ArevaEPRDCPEm Resource

From: BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]
Sent: Monday, March 01, 2010 3:39 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 342 , FSARCh. 5 OPEN ITEM
Attachments: RAI 342 Response US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 342 Response US EPR DC.pdf" provides a technically correct and complete response to the question.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 342 Question 05.04.12-5.

The following table indicates the respective pages in the response document, "RAI 342 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 342 — 05.04.12-5	2	4

This concludes the formal AREVA NP response to RAI 342, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, January 19, 2010 9:39 AM
To: ZZ-DL-A-USEPR-DL
Cc: Budzynski, John; VanWert, Christopher; Donoghue, Joseph; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 342 (3933), FSARCh. 5 OPEN ITEM

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on December 7, 2009, and on January 18, 2010, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The question in this RAI is an OPEN ITEM in the safety evaluation report for Chapter 5 for Phases 2 and 3 reviews. As such, the schedule we have established for your application assumes technically correct and complete responses prior to the start of Phase 4 review. For any RAI that cannot be answered prior to the start of Phase 4 review, it is expected that a date for receipt of this information will be provided 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: 1195

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From: BRYAN Martin (EXT)

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Reply Requested: No
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Response to

Request for Additional Information No. 342 (3933), Revision 0

01/19//2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 05.04.12 - Reactor Coolant System High Point Vents
Application Section: FSAR Chapter 5

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

Question 05.04.12-5:

OPEN ITEM

The applicant's response to RAI 5.4.12-1 stated that "In the event that the vent flow path does not close, flow is restricted by an orifice such that the normally operating chemical and volume control system (CVCS) can make up the loss of coolant mass with the assumption that only one high pressure charging pump is available. The makeup flow is based on flow from one charging pump at system pressure and temperature minus the flow diverted to the reactor coolant pump (RCP) seals. Additionally, the redundancy of the vent design (i.e., two valves in series for each vent line powered from separate electrical divisions) precludes the possibility of a stuck open flow path. Breaks upstream of the flow-restricting orifice are bounded by the small break loss of coolant accident (SBLOCA) analysis in FSAR Tier 2, Section 15.6.5.2."

The staff finds the response to be inadequate. In addition, the staff is concerned with this response because FSAR Tier 2 Revision 1 Section 9.3.4, "Chemical and Volume Control System (Including Boron Recovery System)," page 9.3-62 states: "The CVCS is not a safety system and is not required to supply reactor coolant makeup to the RCS in the event of small breaks or leaks in the RCPB. Also, the CVCS is not designed to perform the safety function of the ECCS during a DBA. Therefore, GDC 33 and GDC 35 are not applicable to the CVCS." However, in Section 5.2 "Integrity of the Reactor Coolant Pressure Boundary," on page 5.2-23 the applicant states: "Components that are connected to the RCS and are part of the RCPB, and that are of such a size and shape so that upon postulated rupture the resulting flow of coolant from the RCS under normal plant operating conditions is within the capacity of makeup systems that are operable from on-site emergency power. The emergency core cooling systems are excluded from the calculation of makeup capacity." The applicant does not identify the makeup systems but infers that the CVCS is capable of performing this task without supporting data to substantiate their claim. Therefore, the staff believes there are inconsistencies with respect to the RAI response and the FSAR sections noted above.

Since the applicant does not describe the makeup systems required to perform this function, additional information is needed to identify the makeup systems and confirm that the makeup systems or CVCS can provide adequate makeup in the event the high point vent system fails open and to confirm that this failure would not be classified as a LOCA. In addition, the staff was unable to determine, in FSAR Tier 1 Section 2.2.1 that the ITAAC includes verification of the "as-built" high point vent system conformance to the assumptions used to conclude, in the event that the system fails open, that the CVCS is capable of providing adequate makeup to the reactor coolant system.

Therefore, provide a reference or a discussion to address the following:

a. The RCS mass discharge flow rate downstream on the flow restricting orifice, including a description of the piping, valve and orifice pressure losses assumed in the flow rate determination,

b. The pressure and temperature (and other thermodynamics variables) used in the flow rate determination (and as applicable the critical flow model used),

c. The CVCS flow (the total flow rate, the flow rate to the RCP seals, and flow rate to the RCS), at the pressure and temperature used to determine the discharge flow rate,

d. Identify the "makeup systems" and provide the data requested in (3), and

e. If no other makeup system is identified, explain the applicant's position that GDC 33 is not applicable to the CVCS system.

f. Identify the ITAAC that includes verification of the "as-built" high point vent system conformance to the assumptions used to conclude that the CVCS is capable of providing adequate makeup to the reactor coolant system in the event that the system fails open.

Response to Question 05.04.12-5:

a. The reactor coolant system (RCS) mass discharge flow rate downstream of the flow restricting orifice is 22.29 lbm/sec.

   The orifice size was determined using Reference 1. For conservatism, the flow limiting orifice upstream pressure and enthalpy are assumed to be those for stagnation conditions in the RCS. Thus, no piping or valve pressure losses are assumed.

b. The flow rate is fixed at the amount that can be supplied to the RCS by one CVCS pump and is 22.29 lbm/sec at 2250 psia and 120ºF. The mass flux in units of lbm/sec-ft^2 is determined (per Reference 1) at operating conditions of 2250 psia and 562.5ºF. This value of mass flux is divided by the given flow rate to provide an orifice size. For conservatism, when determining orifice size, the cold leg temperature is used.

   U.S. EPR FSAR Tier 2, Section 5.2.4.1.6 will be modified to include a reference to the capacity of one CVCS charging pump at normal operating conditions:

   - "Components that are connected to the RCS and are part of the RCPB, and that are of such a size and shape so that upon postulated rupture the resulting flow of coolant from the RCS under normal plant operating conditions is within the capacity of one CVCS charging pump that is operable from on-site power. The emergency core cooling systems are excluded from the calculation of makeup capacity."

c. The total CVCS charging pump flow is 176 gpm at 2250 psia and 120ºF. The charging flow to the RCP seal injection is 32 gpm, of which 20 gpm is injected through the seals into the RCS and 12 gpm is returned to the volume control tank through the leakoff lines. Also, 3 gpm of the charging pump flow is directed to the hydrogenation station water jet pump. This results in a total flow supplied to the RCS of 161 gpm (176 - 32 + 20 - 3 = 161).

d. Although the CVCS is not a safety-related system, it provides RCS makeup in the event of small breaks or leaks in the reactor coolant pressure boundary. The CVCS is designed with both on-site and off-site electric power capability to allow system operation, with either a loss of on-site or off-site electric power, and has the capability as indicated in (c).

e. U.S. EPR FSAR Tier 2, Section 9.3.4.3 will be revised to indicate that the CVCS meets GDC 33.

   - "The CVCS is designed to supply reactor coolant makeup in the event of small breaks or leaks in the reactor coolant pressure boundary. The CVCS is designed with both on-site and off-site electric power and meets GDC 33.

   - The CVCS is not designed to perform the safety function of the ECCS during a DBA. Therefore, GDC 35 is not applicable to the CVCS."

f. The applicable ITAAC is U.S. EPR FSAR Tier 1, Table 2.2.1-5—Reactor Coolant System ITAAC, Commitment 2.1.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 5.2.4.1.6 and 9.3.4.3 will be revised as described in the response and indicated on the enclosed markup.

References:

1. Appendix C of BAW-10164P-A, Rev. 6 “RELAP5/MOD2-B&W – An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analysis.”

U.S. EPR Final Safety Analysis Report Markups

Certain Class 1 components are exempt from surface and volumetric examination in accordance with Subarticle IWB-1220. These include:

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- Components that are connected to the RCS and are part of the RCPB, and that are of such a size and shape so that upon postulated rupture the resulting flow of coolant from the RCS under normal plant operating conditions is within the capacity of ~~makeup systems that are~~ one CVCS charging pump that is operable from on-site ~~emergency~~ power. The emergency core cooling systems are excluded from the calculation of makeup capacity.
- Components and piping segments of nominal pipe size (NPS) 1 and smaller, except for steam generator tubing, including those:
  - That have one inlet and one outlet, both of which are NPS 1 and smaller.
  - Those that have multiple inlets or multiple outlets whose cumulative cross-sectional area does not exceed the cross-sectional area defined by the OD of NPS 1 pipe.
- Reactor vessel head connections and associated piping, NPS 2 and smaller, made inaccessible by control rod drive penetrations.

5.2.4.1.7 Relief Requests

No relief from Class 1 PSI or ISI requirements is required for the U.S. EPR.

5.2.4.1.8 Code Cases

No code cases applicable to Class 1 PSI or ISI requirements are invoked for U.S. EPR design. However, supplemental inservice inspections for the reactor pressure vessel head are required, in accordance with 10 CFR 50.55a. Compliance with the requirements of this order may be accomplished with conditional implementation of code case N-729-1, “Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds.” COL applicants that reference the U.S. EPR design certification may invoke code case N-729-1, with conditions, in accordance with 10 CFR 50.55a.

5.2.4.1.9 Augmented ISI to Protect Against Postulated Piping Failures

No Class 1 piping penetrates the Reactor Building. Therefore, augmented ISI to protect against postulated failures of Class 1 piping between containment isolation valves is not required for the U.S. EPR. Refer to Section 6.6 for a description of augmented ISI for Class 2 high energy piping.

5.2.4.1.10 Other Inspection Programs

The ISI program includes provisions to detect and correct potential RCPB corrosion caused by boric acid leaks, as described in NRC generic letter 88-05. ~~The ISI program~~

- The CVCS is not designed to perform the safety function of RCS boration for the mitigation of DBEs.

- The CVCS is designed to supply borated water to the RCS during normal power operating conditions. To provide assurance that this operational function is satisfactorily performed, the design of components and instrumentation associated with this function are redundant.

GDC 33 and GDC 35 require that safety-related portions of the CVCS supply reactor coolant makeup in the event of small breaks or leaks in the RCPB and to function as part of the ECCS assuming a single active failure coincident with a LOOP; if the plant design relies on the CVCS to perform the safety function of safety injection as part of the ECCS.

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- The CVCS is designed to supply reactor coolant makeup in the event of small breaks or leaks in the reactor coolant pressure boundary. The CVCS is designed with both on-site and off-site electric power and meets GDC 33.

- ~~The CVCS is not a safety system and is not required to supply reactor coolant makeup to the RCS in the event of small breaks or leaks in the RCPB. Also, t~~The CVCS is not designed to perform the safety function of the ECCS during a DBA. Therefore, ~~GDC 33 and~~ GDC 35 is~~are~~ not applicable to the CVCS.

The design of safety-related portions of the CVCS satisfies GDC 60 regarding vents and drains containing gaseous and liquid radioactive material through closed systems.

- The CVCS component vents and drains are piped to the nuclear island vent and drain system (NIDVS), which allows storage and processing of the discharged liquids. The gases discharged from the CVCS are collected and processed in the gaseous waste processing system.

The design of safety-related portions of the CVCS satisfies GDC 61 regarding the assurance of adequate safety under normal and postulated accident conditions.

- The CVCS design permits periodic inspections with suitable shielding for radiation protection and with appropriate containment, confinement and filtering systems. To allow personnel access to different system components while maintaining exposure low, radioactive components are separated from non-radioactive components.

The design of safety-related portions of the CVCS satisfies 10 CFR 50.34(f)(2)(xxvi) regarding detection of reactor coolant leakage outside containment by providing leakage control and detection systems in the CVCS and implementation of appropriate leakage control program.

- The CVCS isolates components or piping so that the CVCS safety function is not compromised. Design provisions include the capability to identify and isolate the