Draft

Request for Additional Information No. 109 (1523, 1524, 1525, 1128, 1129, 1419), Revision 0

10/20/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.04.01 - Internal Flood Protection for Onsite Equipment Failures
SRP Section: 03.05.01.01 - Internally Generated Missiles (Outside Containment)
SRP Section: 03.05.01.02 - Internally Generated Missiles (Inside Containment)
SRP Section: 03.05.01.03 - Turbine Missiles
Application Section: FSAR Ch. 3

QUESTIONS for Balance of Plant Branch 2 (ESBWR/ABWR) (SBPB)
QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

03.04.01-1

FSAR Section 3.4.3.3 states that all the safety-related SSCs are located above the flood level. If safety-related SSCs must be located below the flood level, these SSCs are either qualified for submerged operation or justification be provided for admissibility.

The staff finds that the above statement does not recognize the need for the staff review of the operability of submerged SSCs. In accordance with SRP Section 3.4.1, Review Procedure No. 5, the safety-related SSCs being located below the flood level should be identified in the FSAR, and the qualification program should be described in the FSAR for the staff review. Exceptions, if any, should be justified in the FSAR.

Clarify whether the U.S. EPR flood protection design intends to include the option of submerged SSCs operation in the design certification stage or in the COL application stage. If it is in the DC stage, provide the above information in the FSAR for the DC. However, if it is in the COL stage, identify a COL information item that requires the applicant provide the above information, if the applicant will locate safety-related SSCs below the flood level. Without an adequate staff review, the option of submerged SSCs operation is not acceptable.

03.04.01-2

The staff reviewed the flood protection in EPGBs, which house the emergency diesel generators, fuel oil storage, and the associated Class 1E electrical equipment. FSAR Tier 2, Section 3.4.3.8, EPGB Flooding Analysis, states that postulated pipe breaks in water-carrying systems were considered in the flood analysis for the maximum flood level determination. The staff requests the applicant to clarify in the FSAR what are the “water-carrying systems” being considered for breaks; which system is the bounding one; what the value of maximum flood level is; and what are the elevations for the SSCs subject to the flood protection. Provide the calculation with all the assumptions for the maximum flood level in the EPGBs.

03.04.01-3

The main control room (MCR), and remote shutdown station (RSS) are located in the safeguard buildings (SB). FSAR Section 3.4.3.4 addresses the flood protection for the MCR and RSS, the applicant indicated that potential flooding water from upper level can be directed through multiple openings, and flow paths to lower building level. In addition, the FSAR discussed the line isolation, leak detection, alarms, and drains for the flood protection. However, it is not clear whether there is a watertight door to protect the MCR and RSS from the external water source. The FSAR discussion does not distinguish the external water source from internal water source relative to the rooms and the flood protection for each. The applicant is requested to provide the following information to clarify the discussion of the flood protection for the MCR and RSS.

a. Clarify whether there are watertight doors being designed to prevent the external water sources entering into the MCR and RSS. If not, demonstrate the adequacy of the flood protection measures to protect the safety-related SSCs in the MCR and RSS. It should be noted that the flow paths may direct the flooding water into the MCR and RSS through doors.

b. The FSAR does not distinguish the source of water being external or internal relative to the rooms. Identify all the potential sources of flooding water inside MCR and RSS. Identify all the measures for the flood protection for the internal water sources.

c. Are the floor drains inside MCR and RSS the necessary equipment for the flood protection? If not, provide a flood analysis to show the flood level in the MCR and RSS and the location levels of all SSCs in the MCR and RSS. If yes, upgrade the floor drains in the MCR and RSS from being nonsafty-related to safety-related. Or justify the adequacy for being nonsafety-related. It should be noted that current FSAR treats the floor drain as non-safety-related equipment because it is not taking into account for any safety analysis.

03.05.01.01-1

a. GDC 4, in part, requires SSCs to be protected from internally generated missiles. Maintenance equipment that is not secured or removed from an area is a potential gravitational missile source. However, evaluation of internal missiles outside containment resulting from failures of plant equipment and components, and unsecured maintenance equipment has not been provided.

   Provide an assessment of potential gravitational missiles generated outside containment and discuss the measures provided to prevent the impact of a falling object on safety-related SSCs. Also, revise the FSAR Tier 2 Table 1.8.2, “U.S. EPR Combined License Information items,” to include a COL information item to establish/provide procedures which ensure that equipment, such as a hoist that is required during maintenance, be either removed or seismically restrained following maintenance to prevent it from becoming a missile. Include this information in the FSAR and provide a markup in your response.

b. To ensure that the EPR design minimizes potential missile generation, in FSAR Tier 2 Section 3.5.1.1.3 AREVA states that high energy fluid systems and components are designed

according to the requirements of the ASME BPV Code, Section III or VIII. ASME BPV Code, Section III specifies that valves with removable bonnets be the pressure seal-type or have bolted bonnets; therefore, valves that only have threaded connections between the body and bonnet are not used in high energy systems. The above statement is valid for Section III, Division 1, Class 1 components, however, Section III, Division 1, Class 2 Components allow threaded connections (NC-3266) and threaded bonnets on pressure relief valves with inlet connections NPS 2 and less (Section NC-3595.4 & ND-3595.4). In FSAR Tier 2 Table 3.2.2-1, AREVA shows Class 2 and 3 components located in high energy applications.

Clarify the above FSAR discrepancy on valve bonnet connection types allowed in high energy systems. Include this information in the FSAR and provide a markup in your response. This RAI also applies to systems inside containment. Include this information in the FSAR and provide a markup in your response.

c. GDC 4, in part, requires SSCs to be protected from internally generated missiles. FSAR Tier 2 Section 3.5.1.1.3 states that portable and temporary gas cylinders, as well as gas cylinders that are periodically replaced in safety-related areas, are built in compliance with the regulations for seamless steel cylinders, as required by the U.S. Department of Transportation. As discussed in NUREG/CR-3551, portable compressed gas cylinders pose a significant missile hazard if not properly controlled, secured or restrained. However, evaluation of internal missiles outside containment resulting from unsecured and non-seismically restrained compressed gas cylinders during a seismic event has not been provided.

   Provide an assessment of potential missiles generated outside containment resulting from unsecured and non-seismically restrained compressed gas cylinders during a seismic event and discuss the measures provided to prevent the impact of such missiles on safety-related SSCs. Also, revise the FSAR Tier 2 Table 1.8.2 to include a COL information item to establish/provide procedures which ensure that pressurized gas cylinders be either removed or seismically restrained during power operation to prevent them from becoming missiles. Include this information in the FSAR and provide a markup in your response.

d. GDC 4, in part, requires SSCs to be protected from internally generated missiles. Missiles resulting from piping failures have not been addressed. A guillotine break of a high energy line could cause the piping attachments to become missile sources. Provide a discussion regarding if a postulated guillotine break of a high-energy line outside containment could become a potential missile source, and discuss the measures provided to prevent the impact of such missiles on safety-related SSCs. Include this information in the FSAR and provide a markup in your response.

e. GDC 4, in part, requires SSCs to be protected from internally generated missiles. Acceptance, in part, is based on adequately identifying credible missile sources. FSAR Tier 2 Section 3.5.1.1.3 states missile generation from hydrogen gas sources are minimized by equipment placement, line routing and adequate ventilation. However, FSAR Tier 2 Table 3.2.2-1 indicates that hydrogen piping and components are non-safety related and non-seismic. Failure of these hydrogen piping and components during a seismic event could cause hydrogen to accumulate in area of stagnant air flow, explode and generate a missile.

Discuss the impact of hydrogen piping failures in the areas where the piping is routed for missile generation. Provide an evaluation to verify that no stagnant air pockets exist in areas that have hydrogen piping. Include this information in the FSAR and provide a markup in your response.

f. GDC 4, in part, requires SSCs to be protected from internally generated missiles. Where barriers are used to protect SSCs from internal missiles, the design is considered acceptable if it meets RG 1.115 Position C.3. Compliance to Position C.3 includes submittal of dimensioned plans and elevations that include wall and slab thickness and materials of pertinent structures. Provide drawings to show the above cited information. Include this information in the FSAR and provide a markup in your response.

g. Per Section II of SRP 3.5.1.1, regulation 10 CFR 52.47(b) (1) requires that a 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's regulations.

   FSAR Tier 2 Section 3.5.1.1 describes the Areva's approach to identify potential missiles, determine the statistical significance of potential missiles, and provide measures for SSCs requiring protection against the effects of missiles outside containment. However, Sections 2.1 - Structures, 2.2 – Nuclear Island Systems, 2.3 – Severe Accident Systems, 2.4 – Instructmentation and Control Systems, 2.5 – Electric Power, 2.6 – HVAC Systems, 2.7 – Support Systems , 2.8 – Steam and Power Conversion Systems, 2.9, - Radioactive Waste Management, and 2.10 – Other systems of the FSAR Tier 1 Chapter 2.0, "System based design Descriptions and ITAAC," do not contain design commitments or inspections, tests, analyses, and acceptance criteria to verify that SSCs outside containment are designed and constructed in accordance with the requirements as described in FSAR Tier 2 Section 3.5.1.1 to prevent or mitigate the effects of internally generated missiles outside containment.

   Therefore, provide an ITAAC that requires the COL applicant to perform a walk-down of the SSCs and to ensure that SSCs described in the above cited sections are protected from internally generated missiles (outside containment) in accordance with the requirements as described in FSAR Tier 2 Section 3.5.1.1. Also, identify which of the SSCs are outside and which of the SSCs are inside the containment. Include this information in the FSAR and provide a markup in your response.

03.05.01.02-1

a. GDC 4 requires that SSCs are protected from internally generated missiles. In FSAR Tier 2, Revision 1, Section 3.5.1.2.3 the applicant states, "Even though potential CRDM missiles are deemed non-credible as described in Section 3.5.1.2.2, the Closure Head Equipment (CHE) is designed to retain the CRDMs so that they are prevented from becoming a missile should the CRDM nozzle flange or pressure housing fail. Therefore, SSCs inside containment are designed to withstand a postulated CRDM missile, even though this event is deemed non-credible." Clarify in the FSAR if the in containment SSCs are capable of withstanding a CRDM missile impact.

b. In accordance with SRP Section 3.5.1.2, regulation 10 CFR 52.47(b) (1) requires that a 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's regulations.

   FSAR Tier 2, Revision 1, Section 3.5.1.2 describes the AREVA's approach to identify potential missiles, determine the statistical significance of potential missiles, and provide measures for SSCs requiring protection against the effects of missiles inside containment.

   However, FSAR Tier 1, Revision 1, Chapter 2.0, "System Based Design Description of ITAAC" does not contain design commitments or inspections, tests, analyses, and acceptance criteria to verify that SSCs inside containment are designed and constructed in accordance with the requirements as described in FSAR Tier 2, Revision 1, Section 3.5.1.2 to prevent or mitigate the effects of internally generated missiles inside containment.

   Therefore, provide an ITAAC that requires the COL applicant to perform a walk-down of the SSCs and to ensure that SSCs are protected from internally generated missiles (inside containment) in accordance with the requirements as described in FSAR Tier 2, Revision 1, Section 3.5.1.2. Include this information in the FSAR and provide a markup in your response.

03.05.01.03-2

The U.S. EPR FSAR, Tier 2 Section 3.5.1.3 states that all safety-related structures, except for two of the four essential service water buildings (ESWBs) and a portion of one of the four emergency power Generating buildings (EPGBs) are located outside of the low-trajectory missile strike zone, as defined in RG 1.115. Therefore, the U.S. EPR FSAR considers the turbine generator is favorably positioned, because most of the safety-related SSCs are located outside the low-trajectory missile strike zone. In addition, the supporting turbine missile analysis evaluates that the probability of a turbine missile being ejected will be less than 1×10^{-4}. Based on this information, provide the following to ensure that safety-related structures, systems and components are protected against missiles in accordance with GDC 4 of 10 CFR Part 50, Appendix A:

a. Discuss in detail how the turbine generator is favorably positioned when the ESWBs and the EPGBs are considered safety-related structures and systems (which are used to safely shutdown and maintain the reactor in a safe shutdown condition) and are located in the low-trajectory missile strike zone. Otherwise, the turbine generator should be considered in an unfavorable position in accordance with RG 1.115, and the probability of turbine failure resulting in ejection of turbine rotor fragments (P1) should be less than 1×10^{-5} in lieu of 1×10^{-4}.
b. It appears from Figure 2.1.2-1 in Tier 1 of the U.S. EPR FSAR that more than one EPGB may be within the low-trajectory missile strike zone. Which EPGB is located in the low-trajectory missile strike zone, and discuss why the other EPGBs are not considered in the low-trajectory missile strike zone.
c. Since ESWBs 3 and 4 are in the low-trajectory missile strike zone, discuss whether the reactor can be shutdown and maintained in a safe condition with ESWBs 1 and 2 only?

d. Since the switch-gear building (SWGB) is adjacent to the turbine building and in the low-trajectory missile strike zone, discuss how a turbine missile strike in the SWGB would affect safety-related components and systems (e.g., offsite power buses, etc.) that could prevent the reactor from being safely shutdown and maintained in a safe condition.

03.05.01.03-3

COL applicant information item No. 3.5-2 in Table 1.8-2 of the U.S. EPR FSAR, Tier 2 states that the COL applicant will confirm the evaluation of the probability of turbine missile generation. However, Section 3.5.1.3 of the U.S. EPR FSAR, Tier 2 does not provide a turbine missile analysis for the either turbine generator design specified in Section 10.2. 10 CFR 52.47 requires that the application for a design certification must contain a level of design information sufficient to enable the Commission to judge the applicant's proposed means of assuring that construction conforms to the design and to reach a final conclusion on all safety questions associated with the design before the certification is granted. Therefore, the staff can not make a final conclusion of the safety issues associated with the turbine design and the potential of generating turbine missiles without a turbine missile probability analysis. The staff requests that a bounding turbine missile analysis be provided in the U.S. EPR FSAR for each turbine design in order for the staff to reach a final conclusion, as required by 10 CFR 52.47, on the safety issues associated with the turbine design and the prevention of generating missiles that may affect safety-related structures, systems and components to ensure the requirements of GDC 4 of Appendix A to 10 CFR Part 50 are met.