ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Thursday, December 17, 2009 10:51 AM
To: Tesfaye, Getachew
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 297, FSAR Ch 6, Supplement 1
Attachments: RAI 297 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a response to 1 of the 10 questions of RAI No. 297 on November 16, 2009. The attached file, "RAI 297 Supplement 1 Response US EPR DC.PDF" provides a technically correct and complete response to 1 of the remaining 9 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 297 Supplement 1 Response US EPR DC.PDF," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 297 — 06.02.01-52	2	6

The schedule for technically correct and complete responses to the remaining 8 questions is unchanged and provided below:

Question #	Response Date
RAI 297 — 06.02.01-49	February 16, 2010
RAI 297 — 06.02.01-50	February 16, 2010
RAI 297 — 06.02.01-51	March 17, 2010
RAI 297 — 06.02.02-37	February 16, 2010
RAI 297 — 06.02.02-38	February 16, 2010
RAI 297 — 06.02.02-39	February 16, 2010
RAI 297 — 06.02.02-40	February 16, 2010
RAI 297 — 06.02.02-41	February 16, 2010

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
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Monday, November 16, 2009 5:58 PM

To: Tesfaye, Getachew
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 297, FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 297 Response US EPR DC.PDF" provides technically correct and complete responses to 1 of the 10 questions.

The following table indicates the respective page(s) in the response document, "RAI 297 Response US EPR DC.PDF," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 297 — 06.02.01-49	2	2
RAI 297 — 06.02.01-50	3	3
RAI 297 — 06.02.01-51	4	4
RAI 297 — 06.02.01-52	5	5
RAI 297 — 06.02.02-37	6	6
RAI 297 — 06.02.02-38	7	7
RAI 297 — 06.02.02-39	8	8
RAI 297 — 06.02.02-40	9	9
RAI 297 — 06.02.02-41	10	10
RAI 297 — 06.02.02-42	11	12

A complete answer is not provided for 9 of the 10 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 297 — 06.02.01-49	February 16, 2010
RAI 297 — 06.02.01-50	February 16, 2010
RAI 297 — 06.02.01-51	March 17, 2010
RAI 297 — 06.02.01-52	January 7, 2010
RAI 297 — 06.02.02-37	February 16, 2010
RAI 297 — 06.02.02-38	February 16, 2010
RAI 297 — 06.02.02-39	February 16, 2010
RAI 297 — 06.02.02-40	February 16, 2010
RAI 297 — 06.02.02-41	February 16, 2010

Sincerely,

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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, October 15, 2009 1:40 PM
To: ZZ-DL-A-USEPR-DL
Cc: Jensen, Walton; Ashley, Clinton; Jackson, Christopher; Hammer, Charles; Terao, David; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 297(3759,3719,3775), FSAR Ch. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 22, 2009, and discussed with your staff on October 13, 2009. Draft RAI Question 06.02.02-41 was 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: 1039

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD410251CC35)

Subject: Response to U.S. EPR Design Certification Application RAI No. 297, FSAR Ch 6, Supplement 1
Sent Date: 12/17/2009 10:51:15 AM
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From: WELLS Russell D (AREVA NP INC)

Created By: Russell.Wells@areva.com

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Tracking Status: None
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Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

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MESSAGE	4695	12/17/2009 10:51:26 AM
RAI 297 Supplement 1 Response US EPR DC.pdf	176698	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 297 (3759, 3719, 3775), Supplement 1, Revision 0

10/15/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.01 - Containment Functional Design
SRP Section: 06.02.02 - Containment Heat Removal Systems
Application Section: FSAR Chapter 6

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)
QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

Question 06.02.01-52:

In an SER concerning reload of AREVA fuel into the North Anna Power Station (ML040370390), the staff concluded that AREVA methodology for calculating minimum containment back pressure using the ICECON code could be accepted if it is shown to be conservative for each case. For US-EPR provide a benchmark showing that, for the limiting large break LOCA analyzed of FSAR Chapter 15, the ICECON methodology is conservative compared with a best estimate analysis using the AREVA multi-node GOTHIC model. The same mass and energy releases should be input into both ICECON and GOTHIC.

Response to Question 06.02.01-52:

The details of the GOTHIC to ICECON code benchmark study performed and the results are described in this response. The containment pressure is calculated using a best estimate multi-node GOTHIC model with the realistic large break loss of coolant accident (RLBLOCA) scenario described in U.S. EPR FSAR Tier 2, Section 15.6.5.1.2.

For the same mass and energy release inputs used in both ICECON and GOTHIC models, the results of the benchmark demonstrate the conservatism of the ICECON model. ICECON produces a conservatively lower containment pressure than the multi-node GOTHIC model during the transient time period of interest, after blowdown.

The methodology used by AREVA NP for containment backpressure calculation using the single-node ICECON model is conservative and meets regulatory requirements.

Discussion

The design basis multi-node GOTHIC containment model used for peak pressure was modified to model a combination of minimum backpressure and best-estimate assumptions. The minimum backpressure assumptions were taken from ICECON. The additional best-estimate assumptions made include the following:

1. Interfacial condensation on the surface of the in-containment refueling water storage tank (IRWST) pool is credited.
2. The heat transfer correlations, which provide best-estimate modeling of wall-fluid interactions, such as the GOTHIC diffusion layer model (DLM) options DLM – film roughening (DLM-F), DLM – mist generation (DLM-M), and DLM – film roughening and mist generation (DLM-FM), are modeled for the containment heat sinks.

The effect of each individual parameter and the cumulative impact is evaluated. The sequence of the benchmark cases associated with the individual parameter changes is described in this response.

- Base Case.

  This case used the mass and energy (MER) tables from the single-node ICECON model and credited interfacial heat transfer at the surface of the IRWST pool.

- Control volumes.

The total containment volume of the multi-node base case is increased by approximately three percent to match the value used in ICECON.

- Initial conditions.

  The initial conditions representing the containment pressure, vapor and liquid temperatures, relative humidity, and the thermal conductors' initial temperatures are set to the values used in the single-node ICECON model.

- Thermal conductors.

  The thermal conductors (heat sinks) are adjusted to reflect the conditions used in the single-node ICECON model. These adjustments include a 10 percent surface area increase of the thermal conductors and the addition of a new thermal conductor representing the internal tanks and equipments, not previously modeled in the GOTHIC models, for conservatism.

- Heat transfer coefficients.

  The following describes the specific changes made to the heat transfer coefficients:

  1) The containment wall is modified so that its external boundaries are no longer insulated. This change is made to credit heat transfer to ambient, and minimizes containment pressure.
  2) The IRWST wall is modified so that its external boundary is no longer insulated, but set to the same heat transfer coefficient (HTC) as the internal boundary. This same HTC is modified from natural convection (to liquid) to DLM. This change is made to credit heat transfer from containment vapor to both surfaces of this heat structure to minimize containment pressure.
  3) The IRWST basemat internal boundary, in contact with IRWST water, is set to a heat transfer coefficient value similar to that used in the single-node ICECON model.

- Material properties.

  The five material types used to model the containment heat sinks are modified to represent the properties used in the ICECON model.

  The changes previously discussed in this response are made to reflect the single-node ICECON input parameters, and one additional change is made. The DLM-FM HTC option is used instead of the base DLM option, which had been used in the preceding benchmark cases. Of the DLM options (F - film roughening, M – mist generation, and FM – film roughening and mist generation); the DLM-FM was selected because it results in the lowest containment pressure prediction.

  The pressure responses for the various multi-node GOTHIC benchmark cases are compared with the ICECON response in Figure 06.02.01-52-1. The gradual decrease of containment pressure, as a result of the successive additive changes made, is shown in Figure 06.02.01-52-1.

The final benchmark case, with DLM-FM, is compared with the ICECON containment pressure prediction in Figure 06.02.01-52-2. This figure shows that during the initial blowdown phase that lasts up to approximately 33 seconds, the multi-node GOTHIC model, with DLM-FM, predicts a lower pressure inside containment than predicted by ICECON. However, after the blowdown phase, the pressure predicted by the multi-node GOTHIC, with DLM-FM option, is higher than what the single-node ICECON predicts. This higher pressure is due to the imperfect mixing that occurs in a multi-node configuration compared to the near perfect mixing inherent in a single-node model such as ICECON.

Conclusion

During the time period of interest, after blowdown, the multi-node GOTHIC benchmark model, with the DLM-FM option, predicts a higher pressure inside containment than that calculated by ICECON (the pressure difference is approximately five psi after 200 seconds). The ICECON methodology for calculating containment backpressure following a LBLOCA is conservative.

FSAR Impact:

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

Figure 06.02.01-52-1—Containment Pressure for the Sequence of Benchmark Cases using the Multi-Node GOTHIC Model – ICECON Prediction

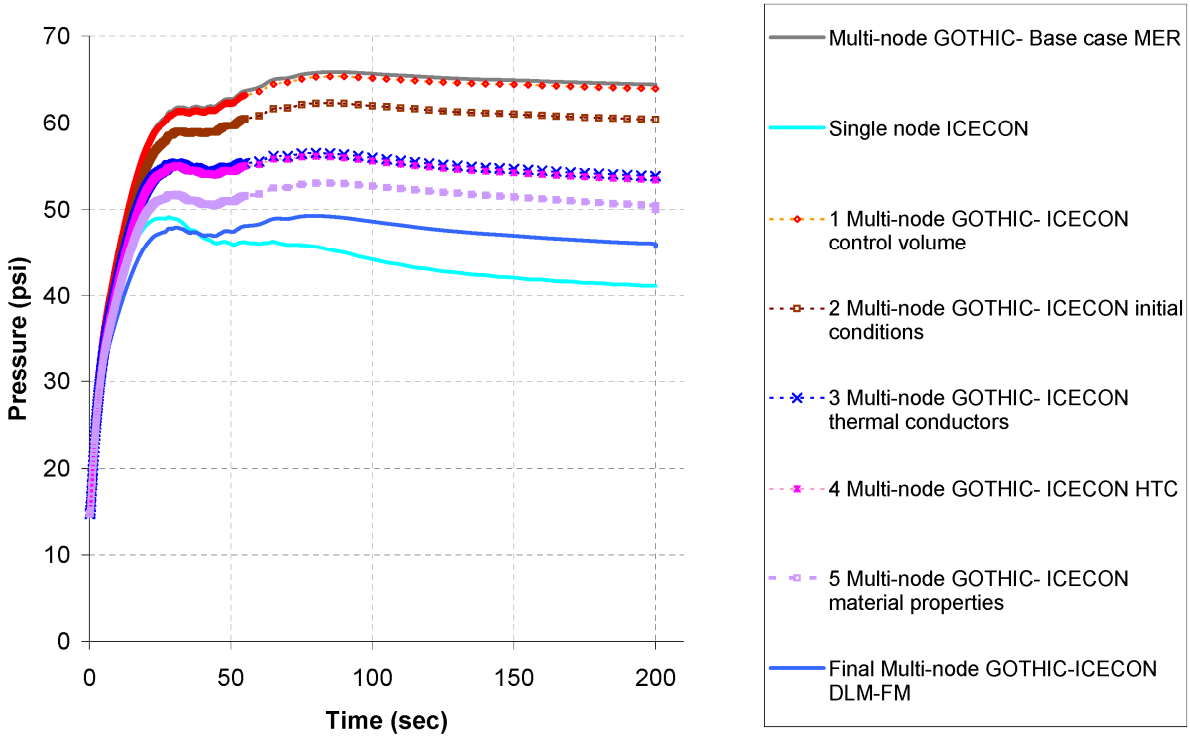
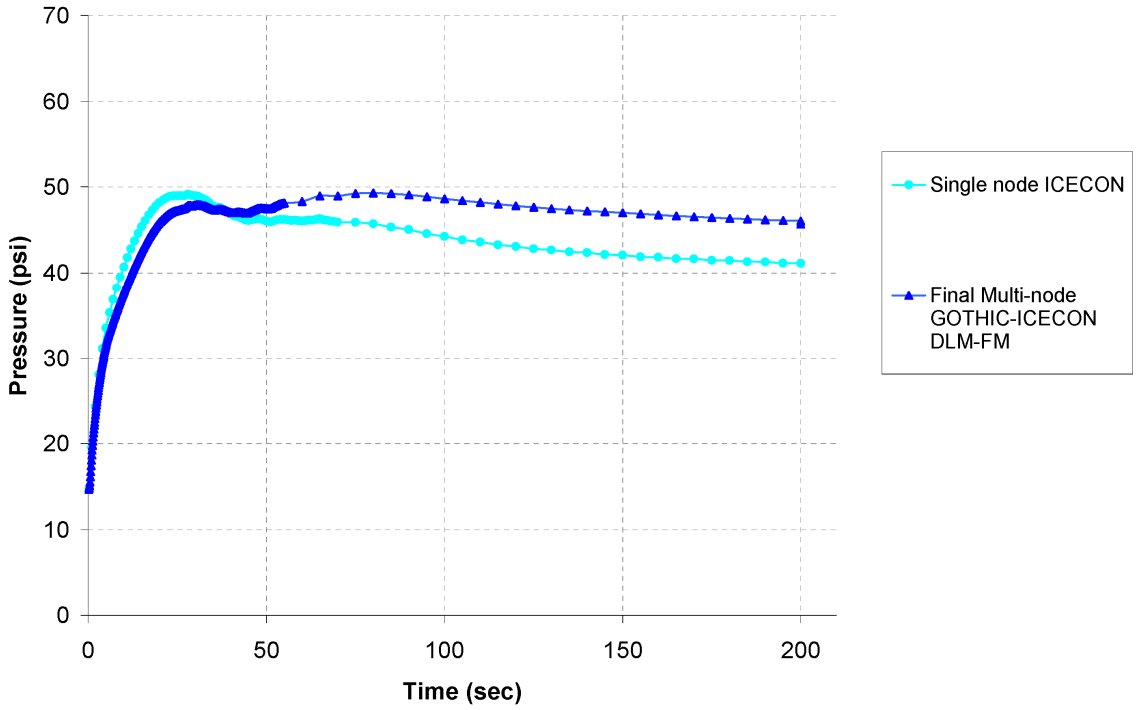
Figure 06.02.01-52-2—Comparison of Containment Pressure Predicted by the Multi-Node GOTHIC with DLM-FM and Single-Node ICECON