSAR Tier 2, Table 3.2.2-1 use the acronym CCU. The staff could not find the meaning of this acronym. Provide the meaning of this acronym.

09.01.04-2

Guidelines specified in SRP Section 9.1.4, "Light Load Handling System Related to Refueling," Revision 3, state that the design layout showing the functional geometric layout of the fuel handling areas is reviewed for whether the various handling operations can be performed safely. SRP Section 9.1.4 also states that the LLHS physical arrangement for stored fuel and fuel handling areas are to be sufficiently described. Figures showing overall system arrangement, including reactor cavity, the core internal storage area, the reactor building transfer compartment, fuel transfer tube facility, the spent fuel pool transfer pit, the spent fuel pool loading pit, spent fuel pool, and the new fuel storage area, refueling canal have not been provided. The applicant needs to provide a figure(s) for the FSAR Section 9.1.4 that supplies the above listed information.

09.01.04-3

Acceptance criteria for meeting the relevant requirements of GDC 61 and GDC 62 are based on meeting the guidelines of American National Standards Institute/American Nuclear Society (ANSI/ANS)-57.1-1992; R1998; R2005 (R=Reaffirmed), “Design Requirements for Light Water Reactor Fuel Handling Systems.” Table 1 in ANSI/ANS-57.1 provides interlock protection requirements for each component of the Fuel Handling System (FHS).

The staff finds that the description of the interlocks in the application do not account for all the interlocks specified in Table 1 of ANSI/ANS 57.1. Therefore, the applicant needs to describe in the FSAR how each required interlock specified in Table 1 of ANSI/ANS 57.1 is applied for each of the FHS components listed in Table 1. Provide FSAR markup showing the above requested information.

09.01.04-4

GDC 62 requires criticality in the fuel storage and handling system be prevented by physical systems or processes, preferably by use of geometrically safe configuration. The applicant has stated in FSAR Tier 2, Section 9.1.4.2.2, “Component Description,” that the new fuel elevator (NFE) is used to lower new fuel assemblies to the bottom of the spent fuel pool for handling by the spent fuel machine. The applicant is requested to explain the design and operation of the NFE such that, in accordance with GDC 62, inadvertent critically is prevented when handling new fuel assemblies. The explanation needs to include the maximum number of fuel assemblies that can be placed in the NFE at any one time.

09.01.04-5

Guidelines specified in SRP Section 9.1.4, “Light Load Handling System Related to Refueling,” Revision 3, state 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.

The applicant stated that the spent fuel cask transfer facility has safety related components and safety related functions and that single failure criterion are applied to the components of the facility performing safety functions. The applicant did not specify and describe safety related components and functions of the spent fuel cask transfer facility, thus the staff can not evaluate the spent fuel cask transfer facility.

In order to complete our review the staff requires the following information:

a. Identify the safety related components and the non safety related components of the spent fuel cask transfer facility,
b. Describe the safety function of each safety related component,
c. Explain the compliance to the single failure criterion,
d. Describe the emergency cooling and the need for emergency cooling of the spent fuel casks,
e. Explain the function of the internal and external interlocks and including the prevention of unsafe operation by the interlocks.

This information should be in the FSAR.

09.01.04-6

In FSAR Tier 2, Section 9.1.4.1, “Design Basis,” the applicant states that the spent fuel cask transfer facility is Seismic Category I and safety related. However, FSAR Tier 2 Table 3.2.2-1 “Classification Summary,” lists neither the spent fuel cask transfer facility nor its components. Table 3.2.2-1 needs to be revised to include these components.

09.01.04-7

Figure 3.8-52- Fuel Building Plan Section C-C, shows the Loading Hall approximately 32 feet below the bottom of the Loading Pit and approximately 17 feet below the bottom of the Spent Fuel Pool (SFP). There is apparently a possible path to drain the SFP to a level of approximately 18 feet above the bottom of the SFP from the pool to the Loading Pit and out to the Loading Hall. The gates between the SFP and the Loading Pit and the connection at the bottom of the Loading Pit are the barriers to prevent draining the SFP.

a. Provide sketches and a description of the seal at the bottom of the cask loading pit. Assuming a single failure of the seal, provide the methodology by which the draining of the SFP is prevented.
b. When the shipping cask is connected to the bottom of the cask loading pit, assuming a single failure of the seal, provide the methodology for preventing draining of the SFP. Provide sketches.
c. Define the design criteria of the gates between the SFP and the Loading Pit. Describe the seals of the gates. Provide sketches to describe the design. Explain whether failure of a gate will jeopardize water inventory in the SFP either during normal operations or during operation of the spent fuel cask transfer facility.
d. With the 3 seals between the SFP and the Loading Hall, [i.e. the two gates between the SFP and the Loading Pit; and the seal at the bottom of the Loading Pit (either the seal with the spent fuel cask or the seal without the spent fuel cask), confirm that operator error at any time during the fuel handling procedures will not result in the loss of water in the SFP. Explain.

The information should be in the FSAR.

09.01.04-8

The spent fuel machine (SFM) transports spent fuel assemblies over and above the spent fuel racks. If the raised fuel assembly was too close to the surface of the spent fuel pool (SFP), excessive radiation levels on the fuel handling floor might occur. GDC 61 requires the avoidance of excessive personnel radiation exposure. Therefore, the applicant should explain the operating interlocks for the SFM, which ensures a spent fuel assembly is not raised above a specified level in the SFP, such that radiation levels in the fuel building are as low as reasonably achievable (ALARA).

The information should be in the FSAR.

09.01.04-9

General Design Criteria (GDC) 62 required provisions to prevent criticality in spent fuel storage. The reactor cavity, the core internal storage compartment, and the reactor building pool transfer compartment are flooded with borated water during refueling operations so that spent fuel assemblies are handled with shielding and criticality prevention. The applicant states in FSAR Tier 2, Section 9.1.4.2.1 that "The boric acid concentration in the water is sufficient to preclude criticality." The applicant has stated in FSAR Tier 2, Section 9.1.4.2.1 under "Spent Fuel Storage and Activities During Plant Normal Operation," that a step in the procedure is "Verification of SFP boron concentration to maintain subcriticality of the fuel assemblies." The applicant has stated in FSAR Tier 2 Section 9.1.4.3 that the fuel handling systems is designed to maintain geometrically safe configurations in the fuel storage areas to prevent inadvertent criticality and that for defense in depth, additional margin to prevent criticality is provided by the borated water. These sections of the FSAR provide conflicting statements with respect to the need for borated water to prevent criticality. Explain if borated water is required to prevent criticality during refueling operations or is provided only for defense in depth and to make the FSAR consistent.

09.01.04-10

(Intentionally deleted)

09.01.04-11

10 CFR 52.47(b) (1), which requires that a design certification (DC) application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC regulations.

Safety related functions should be described in the FSAR Tier 1, Section 2.2.8,"Fuel Handling System" and Table 2.2.8-2, " FHS Inspections, Test, and Analysis and Acceptance Criteria." (ITAAC).

Justify the exclusion of ITAAC for the safety related systems, structures, and components and safety related functions, that include the fuel tube transfer facility (FTTF) and the spent fuel transfer facility.

09.01.04-12

The staff notes that FSAR Tier 1 Section 4.5, “Fuel Handling System,” describes various design requirements for the fuel storage racks and interface requirements for Tier 2, Section 9.1.2, “New and Spent Fuel Storage,” but does not discuss interfaces with Tier 2 Section 9.1.4, “Fuel Handling System.” Justify designating FSAR Tier 1 Section 4.5 as an interface requirements for the “Fuel Handling System” and not the “New and Spent Fuel Storage”.

09.01.04-13

The applicant stated in FSAR Tier 2 Section 9.1.4.2.2 that one of the main components of the Spent Fuel Cask Transfer Facility is fluid circuits. The staff does not know the meaning of the term “fluid circuits” in this application. Explain the meaning of the term “fluid circuits” in the FSAR. Furthermore, the applicable components of the Spent Fuel Cask Transfer Facility referred to as "fluid circuits" should be listed in FSAR Tier 2, Table 3.2.2-1.

09.02.01-25

Flooding isolation of the Essential Service Water System (ESWS) pumps is discussed in two sections of the Final Safety Analysis Report (FSAR) (see below); however, Tier 2, Section 9.2.1 makes no mention of this important feature to mitigate a flood in the Safeguards Building (SB) or Fuel Building (FB). Provide a detailed discussion in the appropriate sections of 9.2.1 related to the flood signals and ESWS isolation. Clarify how the logic will isolate each division of ESWS pumps (or all ESWS pumps) and clarify if any pump receives a lockout from starting. Provide schematic diagrams showing all inputs (i.e., logic inputs , sensor inputs, all variables, actuation logic, binary limitation signals), with input types (i.e., hardwired, fiber, type of isolation used), ESWS circuit components, and all ESWS control signal outputs of the ESWS control system. The schematic provided should be of the type provided by Figure RAI 19-1, page 5, and Figure RAI 19-2, page 6, in “Response to Second Request for Additional information”, Attachment A, ANP-10284Q2P, dated June 13, 2008. In addition, describe operator actions that are required and justify the non-safety-related classification for the ESWS flooding isolation logic.

From Tier 2 FSAR 19.1.5.2.2.5

“Floods caused by a break in a system with very large flooding potential (ESWS or DWS) are assumed to be contained below ground level of the affected buildings (SB or FB). This is a reasonable assumption since those systems are automatically isolated if the building sump detects a large flooding event. Moreover, expansive time is needed to flood a building up to ground level, so operator isolation is likely to succeed if automatic isolation failed.”

From Tier 2 FSAR 3.4.3.4

"Relevant component and system piping failures considered in the analysis for this elevation include failures in the essential service water system (ESWS) and component cooling water system (CCWS) heat exchangers, leaks in the emergency feedwater system, leaks in the CCWS, and pipe failure in the fire water distribution system.

A postulated pipe break or erroneous valve alignment in the ESWS has the potential to impact more than one division. The ESWS piping penetrates the SBs at elevation -14 feet, 9-1/4 inches and is routed to the CCWS heat exchangers at elevation +0 feet. The worst case scenario assumed in the analysis is an erroneous valve alignment where the CCW heat exchanger is left open after plant maintenance, resulting in the entire cross section of the associated ESW line releasing water at elevation +0 feet. To cope with nonclosure of the heat exchanger or a large break in the ESWS piping, the pump must be stopped and the isolation valve in the discharge line of the affected ESWS train must be closed to limit the flooding volume in the affected SB.

Non safety-related detection and isolation signals are provided in the nuclear island drain and vent system in each SB to isolate the ESWS. The alarm that actuates the isolation is above the floor level so only large flooding events can activate the alarm. Two level sensors in a one-out-of-two logic activate the alarm. If a level instrument fails that sensor is not considered for the voting, and the signal is activated when one sensor alarms."

09.05.06-1

FSAR Tier 2, Table 3.2.2-1, "Classification Summary," lists the components of the diesel generator starting air system (DGSAS) as safety related, Quality Group C, and seismic Category I from the receiver inlet check valves to the engine. The DGSAS from the air compressors to the inlet check valves is non safety related, Quality Group E, and non seismic (NSC). FSAR Tier 2, Table 3.2.2-1 conflicts with FSAR Tier 2 Figure 9.5.6-1, "Emergency Diesel Generator Starting Air System," which shows the Quality Group C to Quality Group E break at the inlet of the isolation valves to the receiver inlet check valves. Provide consistency between FSAR
Tier 2, Table 3.2.2-1 and FSAR Tier 2 Figure 9.5.6-1.

09.05.06-2

Regulatory Guide 1.29, "Seismic Design Classification," states that those portions of structures, systems, and components (SSCs) of which continued function is not required but of which failure could reduce the functioning of the Class 1E electrical systems, including the auxiliary systems for the onsite electric power supplies to an unacceptable safety level, should be designed and constructed so that the safe shutdown earthquake (SSE) would not cause such failure.

The applicant did not state that the non seismic Category I SSCs both in the DGSAS and in surrounding SSCs will either have no effect on the safety related functions of the DGSAS after an SSE or are designed to withstand SSE seismic loads, without incurring a structural failure that could reduce the safety related functions of the DGSAS.

Provide a description of the effects of non seismic Category I SSCs in the DGSAS and other non seismic Category I SSCs upon the safety related SSCs in the DGSAS during an SSE. The FSAR should be changed to reflect this information.

09.05.06-3

The four DGSAS are situated in two emergency power generation building (EPGB). The applicant did not provide in FSAR Tier 2, Section 9.5.6, “Diesel Generator Starting Air,” a description of the protection methodology for for the prevention of an internally generated missle adversely affecting more than one DGSAS. Additionally, the applicant stated that there are no high energy lines in the EBGB; however, the applicant did not state that the DGSAS are protected from moderate energy line breaks. Since the applicant did not state that an internal missile could not damage more that one DGSAS, and the applicant did not state that each DGSAS could withstand the effects of any moderate energy line break in the area, the applicant did not demonstrate that the application meets the requirements of GDC 4.

a. Provide and justify a statement in the DCD (FSAR Tier 2, Section 9.5.6) that an internally generated missile will not disable more that one DGSAS.
b. Provide the effects of a moderate line break upon the DGSAS.

The FSAR should be changed to reflect this information.

09.05.06-4

Guidelines in SRP Section 9.5.6 state that part of meeting the requirements of GDC-17 is meeting the recommendations of NUREG/CR 0660, “Enhancement of On-Site Emergency Diesel Generator Reliability.” NUREG/CR 0660 provides several recommendations related to starting air and states that moisture removal by air driers of the desiccant type and refrigerated type are the most effective.

The applicant needs to specify the type of air driers used in the DGSAS and how it meets the recommendations of NUREG/CR 0660. The FSAR should be changed to reflect this information.

09.05.06-5

FSAR Tier 2, Chapter 16, Technical Specification 3.8.3, “Diesel Fuel Oil, Lube Oil, and Starting Air,” provide limiting conditions of operation and surveillance requirements related to EDG starting air. Surveillance Requirement 3.8.3.4 requires the pressure of each EDG air start receiver to be ≥ 3100 kPa (≥ 435 psig). Paragraph E.1 of the bases for this requirement (B 3.8.3) states that sufficient air capacity for 5 consecutive starts is not available with receiver pressure < 3100 kPa (< 435 psig), but that at least one start attempt is available with pressure > 1618 kPa (> 220 psig) and that the EDG can be considered operable as long as the pressure is restored from > 1618 kPa (> 220 psig) to > 3100 kPa (> 435 psig) within the next 48 hours.

a. Noting that the diesel engines are yet to be purchased, provide the methodology for calculating the the air quantities specified in the Technical Specifications.

b. In meeting the guidelines of SRP Section 9.5.6 II.4.C regarding the DGSAS being capable of cranking a cold diesel engine five times without recharging the receivers, provide the above described information in FSAR Tier 2, Section 9.5.6.

09.05.06-6

FSAR Tier 2 Chapter 14.2 (Test #106) tests the EDG auxiliaries, including DGSAS. This testing is comprehensive including demonstrating operation of starting air receiver volume for 5-consecutive starts, starting air compressors, starting-air pneumatic controls, and starting-air alarms, interlocks, and automatic operations. The acceptance criteria require DGSAS performance to conform to the details of FSAR Tier 2, Section 9.5.6. The staff notes that this testing does not specifically identify testing of a single EDG start from 1618 kPa (220 psig) receiver pressure.

Since a single EDG start from 1618 kPa (220 psig) receiver pressure is the basis for operability as specified in Technical Specification 3.8.3, “Diesel Fuel Oil, Lube Oil, and Starting Air,” testing to confirm the validity of the value should be included in Test # 106. Justify not including in Test 106 the testing for the single start capability when air receiver pressure is 1618 kPa (220 psig).

09.05.06-7

10 CFR 52.47(b) (1) requires that a DC application contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the ITAAC are performed and the acceptance criteria met, a plant that incorporates the design certification has been constructed and will be operated in conformity with the design certification, the provisions of the Act, and the Commission’s rules and regulations.

Additionally, SRP Section 14.3, “Inspection, Tests, Analyses, and Acceptance Criteria,” specify that Tier 1 information include a certified design description and figures. Figures are to be provided for most systems, with the amount of information depicted based on the safety significance of the SSCs. The figures are intended to depict the functional arrangement of the significant SSCs of the standard design.

FSAR Tier 1, Section 2.5.4, “Emergency Diesel Generator,” describes certified design material and Inspection, Tests, Analyses, and Acceptance Criteria (ITAAC) for the EDG. The ITAAC for the DGSAS includes verifying that the starting air receivers are in place and designed and tested to ASME Code Section III and have specifications. Also an ITAAC exists for the DGSAS to start the EDG five consecutive times without recharging respective starting receivers between EDG starts.

Other than the air receivers, certified design material and ITAAC do not exist for other safety related and seismic Category I SSC of the DGSAS, such as valves, pipe, filters, instrumentation and alarms. FSAR Tier 1, Section 2.5.4 does not have a figure showing the functional arrangement of the significant SSCs of the standard design.

The applicant needs to provide additional certified design material and ITAAC for the other safety related SSCs and safety related functions of the DGSAS, including a figure showing functional arrangement of significant SSCs.

09.05.06-8

The applicant stated in FSAR Section 9.5.6.3.2, “Abnormal Operation,” that a failure that will jeopardize continued operation will activate a trip signal. The applicant did not identify the failures that jeopardize continued operation; therefore, the staff requests that the applicant identify in the FSAR the failures that activate a trip signal.