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

**Response to NRC Review of ANP-10284, "U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth Methodology Topical Report" (TAC No. MD5884)**

- Ref. 1: Letter, Ronnie L. Gardner (AREVA NP Inc.) to Document Control Desk (NRC), "Request for Review and Approval of ANP-10284, 'U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth Methodology Topical Report'," NRC:07:022, June 20, 2007.
- Ref. 2: Letter, Ronnie L. Gardner (AREVA NP Inc.) to Document Control Desk (NRC), "Response to a Second Request for Additional Information Regarding ANP-10284, 'U.S. EPR Instrumentation and Control Diversity and Defense-In-Depth Methodology Topical Report' (TAC No. MD5884)," NRC:08:041, June 13, 2008.
- Ref. 3: Letter, Ronnie L. Gardner (AREVA NP Inc.) to Document Control Desk (NRC), "Response to a Request for Additional Information Regarding ANP-10284 'U.S. EPR Instrumentation and Control Diversity and Defense-In-Depth Methodology Topical Report' (TAC No. MD5884)," NRC:08:003, January 22, 2008.
- Ref. 4: Letter, Getachew Tesfaye (NRC) to Ronnie L. Gardner (AREVA NP Inc.), "Review Status of the U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth [D3] Methodology Topical Report - ANP-10284" (TAC NO. MD5884), January 8, 2009.
- Ref. 5: Letter, Sandra M. Sloan (AREVA NP Inc.) to Document Control Desk (NRC), "U.S. EPR Instrumentation and Controls Topical Reports," NRC:09:004, January 23, 2009.
- Ref. 6: Letter, Ronnie L. Gardner (AREVA NP Inc.) to Document Control Desk (NRC), "Path Forward for ANP-10284, 'U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth (D3) Methodology Topical Report' (TAC No. MD5884)," NRC:09:025, March 30, 2009.

AREVA NP Inc. (AREVA NP) requested the NRC's review and approval of topical report ANP-10284, "U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth Methodology Topical Report" in Reference 1. AREVA NP provided additional information to the NRC regarding this report in References 2 and 3. The NRC provided preliminary results and status of the review of this report in Reference 4. In a meeting on January 15, 2009, the NRC staff and AREVA NP, discussed the information provided in Reference 4. Based on the information provided by the NRC staff in Reference 4 and discussed on January 15, 2009, AREVA NP provided a proposed path forward for the diversity and defense-in-depth (D3) topical report in Reference 5.

**AREVA NP INC.**  
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Subsequently, AREVA NP and the NRC staff conducted telephone calls on January 27, February 9, February 11, and February 25, to discuss the proposed path forward for this topical report. Based on those discussions, in Reference 6 AREVA NP provided the revised path forward to support the NRC review of the subject of instrumentation and control (I&C) diversity and defense-in-depth for the U.S. EPR design certification. The proposed path forward for D3 for the U.S. EPR, as outlined in Reference 6, was discussed with the NRC staff in a meeting on April 29-30, 2009.

In accordance with the plans outlined in Reference 6, AREVA NP has revised the D3 topical report to incorporate changes associated with responses to Requests for Additional Information (RAIs) provided to the NRC to date (Reference 2 and Reference 3). AREVA NP has also reissued the revised D3 report as a technical report rather than a topical report. The technical report, "U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth Methodology Technical Report" (ANP-10304) is enclosed with this letter.

AREVA NP no longer requests the NRC issue a separate safety evaluation report for the D3 report, but rather requests that the NRC incorporate the review of the report (ANP-10304) into the overall evaluation of I&C diversity and defense-in-depth in the safety evaluation report for the U.S. EPR Final Safety Analysis Report (FSAR) in a manner consistent with other reports which are incorporated by reference in the U.S. EPR FSAR.

In accordance with the plans outlined in Attachment A of Reference 6, the associated markups to the U.S. EPR FSAR are enclosed. The U.S. EPR qualitative, best-estimate D3 analysis performed to support the original D3 topical report (ANP-10284) is appended to the technical report (ANP-10304). The appended qualitative analysis includes the fundamental events evaluated, the basic analysis assumptions, and the expected plant responses which are representative of the U.S. EPR behavior for those events. However, the assumptions and bases for the qualitative analysis are evolving as a consequence of continued AREVA NP and NRC interactions regarding D3 for the U.S. EPR. Any changes to the qualitative analysis as a result of the ongoing quantitative confirmatory analysis, including any potentially credited manual actions, will be provided with the results of the quantitative confirmatory analysis.

Attachment A summarizes the resolution of items identified by the NRC in Reference 4, following the original listing provided in Attachment A of Reference 6.

As stated in Reference 6, AREVA NP will provide the results of the quantitative confirmatory analysis, and any resulting modifications to Diverse Actuation System (DAS) functions, to the NRC by the end of November, 2009. AREVA NP requests a meeting with the NRC staff in August 2009 to present the confirmatory analysis approach.

If you have any questions related to this submittal, please contact me. I may be reached by telephone at 434-832-2369 or by e-mail at [sandra.sloan@areva.com](mailto:sandra.sloan@areva.com).

Sincerely,

A handwritten signature in cursive script that reads "Sandra M. Sloan".

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

Enclosures

cc: G. Tesfaye  
Docket No. 52-020

## ATTACHMENT A

### Resolution of Items Identified in January 8, 2009 Letter from NRC to AREVA NP Inc. Regarding D3 Topical Report

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**Item 1.** *Diversity between Echelons of Defense:*

*The TR does not specify the diverse actuation system (DAS) platform specifications or provide a NUREG/CR-6303 Guideline 2 diversity analysis between the DAS and the Protection System (PS).*

**Resolution 1.** Revised U.S. EPR FSAR, Tier 2, Section 7.1, Diversity Requirements.

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**Item 2.** *BTP 7-19 Points 2 & 3 of the NRC Four-point position on D3 for ALWRs:*

*The TR did not provide the plant response calculated using best-estimate analyses for each anticipated operational occurrence (AOO) and each postulated accident (PA) in the design basis occurring in conjunction with each single postulated common-cause failure to demonstrate that adequate diversity and adequate protection exists.*

**Resolution 2.** Qualitative analysis enclosed.

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**Item 3.** *The TR did not describe how the DAS is designed such that its actuation signals and its initiation of protective functions do not interfere with the PS actuation process or actuation safety functions before the PS.*

**Resolution 3.** Revised U.S. EPR FSAR Tier 2, Section 7.8, Process Automation System.

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**Item 4.** *The TR did not identify the selection of DAS automatic and manual actuated functions.*

**Resolution 4.** Any modifications to DAS functions as a consequence of the quantitative confirmatory analysis will be provided with the results of the quantitative confirmatory analysis that will be submitted in November 2009. Appropriate changes to the U.S. EPR FSAR will be made based on this analysis.

Note: In Reference 6, Attachment A, item 4, AREVA NP stated that no manual controls are credited for BTP 7-19 points 2 and 3. Further review of the qualitative analysis that is appended to the technical report (ANP-10304) identified that manual actions, beyond 30 minutes, were credited for the steam generator tube rupture event. As noted above, any modifications to DAS functions as a consequence of the quantitative confirmatory analysis, whether automatic or manual, will be provided with the results of the quantitative confirmatory analysis.

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**Item 5.** *The TR did not address the quality assurance aspects of the design and development process for DAS software and hardware.*

**Resolution 5.** Revised U.S. EPR FSAR Tier 2, Section 7.1, Quality Requirements.

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**Item 6.** *The TR did not establish or describe the applicant's commitment to test the DAS in accordance with the guidance provided in Generic Letter 85-06 and its enclosure titled "QA Guidance for Non-safety-related ATWS Equipment" to ensure availability.*

**Resolution 6.** Previous response to RAI 57 Question 7.8-2 made revision to U.S. EPR FSAR Tier 2, Section 7.8 that addresses this item.

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**Item 7.** *The TR did not describe the type of environment DAS equipment would be installed in or the requisite assurance commitments necessary to show that the DAS equipment is able to operate in the environment that would occur during normal plant operation, including AOOs.*

**Resolution 7,** Revised U.S. EPR FSAR Tier 2, Section 7.1, Qualification Requirements.

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**Item 8.** *The TR does not directly address how the DAS actuation status of the systems and components actuated by DAS is confirmed*

**Resolution 8.** Revised U.S. EPR FSAR Tier 2, Section 7.8, Process Automation System.

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**Item 9.** *The TR does not describe the architectural aspects of the DAS and how it interfaces with other parts of the U.S. EPR I&C system. Specifically, an adequate description of electrical isolation (isolation devices), communications independence, and physical separation between the DAS and the PS is needed.*

**Resolution 9.** This item is addressed in U.S. EPR FSAR Tier 2, Sections 7.1.1.4.6 and 7.1.1.6.4. No changes needed.

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**Item 10.** *The TR did not provide an evaluation of design features to reduce the effects of spurious trips and actuations.*

**Resolution 10.** Revised U.S. EPR FSAR Tier 2, Section 7.8, Process Automation System.

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**Item 11.** *The TR did not address assurance of DAS completion of protective actions.*

**Resolution 11.** Revised U.S. EPR FSAR Tier 2, Section 7.8, Process Automation System.

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**Item 12.** *The TR did not provide an analysis of monitoring or display communication failures or faulty signals and commands that are transmitted to other systems or to the plant data network.*

**Resolution 12.** Revised U.S. EPR FSAR Tier 2, Section 7.8, Process Information and Control System.

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**Item 13.** *In addition to the items listed above, the information provided by AREVA NP indicated that manual initiation of diverse actuation is performed at the component level versus the system level. This concept is inconsistent with NRC staff guidance and position that indicates a need for system-level manual actuation. Therefore, the staff does not find the component-level manual actuation acceptable.*

**Resolution 13.** AREVA NP Inc. is evaluating possible design modifications to address this concern. By the end of July, 2009 AREVA NP Inc. will provide information to fully address this issue.

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**Item 14.** *The Priority Actuation and Control System Module (AV42) is a common element for both safety-related engineered safety features actuation and the DAS signals. AREVA NP proposed that the AV42 is not susceptible to a software CCF. However, the NRC staff did not find the AV42 as proposed in TR ANP-10273P acceptable. Therefore, AREVA NP would need to propose an acceptable design with regards to the AV42.*

**Resolution 14.** Modifications to the U.S. EPR FSAR to address the AV-42 issues, such as use of design ITAAC, will take into account D3-related requirements.

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**Item 15.** *TR ANP-10284 does not clearly indicate how 10 CFR 50.62, "Requirements for Reduction of Risk From Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants," is met.*

**Resolution 15.** This item is addressed in U.S. EPR FSAR Tier 2, Section 7.8.2.1.3. No changes needed.