ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Friday, December 19, 2008 2:08 PM
To: Getachew Tesfaye
Cc: John Rycyna; Pederson Ronda M (AREVA US); BENNETT Kathy A (OFR) (AREVA US); DELANO Karen V (AREVA US)
Subject: Response to U.S. EPR Design Certification Application RAI No. 86, FSAR Ch 9, Supplement 1
Attachments: RAI 86 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided responses to 7 of the 14 questions of RAI No. 86 on November 3, 2008. The attached file, "RAI 86 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to 2 of the remaining 7 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 86 Question 09.01.02-21.

The following table indicates the respective pages in the response document, "RAI 86 Supplement 1 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 86 — 09.01.01-1	2	3
RAI 86 — 09.01.02-21	4	5

The schedule for technically correct and complete responses to the remaining 5 questions is unchanged and provided below:

Question #	Response Date
RAI 86 — 09.01.01-2	January 21, 2009
RAI 86 — 09.01.02-19	January 21, 2009
RAI 86 — 09.01.02-20	January 21, 2009
RAI 86 — 09.01.03-1	January 21, 2009
RAI 86 — 09.01.03-2	January 21, 2009

Sincerely,

(Russ Wells on behalf of)

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
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From: WELLS Russell D (AREVA NP INC)
Sent: Monday, November 03, 2008 7:31 PM

To: 'Getachew Tesfaye'
Cc: 'John Rycyna'; Pederson Ronda M (AREVA US); BENNETT Kathy A (OFR) (AREVA US); DELANO Karen V (AREVA US)
Subject: Response to U.S. EPR Design Certification Application RAI No. 86, FSAR Ch 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 86 Response US EPR DC.pdf" provides technically correct and complete responses to 7 of the 14 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 86 Questions 09.01.03-3 and 09.01.02-20.

The following table indicates the respective pages in the response document, "RAI 86 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 86 — 09.01.01-1	2	2
RAI 86 — 09.01.01-2	3	3
RAI 86 — 09.01.02-19	4	5
RAI 86 — 09.01.02-20	6	7
RAI 86 — 09.01.02-21	8	8
RAI 86 — 09.01.03-1	9	9
RAI 86 — 09.01.03-2	10	10
RAI 86 — 09.01.03-3	11	11
RAI 86 — 09.05.04-1	12	12
RAI 86 — 09.05.04-2	13	13
RAI 86 — 09.05.04-3	14	15
RAI 86 — 09.05.04-4	16	16
RAI 86 — 09.05.04-5	17	18
RAI 86 — 09.05.04-6	19	20

A complete answer is not provided for 7 of the 14 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 86 — 09.01.01-1	December 19, 2008
RAI 86 — 09.01.01-2	January 21, 2009
RAI 86 — 09.01.02-19	January 21, 2009
RAI 86 — 09.01.02-20	January 21, 2009
RAI 86 — 09.01.02-21	December 19, 2008
RAI 86 — 09.01.03-1	January 21, 2009
RAI 86 — 09.01.03-2	January 21, 2009

Sincerely,

(Russ Wells on behalf of)
Ronda Pederson
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, October 03, 2008 3:09 PM
To: ZZ-DL-A-USEPR-DL
Cc: Jeffrey Poehler; David Terao; Peter Hearn; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 86(1216,1143,1227,1106), FSAR Ch. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 19, 2008, and discussed with your staff on October 3, 2008. Draft RAI Questions 09.01.02-21 and 09.01.03-2 were modified as a result of that discussion. 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,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 74

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From: WELLS Russell D (AREVA NP INC)

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Return Notification: No
Reply Requested: No
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Response to

Request for Additional Information No. 86 Supplement 1 (1216, 1143, 1227, 1106), Revision 0

10/3/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling
SRP Section: 09.01.02 - New and Spent Fuel Storage
SRP Section: 09.01.03 - Spent Fuel Pool Cooling and Cleanup System
SRP Section: 09.05.04 - Emergency Diesel Engine Fuel Oil Storage and Transfer System
Application Section: FSAR Ch. 9
CIB1 Branch

Question 09.01.01-1:

Conformance with GDC 62 and 10 CFR 50.68 requires that the control of fission during fuel storage be assured by using a geometrically safe configuration. Neutron moderator materials that have been used in the spent fool pool (SFP) in the past (e.g., Boraflex™) have been tested in radiation fields with dry air, or in borated water solutions without a radiation field, but never both together. A design flaw that was unrealized was that in borated water and in the presence of a radiation field, hydrogen peroxide and peroxide radicals form (as well as other free radicals) that attack the Boraflex™ causing it to decompose and decrease its geometric neutron capture capability. A significant release of silica results from this degradation and challenges the demineralizer capability to remove contaminants that promote stress corrosion cracking. Another material, Boral™ showed attack in the SFP environment after a few years of service. In this case the material blistered and the final cause of this attack is still under investigation. Additionally, elevated concentrations of sulfates have been determined in these SFPs as a result of the action of peroxide on cation resins. Sulfates in acidic environments have been the subject of fuel assembly top nozzle failures (US NRC Information Notice 2002-09) and attack of the Boraflex™ neutron absorber material some nuclear plants. Although Metamic™ is a different type of material from the Boraflex™ or Boral™, it may suffer a similar type of degradation if not shown to be resistant to attack under true conditions experienced by the material in the SFP environment.

Report UN-TR-08-001(P), "Spent and New Fuel Storage Analyses for U.S. EPR Topical Report," does not address the following questions and require clarification:

For the Metamic™ material proposed as a neutron moderator for the SFP:

a. Provide the test results of the effects of radiation, peroxide and sulfates in boric acid solution, on the integrity of the Metamic™ tested simultaneously (i.e., *in situ*).

b. Determine the effect of sulfates in the SFP (at concentrations as high as 150 ppb the recommended control limit in the EPRI PWR Primary Water Chemistry Guidelines, 2007, Chapter 7.2) acidic environment on the stability of the neutron absorbing material. Provide any supporting documentation.

Response to Question 09.01.01-1:

It is noted that the Metamic neutron absorber, described in Report UN-TR-001(P), has been previously approved by the NRC for use in 8 spent fuel storage pools for the following applicants:

Plant Name	Docket Number
Arkansas Nuclear One Unit 1	50-313
Arkansas Nuclear One Unit 2	50-368
Clinton	50-461
Cooper	50-298
Diablo Canyon Unit 1	50-275
Diablo Canyon Unit 2	50-323
St. Lucie Unit 2	50-389
Turkey Point Unit 3	50-250

For the first of these approvals, for the Arkansas Nuclear One plants, a topical report describing the use of Metamic in spent fuel pools (Holtec Report HI-2022871) was submitted to the NRC and an NRC SER (ADAMS Accession Number ML031681432) was issued.

In addition to its use in spent fuel pools in compliance with 10 CFR 50, the NRC also approved the use of Metamic in dry storage casks from multiple cask vendors in compliance with 10 CFR 72. These casks are typically placed into the spent fuel pool or a connected loading pit to be loaded with fuel assemblies, exposing the contained Metamic to the spent fuel pool environment.

The latest Metamic qualification report describing the conditions occurring in spent fuel pools is documented in a Holtec-proprietary report (Holtec Report HI-2043215). This report includes the original NRC-reviewed Holtec Report HI-2022871 as an appendix, but also includes additional testing results data that occurred after issuance of the NRC SER. This report documents the resistance of Metamic to spent fuel pool conditions, including temperature, water, acid solutions, sodium chloride solutions, and radiation. Holtec has provided the proprietary and non-proprietary versions of this document in response to RAIs associated with the Model No. HI-STAR 100 HB transportation package (Refer to Docket #71-9261, TAC No. L24029, Holtec Letter 5014631, August 3, 2007).

FSAR Impact:

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

Question 09.01.02-21:

The regulatory requirements for control of radioactive releases are described in 10 CFR 50, Appendix A GDC-60, 10 CFR 20.1101, 10 CFR 20.1302, and 10 CFR 20, Appendix B Table 2. FSAR Tier 1, Chapter 5 Table 5.0-1 "Site Parameters for the US EPR," identifies a list of radionuclides that can potentially contaminate the groundwater. Several of the radionuclides listed have half-lives that are so short that there is no reasonable pathway for them to find their way into groundwater even during a severe accident. [Notably ^{138}Cs (33 m), ^{83}Br (2.4 h), ^{84}Br (32 m), ^{85}Br (2.9 m), ^{93}Y (10 h), ^{92}Y (3.5 h), ^{91m}Y (49 m)]. Additionally, ^{130}I is listed but it is neither an activation nor a fission product and has no credible formation mechanism in the RCS.

In contrast, certain radionuclides known to exist in the plant systems and normal effluents are not listed. Specifically, $^{124, 125, 126, 127}$Sb, ^{108m}Ag, $^{121, 123, 125, 126, 127}$Sn, ^{99}Tc, ^{94}Nb, ^{95m}Nb, ^{93m}Nb and ^{93}Zr are not included in this table.

1. Provide the criteria used to determine the radionuclides listed in this table.
2. Provide the methodology used to consider the half-life of the radionuclide and potential chemical/physical pathway to the environment when the listed radionuclides were included.
3. Confirm that the identified radio-nuclides listed above were excluded. If they were justify their exclusion.

Response to Question 09.01.02-21:

U.S. EPR FSAR Tier 1, Table 5.0-1 contains a list of important radionuclides considered for a range of radiological analysis applications. The table will be revised to include tritium (at 1.0 µCi/g), increasing the total number of radionuclides from 59 to 60. Tritium was inadvertently omitted from U.S. EPR FSAR Tier 1, Table 5.0-1, but is included in U.S. EPR FSAR Tier 2, Table 11.1-2 and in the discussion of activation products in U.S. EPR FSAR Tier 2, Section 11.1.1. Because the list was compiled by screening a list of nearly 400 radionuclides for various radiological applications, there are some radionuclides that may not be as important for the evaluation of groundwater contamination as others. However, all important radionuclides for the evaluation of groundwater contamination are present. Some decay daughters are not listed, but are included in the relevant radiological analysis applications. For certain radiological analysis applications, important noble gas isotopes are also considered.

To demonstrate the bounding nature of the radionuclides in U.S. EPR FSAR Tier 1, Table 5.0-1, the product of the coolant activity concentration (µCi/g) and the inverse of the Federal Guidance Report 11, annual limit on intake (ALI with units of µCi) may be used as indication of the potential dose from a given radionuclide due to environmental contamination. Table 09.01.02-21-1 compares the calculated value of this product for several of the long-lived radionuclides listed in U.S. EPR FSAR Tier 1, Table 5.0-1 (and used for the evaluation of groundwater contamination) to the corresponding values for the radionuclides listed in the RAI Question 9.01.02-21.

Table 09.01.02-21-1 – Comparison of Ratio of RCS Coolant Concentration To Annual Limit on Intake for Radionuclides Considered for Evaluation of Groundwater Contamination

Radionuclide	Half-life (days)	RCS Conc (uCi/g)	Ingestion ALI (uCi) (min value)	RCS/ALI (per gram)
Selected Nuclides from Table 5.0-1				
Cs-137	1.10E+04	1.08E-01	100	1.08E-03
H-3	4.48E+03	1.00E+00	80000	1.25E-05
Co-60	1.92E+03	3.40E-04	200	1.70E-06
Sr-90	1.04E+04	3.25E-05	30	1.08E-06
I-129	5.73E+09	4.59E-08	5	9.18E-09
Nuclides from RAI list				
Zr-93	5.58E+08	1.25E-10	1000	1.25E-13
Nb-93m	5.33E+03	9.64E-12	9000	1.07E-15
Nb-94	7.41E+06	7.35E-15	900	8.17E-18
Nb-95m	3.61E+00	6.65E-07	2000	3.33E-10
Tc-99	7.77E+07	1.05E-09	4000	2.63E-13
Ag-108m	4.64E+00	1.46E-15	600	2.43E-18
Sn-121	1.13E+00	6.67E-07	6000	1.11E-10
Sn-123	1.29E+02	1.85E-07	500	3.70E-10
Sn-125	9.64E+00	6.49E-07	400	1.62E-09
Sn-126	3.65E+07	4.57E-11	300	1.52E-13
Sn-127	8.75E-02	5.01E-06	7000	7.16E-10
Sb-124	6.02E+01	7.56E-08	500	1.51E-10
Sb-125	1.01E+03	7.96E-07	2000	3.98E-10
Sb-126	3.85E+00	5.77E-08	500	1.15E-10
Sb-127	1.24E+01	5.01E-06	700	7.16E-09
Total of Nuclides in RAI list				1.10E-08

Table 09.01.02-21-1 shows that I-129 alone (neglecting completely the potential dose contribution from the other long-lived radionuclides considered to be important for the evaluation of groundwater contamination) has an impact nearly as great as the sum of the omitted radionuclides identified in the RAI. With the exception of I-129, the selected radionuclides exhibit half-lives of the order of 10^3-10^4 days (i.e., they are much longer lived than all but Zr-93, Nb-93m, Nb-94, Tc-99, Sn-126, and Sb-125). The RCS/ALI sum for these six radionuclides is only 4E-10 per gram, a factor of more than 20 less than I-129 alone. On this basis, it is judged that all of the radionuclides from the RAI list may be neglected in the assessment of groundwater contamination.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 5.0-1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

Table 5.0-1—Site Parameters for the U.S. EPR Design (5 Sheets)

Inventory of Radionuclides which Could Potentially Seep Into the Groundwater

Nuclide	Activity (µCi/g)	Nuclide	Activity (µCi/g)	Nuclide	Activity (µCi/g)	Nuclide	Activity (µCi/g)
Br-83	3.2E-02	**Mn-54**	1.0E-03	**Y-91M**	5.2E-04	**TE-129**	2.4E-03
Br-84	1.7E-02	**Fe-55**	7.6E-04	**Y-91**	8.1E-05	**TE-131M**	3.7E-03
Br-85	2.0E-03	**Fe-59**	1.9E-04	**Y-92**	1.4E-04	**TE-131**	2.6E-03
I-129	4.6E-08	**Co-58**	2.9E-03	**Y-93**	6.5E-05	**TE-132**	4.1E-02
I-130	5.0E-02	**Co-60**	3.4E-04	**ZR-95**	9.3E-05	**TE-134**	6.7E-03
I-131	7.4E-01	**Na-24**	3.7E-02	**NB-95**	9.3E-05	**BA-137M**	1.0E-01
I-132	3.7E-01	**Zn-65**	3.2E-04	**M0-99**	1.1E-01	**BA-140**	6.2E-04
I-133	1.3E+00	**W-187**	1.8E-03	**TC-99M**	4.6E-02	**LA-140**	1.6E-04
I-134	2.4E-01	**Rb-88**	1.0E+00	**RU-103**	7.7E-05	**CE-141**	8.9E-05
I-135	7.9E-01	**Rb-89**	4.7E-02	**RU-106**	2.7E-05	**CE-143**	7.6E-05
Cs-134	1.7E-01	**Sr-89**	6.3E-04	**RH-103M**	6.8E-05	**CE-144**	6.9E-05
Cs-136	5.3E-02	**Sr-90**	3.3E-05	**RH-106**	2.7E-05	**PR-143**	8.8E-05
Cs-137	1.1E-01	**Sr-91**	1.0E-03	**AG-110M**	2.0E-07	**PR-144**	6.9E-05
Cs-138	2.2E-01	**Sr-92**	1.7E-04	**TE-127M**	4.4E-04	**NP-239**	8.7E-04
Cr-51	2.0E-03	**Y-90**	7.7E-06	**TE-129M**	1.5E-03	H-3	1.0E+00

09.01.02-21