March 10, 2009
NRC:09:020

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Response to U.S. EPR Design Certification Application RAI No. 164, Supplement 1

Ref. 1: E-mail, Getachew Tesfaye (NRC) to Ronda Pederson, et al (AREVA NP Inc.), "U.S. EPR Design Certification Application RAI No. 164 (1727), FSAR Ch. 12," January 09, 2009 (Accession No. ML090090781).

Ref. 2: E-mail, Ronda M. Pederson (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 164 (1727), FSARCh. 12," January 23, 2009 (Accession No. ML090230274).

In Reference 1, the NRC provided a request for additional information (RAI) regarding the U.S. EPR design certification application (i.e., RAI No. 164). In Reference 2, AREVA NP indicated that the response to the one question (12.03-12.04-8) would be provided by March 10, 2009. Accordingly, a technically correct and complete response to RAI No. 164, Supplement 1, Question 12.03-12.04-8 is enclosed with this letter.

The following table indicates the respective pages in the enclosure that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 164—12.03-12.04-8	2	10

Also enclosed are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 164, Supplement 1, Question 12.03-12.04-8.

AREVA NP considers some of the material contained in the enclosure to be proprietary. As required by 10 CFR 2.390(b), an affidavit is enclosed to support the withholding of the information from public disclosure. Proprietary and non-proprietary versions of the enclosure to this letter are provided.

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The enclosed response also contains security-related sensitive information that should be withheld from public disclosure in accordance with 10 CFR 2.390. A public version is also provided with the security-related sensitive information redacted.

Sincerely,

Ronda M Pederson for

Sandra M. Sloan, Manager
New Plants Regulatory Affairs
AREVA NP Inc.

Enclosures

cc: G. Tesfaye
Docket No. 52-020

AFFIDAVIT

COMMONWEALTH OF VIRGINIA)
) ss.
CITY OF LYNCHBURG)

1. My name is Ronda M. Pederson. I am Licensing Manager, U.S. EPR Design Certification, Regulatory Affairs for New Plants, for AREVA NP Inc. and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by AREVA NP to determine whether certain AREVA NP information is proprietary. I am familiar with the policies established by AREVA NP to ensure the proper application of these criteria.

3. I am familiar with the AREVA NP information contained in the letter, "Response to Request for Additional Information No. 164, Supplement 1," NRC:09:020 and referred to herein as "Document." Information contained in this Document has been classified by AREVA NP as proprietary in accordance with the policies established by AREVA NP for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA NP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is

requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information".

6. The following criteria are customarily applied by AREVA NP to determine whether information should be classified as proprietary:

(a) The information reveals details of AREVA NP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA NP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA NP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by AREVA NP, would be helpful to competitors to AREVA NP, and would likely cause substantial harm to the competitive position of AREVA NP.

The information in the Document is considered proprietary for the reasons set forth in paragraphs 6(b) and 6(c) above.

7. In accordance with AREVA NP's policies governing the protection and control of information, proprietary information contained in this Document has been made available, on a limited basis, to others outside AREVA NP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA NP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

Ronda M Pederson

SUBSCRIBED before me this 10th

day of March 2009.

S McFadden

Sherry L. McFaden
NOTARY PUBLIC, COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES: 10/31/2010
Registration # 7079129

SHERRY L. MCFADEN
Notary Public
Commonwealth of Virginia
7079129
My Commission Expires Oct 31, 2010

Response to

Request for Additional Information No. 164, Supplement 1

01/09/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 12.03-12.04 - Radiation Protection Design Features
Application Section: 12.3, Radiation Protection Design Features

QUESTIONS for Health Physics Branch (CHPB)

Question 12.03-12.04-8:

1. RG 1.206, Part C.I.12.1.2, Design Considerations, states that the applicant should address the detailed facility design features for radiation protection to ensure that occupational radiation exposures will be ALARA, in accordance with the requirements of 10 CFR 20.1101(b).

   a. The EPR FSAR Tier 2, Section 12.1.2.3.1, Material Selection, discusses the minimization of cobalt-containing alloys for parts that make up the primary system. However, in addition to cobalt, experience has shown that the presence of antimony (Sb-124 and Sb-125) in Reactor Coolant Pump (RCP) journal bearings has in some current generation plants resulted in an increased number of hot particles at these plants.

      Discuss whether, or to what extent, antimony will be present in the EPR design, particularly Reactor Coolant Pump journal bearings.

   b. EPR FSAR Section 12.3.1.9.2, Equipment Design Features, describes features that result in the reduction of personnel radiation exposure. For the EPR Steam Generators, Section 12.3.1.9.2 states:

      "...numerous features have been incorporated to improve reliability and minimize maintenance worker occupancy times when special maintenance is necessary. An example of one such improvement is the material selection of low cobolt content alloys..."

      However, the "numerous features" mentioned in Section 12.3.1.9.2 are not described anywhere in chapter 12. Provide more information and examples to support the claim that the EPR Steam Generator design has improved reliability and minimizes worker occupancy times.

   c. The EPR FSAR Section 11.4.1.2.4 "Controlled Releases," states that the radioactive concentrates processing system receives evaporator concentrates and sludge generated in the liquid waste processing and storage system as well as spent resins generated in the coolant purification system and the liquid waste processing system.

      It is not clear to what extent the guidance provided in RG 8.8 (Regulatory Position 2.h) was applied to the EPR piping design for systems that transport, store, or process resins or slurries. Discuss to what extent the RG 8.8 design features for resin and sludge treatment systems were incorporated into the EPR design, or justify why not. If piping were to become plugged, discuss any design features which will allow for unplugging the piping while maintaining dose to workers ALARA.

   d. Compliance with GDC 61 requires that the occupational radiation protection aspects of fuel storage, handling, radioactive waste and other systems that may contain radioactivity be designed with suitable shielding as well as appropriate containment and filtering systems such that adequate safety is assured during normal and postulated accident conditions.

RG 1.206, Part C.I.12.3.1, Facility Design Features, states that the applicant should provide scaled layout and arrangement drawings of the facility with radiation zone designations and boundaries for normal operations, refueling outages, and postaccident conditions. However the EPR FSAR, Section 12.3 does not provide containment layout drawings with radiation zone designations for refueling, specifically, radiation zones for some areas within containment that would be occupied during outages. Therefore in accordance with the guidance in RG 1.206 and the requirements of GDC 61, provide the following in the FSAR:

i) EPR FSAR Tier 2, Figure 12.3-8, "Containment Building Section Looking Plant-West at the reactor Cavity, Core Internals Storage, Instrument Lance Storage, and Spreading Area," shows areas (on the left side of the drawing) inside containment that personnel may access. Provide radiation zones for these areas during refueling when the instrument lances would be located in the instrument lance storage area.

2. Personnel access to radiological vital areas under accident conditions should be demonstrated in accordance with 10 CFR 50.34(f)(2)(vii), using the methods listed in Section II.B.2 of NUREG-0737. Section II.B.2 of NUREG-0737 provides a dose rate criteria for vital areas requiring continuous occupancy (such as the Main Control Room or MCR) of less than 15 mrem/hr (averaged over 30 days).

   EPR FSAR Tier 2, Table 12.3-12, U.S. Estimated Accident Mission Dose, provides a total dose per person for the "MCR, TSC and nearby stations" of 4.0 rem, accumulated over 30 days post-LOCA. However, dose rate is not specified. Provide information on the dose rate as a function of time for the MCR, TSC and nearby stations for the design basis accident which results in the highest dose for the MCR.

Response to Question 12.03-12.04-8:

1.a The specifications for the U.S. EPR reactor coolant pumps require that the steel used for the pumps' journal bearings have only trace amounts of antimony, and that no antimony shall be intentionally added to the steel during manufacturing. Furthermore, the guidelines for U.S. EPR material selection require that all materials that come in contact with reactor coolant shall have only trace amounts of antimony.

U.S. EPR FSAR, Tier 2, Section 12.1.2.3.1, "Material Selection," will be changed to address the NRC questions over antimony levels by adding the following to the end of the section:

"The presence of antimony in reactor coolant pump journal bearings of some operating reactors has resulted in an increased number of hot particles in these plants. In order to prevent hot particles from being created, the carbon portion of the reactor coolant pump journal bearings, which comes into contact with reactor coolant, has no antimony, as specified in U.S. EPR FSAR, Tier 2, Section 5.2.3.1. In addition, other austenitic stainless steel components that come into contact with reactor coolant will have no added antimony and the trace antimony content will be restricted as specified in Section 5.2.3.1."

In addition to the above change, U.S. EPR FSAR, Tier 2 Section 5.2.3.1, "Material Specifications," will be revised as follows to be consistent with U.S. EPR FSAR, Tier 2, Section 12.1.2.3.1:

"When supplementary chemical analysis is performed, which would be more complete than the analysis used to check the content of the specific elements, the results will show that the sample contains no more than residual antimony. In addition, the carbon portion of the reactor coolant pump journal bearing will have no antimony."

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 12.1.2.3.1 and Section 5.2.3.1 will be revised as described in the response and indicated on the enclosed markup.

Response to Question 12.03-12.04-8:

1.b Additional information indicating that the U.S. EPR steam generator design incorporates improved reliability and minimizes worker occupancy times is as follows:

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Response to Question 12.03-12.04-8, Question 1, Part C:

1.c As indicated in U.S. EPR FSAR, Tier 2, Table 1.9.2, AREVA NP has committed to RG 8.8. Therefore, the systems that transport, store, or process resins or slurries will conform to regulatory position 2.h of RG 8.8.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Response to Question 12.03-12.04-8, Question 1, Part D:

1.d Table 12.03-12.04-8-1 shows the rooms that personnel may access and their associated radiation zones.

Table 12.03-12.04-8-1—Containment Building Section (Plant West) Radiation Zones

Building Elevation	Room Number	Room Name	Radiation Zone Color Code	Zone
-8 feet	UJA07 016	Piping Penetration	Red	6
-8 feet	UJA07 024	KT (RCDT) Tank Room	Red	6
-8 feet	UJA07 027	KBA11 (CVCS) HX Room	Red	6
+5 feet	UJA11 023	KBA (CVCS) Valve Room	Red	6
+5 feet	UJA11 002	JEB10 (RCP) Oil Collection Tank Area	Magenta	5
+5 feet	UJA11 013	Annular Space	Green	3
+5 feet	UJA11 022	KBA (CVCS) Valve Room	Magenta	5
+29 feet	UJA18 002	Reactor Coolant Pump	Magenta	5
+29 feet	UJA18 003	Steam Generator	Magenta	5
+45 feet	UJA23 013	LHSI Tank and Annular Space	Green	3
+64 feet	UJA29 013	Setdown Area, Operating Floor	Green	3
+64 feet	UJA29 019	Pressurizer	Magenta	5

These zones are shown in the attached mark-up to U.S. EPR FSAR, Tier 2, Figure 12.3-8.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Figure 12.3-8 will be revised as described in the response and indicated on the enclosed markup.

Response to Question 12.03-12.04-8, Question 2:

2. Per Section II.B.2 of NUREG-0737, the dose rate for areas requiring continuous occupancy (such as the Main Control Room (MCR), Technical Support Center

(TSC), and nearby stations within the MCR envelope) must be less than 15 mrem/hr averaged over 30 days post-accident. The accumulated dose of 4.0 rem is for the most exposed individual within the MCR envelope for the stated 30 day post-accident period. Therefore, the dose rate for the most exposed individual averaged over 30 days is 4.0 rem divided by 720 hours or 5.6E-3 rem/hr (5.6 mrem/hr). This value is well within the 15 mrem/hr 30-day average criterion given by NUREG-0737.

Because the dose rate criterion is a 30-day average, specific dose rates as functions of time within that 30-day period have not been explicitly calculated.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

U.S. EPR Final Safety Analysis Report Markups

components in auxiliary systems, including pumps and valves, which further reduce corrosion products available for activation.

12.03-12.04-8

Wherever it is compatible with the process, stainless steel is used for parts of components that contact reactor coolant or processed reactor coolant. For example, the coolant storage tanks are made of stainless steel.

The presence of antimony in reactor coolant pump journal bearings of some operating reactors has resulted in an increased number of hot particles in these plants. In order to prevent hot particles from being created, the carbon portion of the reactor coolant pump journal bearings, which comes into contact with reactor coolant, has no antimony, as specified in Section 5.2.3.1. In addition, other austenitic stainless steel components that come into contact with reactor coolant will have no added antimony and the trace antimony content will be restricted as specified in Section 5.2.3.1.

12.1.2.3.2 Water Chemistry

The reactor coolant chemistry for the U.S. EPR is designed to minimize the production of activated corrosion products by creating an environment that is less corrosive to the selected materials. Chemistry, which is coordinated with the boron content of the reactor coolant, is used to provide a constant pH in a target range that is optimized to minimize the production of corrosion products at the operating temperature. Enriched boron is used to limit the required boric acid concentration for reactivity control, limiting the addition of a pH buffer to the reactor coolant. A slightly basic solution is used to minimize corrosion of metals exposed to reactor coolant at operating conditions. Lithium hydroxide is used as the pH buffer and is enriched in lithium-7 to limit the production of tritium via the $^{6}Li(n,)^{3}H$ reaction. Suspended solids in the reactor coolant can be activated when they pass through the core, and contribute to activation of plant systems and increase dose rates when they are deposited at different places through the RCS. The coordinated boron–lithium chemistry is designed to minimize the amount of suspended solids.

Hydrogen is added to the RCS to maintain a reducing environment in the primary coolant, thereby minimizing oxidation and corrosion of the primary system materials of construction. Dissolved hydrogen accomplishes this efficiently at power operation by scavenging oxidizing molecular products formed by the radiolysis of water. By its action on the stability and solubility of corrosion products, hydrogen also has a significant influence on the radiation fields in and around SGs, in and around reactor coolant piping, and on crud buildup on the fuel rods.

The chemistry control scheme for cold shutdown increases corrosion product concentration, which may be removed through the CVCS. The changes in reactor coolant physics and chemistry causing these conditions are because of boration, decrease in temperature, change from a reducing environment to an oxidizing probability of rapidly propagating fracture and gross rupture of the RCPB. (GDC 14, GDC 31)

RCPB materials are handled, protected, stored, and cleaned according to recognized and accepted methods that are designed to prevent damage or deterioration. Process specifications stipulate the procedures covering these controls in compliance with 10 CFR 50, Appendix B, Criterion XIII.

5.2.3.1 Material Specifications

Table 5.2-2 lists the materials incorporated into the design of the RCPB (excluding the reactor pressure vessel), including grade or type and final metallurgical condition. Table 5.2-2 includes the materials specified for the steam generators, PZR, RCPs, RCPB piping, and control rod drive mechanism. ASME Boiler and Pressure Vessel Code, Section II material specifications are used for materials in the RCPB, including weld materials.

The weld filler materials used for joining the ferritic base materials of the RCPB conform to ASME Section II Part C material specifications SFA 5.5, 5.17, 5.18, 5.20, 5.23, 5.28, and 5.29. The weld filler materials used for joining the austenitic stainless steel base materials of the RCPB conform to ASME Section II Part C material specifications SFA 5.4, 5.9, and 5.22. The weld filler materials used for joining nickel-chromium-iron (NiFeCr) alloys in similar base material combination and in dissimilar ferritic or austenitic base material combination conform to ASME Section II Part C material specifications SFA 5.11 and 5.14.

Low alloy steel pressure boundary forgings have limited sulfur content not exceeding 0.008 wt%, (wt = weight). Clad low alloy steel pressure boundary materials have ASTM grain size 5 or finer.

12.03-12.04-8

Austenitic stainless steel base metal conforms to RG 1.44. Austenitic stainless steel base metal and weld metal have limited carbon content not exceeding 0.03 wt%. Austenitic stainless steel base metal and weld filler metal in contact with RCS primary coolant has limited cobalt content not exceeding 0.05 wt%. Austenitic stainless steel base metal in contact with RCS primary coolant has limited sulfur content not exceeding 0.02 wt%. When supplementary chemical analysis is performed which would be more complete than the analysis used to check the content of specific elements, the results will show that the sample contains no more than residual antimony. In addition, the carbon portion of the reactor coolant pump journal bearings will have no antimony.

Austenitic stainless steel welds in RCS piping, including surge line piping, have delta ferrite content limited to a ferrite number (FN) between 5 and 10, measured as determined by ASME Section III, NB-2433. Austenitic stainless steel weld materials for stainless steel welds joints in the balance of the RCPB system have delta content

12.03-12.04-8

Figure 12.3-8—Containment Building Section Looking Plant-West at the Reactor Cavity, Core Internals Storage, Instrument Lance Storage, and Spreading Area