## ArevaEPRDCPEm Resource

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**Subject:** Draft - U.S. EPR Design Certification Application RAI No. 163 (1809, 1763), FSAR Ch. 9
**Attachments:** Draft RAI_163_SBPA_1809_SBPB_1763.doc

Attached please find draft RAI No. 163 regarding your application for standard design certification of the U.S. EPR. If you have any question or need clarifications regarding this RAI, please let me know as soon as possible, I will have our technical Staff available to discuss them with you.

Please also review the RAI to ensure that we have not inadvertently included proprietary information. If there are any proprietary information, please let me know within the next ten days. If I do not hear from you within the next ten days, I will assume there are none and will make the draft RAI publicly available.

Thanks,
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Request for Additional Information No. 163 (1809, 1763), Revision 0

12/23/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
SRP Section: 09.03.03 - Equipment and Floor Drainage System

Application FSAR Ch. 9

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

09.02.02-1

General Design Criteria (GDC 2) requires structures, systems and components (SSCs) important to safety to be protected from natural phenomena such as seismic events. Although the seal water supply system (SEWSS) is non-safety related, it includes piping and components in Safeguards Building 4 (SB 4) and in the Fuel Building (FB), which contain safety-related equipment. The applicant states in Final Safety Analysis Report (FSAR) Tier 2 Section 9.2.7.1 that the SEWSS performs no safety-related functions and is classified as non-safety-related. Additionally, the FSAR states that the SEWSS is designated as non-seismic "excluding portions of the system located within the Safeguard Building (SB) 4 and the Fuel Building (FB)." However, the staff found that the system functional diagram (FSAR Tier 2 Figure 9.2.7-1) and FSAR Tier 2 Table 3.2.2-1, "Classification Summary," sheets 104 to 107, only identify non-seismic piping and components. It was also noted that the functional diagram was incorrectly referenced as FSAR Figure 9.2.12-1 in section 9.2.7.2.1, "General Description." Consequently, the FSAR needs to be revised to include the following information:

- Identify which SEWSS pipes and components are designated as seismic in FSAR Tier 2 Figure 9.2.7-1 and in Table 3.2.2-1 to be consistent with the description in FSAR Tier 2 Section 9.2.7.1.
- Provide the design basis for using seismically qualified pipe and components in the SEWSS and justify this design-basis consideration in FSAR Tier 2 Section 9.2.7.
- Correct FSAR Tier 2 Section 9.2.7.2.1, "General Description," to refer to Figure 9.2.7-1 as the flow diagram for SEWSS.

09.02.02-2

General Design Criteria (GDC) 60 requires nuclear power unit designs to include means to control the release of radioactive materials in gaseous and liquid effluents produced during normal reactor operation, including anticipated operational occurrences. Means must also be provided for monitoring effluent discharge paths and the plant environs for

radioactivity that may be released in accordance with GDC 64 requirements. Additionally, 10 CFR 52.47(a)(6) and 10 CFR 20.1406 require applicants for standard plant design certifications to describe how facility design and procedures for operation will minimize contamination of the facility and the environment. In order for the staff to confirm compliance with these requirements, the Final Safety Analysis Report (FSAR) needs to be revised to address the following considerations:

1. The regulatory bases of the seal water system (SEWSS) need to be explained, especially with respect to the above requirements and the role it plays in preventing the spread of radioactive materials. FSAR Tier 2 Section 9.2.7 needs to justify satisfying the above regulations by the system design. Note that Regulatory Guide 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," provides guidance that may be used for addressing the requirements specified by 10 CFR 20.1406. Revise other sections of the Final Safety Analysis Report (FSAR) as appropriate to reflect this information, such as Tier 2 Section 3.1.6, "Criterion 60 – Control of Releases of Radioactive Materials to the Environment."

2. Justify providing SEWSS to pump seals (e.g., provide seal cooling, prevent leakage of radioactive fluid, prevent air in-leakage).

3. Identify any equipment that has continuous seal water leakoff flow, and described the potential for this flow to be contaminated and the prevention of the release of radioactive material by the design.

4. Describe the prevention of the intrusion of radioactive process system water into individual seal water supply lines since system check valves are not shown in the seal water supply to each component in FSAR Tier 2 Figure 9.2.7-1.

5. Describe the capability of the design to detect contamination of the SEWSS and to monitor the release of radioactive material from the SEWSS.

6. Justify the satisfaction of the requirements specified by 10 CFR 20.1406, "Minimization of Contamination by the SEWSS design."

7. Describe the consequences of a loss of SEWSS..

09.02.02-3

The seal water supply system (SEWSS) description in the Final Safety Analysis Report (FSAR) Tier 2 Section 9.2.7.2.1 and the Piping and Instrumentation Diagrams (P&IDs) are inadequate and the FSAR needs to be revised accordingly. The application states that the discharge lines of the pumps combine into a common header which distributes the seal water to the various users in the Nuclear Auxiliary Building (NAB), Radioactive Waste Processing Building (RWB), Safeguards Buildings (SBs) 1 and 4, and Fuel Building (FB) through piping, isolation valves, check valves, and buffer tanks. However, FSAR Figure 9.2.7-1 (the P&ID for the SEWSS) does not show any SEWSS piping and components in SB 1 as stated in the FSAR.

09.02.02-4

The seal water supply system (SEWSS) description in the Final Safety Analysis Report (FSAR) Tier 2 Section 9.2.7.2 and the Piping and Instrumentation Diagrams (P&IDs) are inaccurate and the FSAR needs to be revised accordingly. In particular, Section 9.2.7.2.2 indicates that the buffer tanks provide a stored volume of seal water to supply the "system users" at sufficient pressure during loss of offsite power (LOOP) conditions. Each buffer tank has a nitrogen gas cushion of sufficient pressure to provide the required seal pressure for any seal water level in the tank. Each buffer tank is protected from excessive nitrogen pressure by a safety valve in the nitrogen supply line. Further in FSAR Section 9.2.7.3.1, "System Operation," states that the valves downstream of the solenoid valves are adjusted and locked in the proper throttled position. Based on a review of FSAR Tier 2 Figure 9.2.7-1 (the SEWSS P&ID), the FSAR needs to be revised to address the following considerations with respect to the buffer tanks:

1. The description in FSAR Section 9.2.7.2.2 implies that the seal water system as a whole can be supplied by the buffer tanks on a LOOP. However, it appears that only a small number of loads are actually supplied by SEWSS during a LOOP, including the chemical and volume control system pump seals in the fuel building (FB) and the Severe Accident Heat Removal pump seals in safeguards building (SB) 4.

2. The safety valves that are described in FSAR Tier 2 Section 9.2.7.2.2, "Buffer Tanks," are not shown on Figure 9.2.7-1.

3. Figure 9.2.7-1 shows a valve downstream of the solenoid operated isolation valve that could be locked in the "throttled position" for only one of the two buffer tanks. The purpose of this valve needs to be described, and an explanation is needed for why a valve is provided for only one of the buffer tanks.

4. A small seal pot is shown on Figure 9.2.7-1 in the level instrumentation for the buffer tank in SB 4 but not on the FB buffer tank. Describe the purpose of this device and explain providing it for only one of the buffer tanks.

5. Related to item 4 above, describe the purpose of the SB 4 buffer tank fill line bypass around the solenoid valve to the tank level instrumentation and confirm that it is not necessary on the FB buffer tank.

09.02.02-5

The seal water supply system (SEWSS) description in the Final Safety Analysis Report (FSAR) Tier 2 Section 9.2.7.3 and the Piping and Instrumentation Diagrams (P&IDs) are inaccurate and the FSAR needs to be revised. In particular, the staff found that the only Charging Pump seal water supply shown in FSAR Tier 2 Figure 9.2.7-1 (the SEWSS P&ID) was connected downstream of the FB buffer tank solenoid isolation valve. However, the description in FSAR section 9.2.7.3 for loss of offsite power (LOOP) indicates that the Charging pump supply from the buffer tank is "normally locked closed." Accordingly, the FSAR needs to be revised to address the following considerations as appropriate:

1. Since the buffer tanks are intended to provide a backup supply of seal water and charging pumps are continuously in service during normal plant operation, describe the

normal source and LOOP source of Charging Pump seal water in FSAR Section 9.2.7. This configuration should also be described in FSAR Tier 2 Section 9.3.4 for the chemical and volume control system (CVCS) pump seal water.

2. FSAR Tier 2 Section 9.2.7.6, “Instrumentation Requirements,” states “Seal water consumers receive an “off” command on low seal water header pressure.” It is not clear if this applies to all users including the CVCS pumps. Describe the basis for his feature and explain if this applies to the normal source of CVCS pump seal water (i.e. a CVCS pump is always in service during normal operation).

3. Describe in the FSAR the consequences if seal water is lost to a CVCS pump (pump seals fail, seal leakage, pump declared inoperable, etc.).

4. Describe in the FSAR the basis for the delay time to manually unlock the buffer tank (CVCS pump in an abnormal condition (e.g. LOOP)). Clarify this in the FSAR.

5. Describe in the FSAR the basis for the operating volume and nitrogen pressure for the buffer tanks.

09.02.02-6

In order to complete its evaluation of the seal water supply system (SEWSS), the staff found that Final Safety Analysis Report (FSAR) Tier 2 Section 9.2.7 needs to be revised to address the following items:

**a.** Describe the initiating signals for the pump automatic start described in FSAR Tier 2 Section 9.2.7.
**b.** Explain the presence of filters in the SEWSS flow path (Figure 9.2.7-1) for some components and not to others.
**c.** Justify the absence of differential pressure instrumentation (not shown on Figure 9.2.7-1).
**d.** The basis for the SEWSS pump trip on low demineralized water tank level needs to be explained.
**e.** The FSAR states that a reducing valve is provided to protect lower pressure downstream piping. Identify the piping this statement is referring to since it appears that all piping shown on Figure 9.2.7-1 has the same design pressure.

09.03.03-1

Please verify the consistencies of the following containment isolation penetration labels.
In FSAR Tier 2, Figure 9.3.3-1, Sheet 4, the bottom penetration on the figure, BQ012, which is isolated by Containment Isolation Valves AA005 and AA006, should be labeled as BQ-008 instead of BQ012 to be consistent with FSAR Tier 2, Table 6.2.4-1 (Sheet 12 of 18), for the BQ-008 and BQ-012 penetration information. Correct the inconsistencies, if any.

09.03.03-2

GDC 2 requires safety-related components to be protected against natural phenomena including earthquakes. The nuclear island drain and vent system (NIDVS) is considered non-safety related except for the containment isolation valves and piping.

SRP Section 9.3.3 Subsection III, Review Procedure 1.D states that if a failure of a portion of the system could affect safety-related structures, systems, or components (SSCs) adversely, it is safety-related and should meet GDC 2. The staff identified the following portions of the system that may be safety-related and subject to GDC 2 requirements:

1. sump pump level instrument in the safeguard building (SB) that provide isolation signal for SB essential service water system (ESWS) train.

   Because the NIDVS level sensors detect flooding and are credited for the thirty minute operator response to secure the source of flooding, a failure or malfunction in this portion of the system could adversely affect safety-related SSCs. A false high sump level could inadvertently render ESWS inoperable or a failure to detect a high level in the redundant level sensors could prevent the flood high level isolation of ESWS.

2. level instruments (in reactor building (RB), SB, and fuel building (FB) sumps) that are used to provide the main control room (MCR) flood alarms:

   These flood alarms notify the MCR operator to begin the operator action to isolate the line causing the flooding. The fire water line break defines the worst case flood analyses for the nuclear island (NI) buildings (RB, SB, and FB). It appears to the staff that a failure or malfunction in this portion of the system could adversely affect safety-related SSCs. A malfunction could prevent the flood level from remaining below the elevation assumed in the flood analysis.

Since the above components are credited to prevent flooding of safety-related equipment, the failure of the above components could adversely affect safety-related SSCs. Classify these components as being safety-related, or justify the nonsafety classification.

09.03.03-3

GDC 4 acceptance is based on the system being able to prevent flooding that could adversely affect structures, systems, and components (SSCs) important to safety. SRP Section 9.3.3 Subsection II, “Acceptance Criteria,” Technical Rationale Number 2 clarifies the acceptance of GDC 4 for the equipment and floor drain system (EFDS). It states that for the EFDS (i.e., NIDVS for EPR), the purpose of GDC 4 is to assure the capability to provide the required drainage capability to accommodate unanticipated flooding from pipe breaks, tank leaks, discharge from fire suppression systems, and other potential flooding sources. Therefore, the drainage capability of the NIDVS for the flood protection should be addressed in the FSAR for NIDVS to meet GDC 4 criterion.

FSAR Tier 2 Section 9.3.3.3, “Safety Evaluation,” states that the design of safety-related portions of the NIDVS satisfy GDC 4 withstanding the effects of the environmental conditions (e.g., flooding) as demonstrated by the design features described in the section. The staff reviewed the above statement and the design features described in FSAR Tier 2 Section 9.3.3.3, and found that the applicant has not completely addressed the compliance of GDC 4 in accordance with SRP Section 9.3.3. Specifically, the drainage capability is not addressed for NIDVS in FSAR Section 9.3.3 or Section 9.3.3.3.

The staff found that FSAR Section 3.4.1, “Internal Flood Protection,” states that the NIDVS is conservatively considered not available for reducing water volume by the respective sump pumps. The staff verified whether the application of the above assumption has been consistently applied in the flood analysis and the design of NIDVS. In FSAR Section 3.4.3.1, the applicant discussed all the assumptions for the internal flood analysis, but the staff could not verify that the unavailability of drain flow capability is one of the assumptions for the flood analysis. In reviewing flood protection for main control room (MCR), the staff questioned in RAI 04.03.02-3 (RAI ID# 1525) that there will be adequate flood protection without taking credit of the floor drains in the MCR. Furthermore, in FSAR Section 9.3.3 and Section 9.3.3.3, the staff could not confirm that the unavailability of drain flow capability for the flood protection is one of the design bases for the NIDVS or one of the bases for GDC 4 being satisfied by the NIDVS.

Based on the inconsistencies identified above, the applicant is requested to (1) clarify the drainage capability that is assumed in the flood analysis, and to substantiate the assumption by calculations for flood analysis, which are not available in the FSAR. (2) Add the assumption for the drainage capability into the list of assumptions in FSAR Section 3.4.3.1 for flood analysis. Furthermore, (3) revise FSAR Section 9.3.3/Section 9.3.3.3 to address GDC 4 compliance in accordance with SRP Section 9.3.3 regarding drainage capability**.**

09.03.03-4

GDC 4 requires safety-related components to be protected against environmental conditions such as flooding. The staff reviewed the NIDVS check valves that prevent backflow of flooding water through the drain system into areas of the plant containing safety-related equipment. NIDVS piping between the two divisions of the fuel building (FB) and between safeguard buildings SB-1, SB-2, SB-3, and SB-4 rely upon double check valves to prevent back flow. The NIDVS piping in the nuclear auxiliary building (NAB) connects to safety-related equipment areas of the FB and SB. Following the review procedures described in SRP Section 9.3.3 Subsection III.1, and RG 1.29, Regulatory Position C.2, the staff found that failure of these nonsafety-related piping and check valves could affect the flood protection of safety-related SSCs. Therefore, the safety significance of these piping and check valves may justify increased attention to their reliability and ability to function following a seismic event.

Discuss the ability of these nonsafety-related piping and check valves to function following a seismic event, and the requirements of testing and inspection of these components to ensure the reliability of these components to be able to perform their intended function.

09.03.03-5

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's regulations. The FSAR Tier 2, Section 9.33 describes the NIDVS to meet GDC 2, GDC 4, and GDC 60. SRP Section 9.3.3 Acceptance Criteria 4 asks the applicant to provide an ITAAC to verify the plant is built in accordance with the design certification. The staff reviewed the FSAR and could not find such an ITAAC

FSAR Tier 2, Table 14.3-8, ITAAC Screening Summary (Sheet 5 of 7) shows that the NIDVS is within the scope of Tier 1, but does not have an FSAR Tier 1 ITAAC. The NIDVS in Tier 1 identifies the system in the table of contents as Section 2.9.5, but there are no Tier 1 entries for the NIDVS. The applicant is requested to provide a design description and appropriate ITAAC table to verify the sizing and layout of the NIDVS to perform its essential functions.

09.03.03-6

In reviewing the potential blockage of the NIDVS in accordance with SRP Section 9.3.3, Review Procedure (III.1.B), the staff found that FSAR Section 5.2.5.4 states that periodic testing of the floor draining system will verify that it is free of blockage. This periodic testing is acceptable for addressing the potential blockage concern. However, FSAR Section 5.2.5.4 is for the floor drain for reactor coolant pressure boundary (RCPB) leakage detection only. The staff can not find a similar periodic testing for the other floor drains. The applicant is requested to address in FSAR Section 9.3.3 the potential blockage and periodic testing of all the floor drains in the NIDVS.