## ArevaEPRDCPEm Resource

**From:** WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
**Sent:** Friday, January 11, 2013 5:18 PM
**To:** Snyder, Amy
**Cc:** Miernicki, Michael; DELANO Karen (AREVA); LEIGHLITER John (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); WILLS Tiffany (AREVA); WELLS Russell (AREVA)
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 388 (4601, 4586), FSAR Ch. 3, Supplement 3
**Attachments:** RAI 388 Supplement 3 Response US EPR DC.pdf

Amy,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI No. 388 on July 1, 2010. AREVA NP submitted Supplement 1 on August 5, 2010, which provided a technically correct and complete response to 1 of the remaining 3 questions. AREVA NP submitted Supplement 2 on September 7, 2010, which provided a technically correct and complete response to the remaining 2 questions. The attached file, "RAI 388 Supplement 3 Response US EPR DC.pdf" provides a technically correct and complete revised final response to Question 03.09.03-22. The purpose of this revision is as follows:

- COL Information Items 3.9-3 and 3.12-6 in U.S. EPR FSAR Tier 2, Table 1.8-2 and U.S. EPR FSAR Tier 2, Sections 3.9.3.1.1 and 3.12.5.10.4 were deleted since the U.S. EPR design takes into consideration the operating experience derived from NRC Bulletin 79-13 in that the U.S. EPR main feedwater lines are designed to minimize thermal stratification.

- U.S. EPR FSAR Tier 2, Section 3.9.3.1.1 and Section 14.2 were revised to provide additional information for the inspection and verification of the absence of thermal stratification in the main feedwater lines.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the revised response to Question 03.09.03-22.

The following table indicates the respective pages in the response document, "RAI 388 Supplement 3 Response US EPR DC.pdf" that contain AREVA NP's response to the subject question.

| Question # | Start Page | End Page |
|---|---|---|
| RAI 388 — 03.09.03-22 | 2 | 3 |

This concludes the formal AREVA NP response to RAI 388 and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

***Dennis Williford, P.E.***
***U.S. EPR Design Certification Licensing Manager***
**AREVA NP Inc.**
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

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**From:** BRYAN Martin (External RS/NB)
**Sent:** Tuesday, September 07, 2010 4:53 PM
**To:** Tesfaye, Getachew

**Cc:** ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); WELLS Russell (RS/NB); Miernicki, Michael
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 388, Supplement 2, FSAR Ch. 3

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI No. 388 on July 1, 2010. AREVA NP submitted Supplement 1 on August 5, 2010, which provided a technically correct and complete response to 1 of the remaining 3 questions. The attached file, "RAI 388 Supplement 2 Response US EPR DC.pdf" provides technically correct and complete responses to the remaining 2 questions (i.e., Questions 03.09.03-22 and 03.09.03-23), 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 Questions 03.09.03-22 and 03.09.03-23.

The following table indicates the respective pages in the response document, "RAI 388 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

| Question # | Start Page | End Page |
|---|---|---|
| RAI 388 — 03.09.03-22 | 2 | 3 |
| RAI 388 — 03.09.03-23 | 3 | 3 |

This concludes the formal AREVA NP response to RAI 388 and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

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**From:** BRYAN Martin (EXT)
**Sent:** Thursday, August 05, 2010 5:43 PM
**To:** 'Tesfaye, Getachew'
**Cc:** DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); WELLS Russell (RS/NB); CORNELL Veronica (EXT)
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 388, Supplement 1, FSAR Ch. 3

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI No. 335 on July 1, 2010. The attached file, "RAI 388 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete response to 1 of the remaining 3 questions, as committed. The responses to Questions 03.09.03-22 and 03.09.03-23 are deferred to allow additional time to address NRC comments.

The attached file, "RAI 388 Response US EPR DC.pdf" provides a technically correct and complete response to question 03.12-24. 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 388 Question 03.12-24.

The following table indicates the respective pages in the response document, “RAI 388 Response US EPR DC.pdf” that contain AREVA NP’s response to the subject questions.

| Question # | Start Page | End Page |
|---|---|---|
| RAI 388 — 03.12-24 | 2 | 3 |

The schedule for technically correct and complete responses to the remaining 3 questions has been changed and is provided below.

| Question # | Response Date |
|---|---|
| RAI 388 — 03.09.03-22 | September 10, 2010 |
| RAI 388 — 03.09.03-23 | September 10, 2010 |

Sincerely,

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**From:** BRYAN Martin (EXT)
**Sent:** Thursday, July 01, 2010 4:42 PM
**To:** 'Tesfaye, Getachew'
**Cc:** ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT); CORNELL Veronica (EXT)
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 388, FSAR Ch. 3

Getachew,

Attached please find AREVA NP Inc.’s response to the subject request for additional information (RAI). The attached file, “RAI 388 Response US EPR DC.pdf” provides a schedule since a technically correct and complete response to the 3 questions is not provided.

The following table indicates the respective pages in the response document, “RAI 388 Response US EPR DC.pdf” that contain AREVA NP’s response to the subject questions.

| Question # | Start Page | End Page |
|---|---|---|
| RAI 388 — 03.09.03-22 | 2 | 2 |
| RAI 388 — 03.09.03-23 | 3 | 3 |
| RAI 388 — 03.12-24 | 4 | 4 |

A complete answer is not provided for 3 of the 3 questions. The schedule for a technically correct and complete response to these questions is provided below.

| Question # | Response Date |
|---|---|
| RAI 388 — 03.09.03-22 | August 5, 2010 |
| RAI 388 — 03.09.03-23 | August 5, 2010 |
| RAI 388 — 03.12-24 | August 5, 2010 |

Sincerely,

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**From:** Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
**Sent:** Wednesday, June 02, 2010 7:22 AM
**To:** ZZ-DL-A-USEPR-DL
**Cc:** Le, Tuan; Hsu, Kaihwa; Dixon-Herrity, Jennifer; Miernicki, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
**Subject:** U.S. EPR Design Certification Application RAI No. 388 (4601, 4586),FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on April 6, 2010, and discussed with your staff on May 28, 2010 and June 1, 2010. No changes were made to the draft RAI as a result of those discussions. 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:** 4138

**Mail Envelope Properties** (554210743EFE354B8D5741BEB695E6560A72F3)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 388 (4601, 4586), FSAR Ch. 3, Supplement 3
**Sent Date:** 1/11/2013 5:17:30 PM
**Received Date:** 1/11/2013 5:17:40 PM
**From:** WILLIFORD Dennis (AREVA)

**Created By:** Dennis.Williford@areva.com

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| **Files** | **Size** | **Date & Time** |
|---|---|---|
| MESSAGE | 8276 | 1/11/2013 5:17:40 PM |
| RAI 388 Supplement 3 Response US EPR DC.pdf | 567388 | |

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**Return Notification:** No
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**Sensitivity:** Normal
**Expiration Date:**
**Recipients Received:**

**Response to**

**Request for Additional Information No. 388(4601, 4586), Revision 0**
**Supplement 3**

**6/02/2010**

**U.S. EPR Standard Design Certification**
**AREVA NP Inc.**
**Docket No. 52-020**
**SRP Section: 03.09.03 - ASME Code Class 1, 2, and 3 Components**
**SRP Section: 03.12 - ASME Code Class 1, 2, and 3 Piping Systems and Piping Components and Their Associated Supports**

**Application Section: FSAR Chapter 3**

**QUESTIONS for Engineering Mechanics Branch 1 (AP1000/EPR Projects) (EMB1)**
**QUESTIONS for Engineering Mechanics Branch 2 (ESBWR/ABWR Projects) (EMB2)**

**Question 03.09.03-22:**

In EPR FSAR Tier 2, Section 3.9.3.1.1, AREVA indicated that the COL applicant referencing the US EPR design certification will examine the feedwater line welds after hot functional testing prior to fuel load in accordance with NRC Bulletin 79-13. Specifically, in Tier 2, Table 1.8-2, Item No. 3.9-3, AREVA stated that a COL Holder referencing the EPR design certificate will report the results of inspections to NRC, in accordance with NRC Bulletin 79-13. According to 10 CFR 52.47(b)(1), a DC application must contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations.

The staff understands that AREVA is proposing to have COL applicants (or Holders in this case) address the final resolution of the issue. However, the staff concern is that COL applicants must address all COL Items whether final action is taken before or after the license is issued. If the information is not provided, COL applicants need to meet RG 1.206 and let the staff know when and how the information will be provided. Given that it is acknowledged that the action will occur during construction, to allow the staff to perform necessary inspection of the report results ensuring the feedwater line welds has been examined, the staff finds that an ITAAC in the FSAR is necessary. The staff requests the applicant to add an appropriate ITAAC in EPR FSAR Tier 1 to address the issue.

**Response to Question 03.09.03-22:**

This response to RAI 388, Question 03.09.03-22, supersedes in its entirety the response provided to RAI 388, Question 03.09.03-22, in Supplement 2

Construction will be finished prior to completion of hot functional testing. Therefore, weld inspection after hot functional testing is not a construction issue. U.S. EPR FSAR Tier 2, Section 14.2 will be revised to include this inspection as part of the initial test program. U.S. EPR FSAR Tier 2, Section 14.2, Test #033 will be revised to also include the feedwater nozzle inspection in accordance with NRC Bulletin 79-13. (Note these changes were reflected in Revision 2 of the U.S. EPR FSAR).

COL Information Items 3.9-3 and 3.12-6 in U.S. EPR FSAR Tier 2, Table 1.8-2, and U.S. EPR FSAR Tier 2, Sections 3.9.3.1.1 and 3.12.5.10.4, will be deleted based on the following information:

- As noted in Section 3.7.1 of AREVA NP Topical Report ANP-10264NP-A and U.S. EPR FSAR Tier 2, Section 3.12.5.10.4, the U.S. EPR design takes into consideration the operating experience derived from NRC Bulletin 79-13 in that the U.S. EPR main feedwater lines are designed to minimize thermal stratification. The main feedwater nozzle (located in the conical shell of the steam generator) and the adjacent feedwater line is angled downward from the horizontal to minimize the potential for thermal stratification.

- As noted above, U.S. EPR FSAR Tier 2, Section 14.2 was revised to include inspection of the feedwater line welds as part of the initial test program in accordance with NRC Bulletin 79-13.

- ITAAC also exist for the inspection of pressure-boundary welds in ASME Code Class 1, 2 and 3 components to confirm that they meet ASME Code Section III non-destructive examination requirements (e.g., U.S. EPR FSAR Tier 1, Table 2.8.6-3, Item 3.7).

U.S. EPR FSAR Tier 2, Section 3.9.3.1.1, will be revised to indicate that inspection of the feedwater line welds, in accordance with NRC Bulletin 79-13, is performed as part of the initial test program (Section 14.2.12.3.10) and that additional information on feedwater line stratification is provided in U.S. EPR FSAR Tier 2, Section 3.12.5.10.4.

U.S. EPR FSAR Tier 2, Section 14.2, Test #195 will be revised to verify the absence of the thermal stratification in the main feedwater lines. U.S. EPR FSAR Tier 2, Section 3.12.5.10.4 will also be revised to indicate that monitoring of the main feedwater line temperatures in accordance with U.S. EPR FSAR Tier 2, Section 14.2, Test #195 will verify that the design transients are representative of actual operations and to verify the absence of thermal stratification in the main feedwater lines.

**FSAR Impact:**

U.S. EPR FSAR Tier 2, Sections 3.9.3.1.1 and 3.12.5.10.4, and U.S. EPR FSAR Tier 2, Table 1.8-2, will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Section 14.2.12.3.10 and Section 14.2.12.16.3, will be revised as described in the response and indicated on the enclosed markup. (Note these changes were reflected in Revision 2 of the U.S. EPR FSAR).

# U.S. EPR Final Safety Analysis Report Markups

**Table 1.8-2—U.S. EPR Combined License Information Items**
**Sheet 14 of 40**

| Item No. | Description | Section |
|---|---|---|
| 3.9-2 | A COL applicant that references the U.S. EPR design certification will prepare the design specifications and design reports for ASME Class 1, 2, and 3 components, piping, supports and core support structures that comply with and are certified to the requirements of Section III of the ASME Code. The COL applicant will address the results and conclusions from the reactor internals material reliability programs applicable to the U.S. EPR reactor internals with regard to known aging degradation mechanisms such as irradiation-assisted stress corrosion cracking and void swelling addressed in Section 4.5.2.1. | 3.9.3 |
| 3.9-3 | ~~A COL applicant that references the U.S. EPR design certification will examine the feedwater line welds after hot functional testing prior to fuel loading and at the first refueling outage, in accordance with NRC Bulletin 79-13. A COL applicant that references the U.S. EPR design certification will report the results of inspections to the NRC, in accordance with NRC Bulletin 79-13.~~ Deleted | ~~3.9.3.1.1~~Deleted |
| 3.9-4 | As noted in ANP-10264NP-A, a COL applicant that references the U.S. EPR design certification will confirm that thermal deflections do not create adverse conditions during hot functional testing. | 3.9.3.1.1 |
| 3.9-5 | As noted in ANP-10264NP-A, should a COL applicant that references the U.S. EPR design certification find it necessary to route Class 1, 2, and 3 piping not included in the U.S. EPR design certification so that it is exposed to wind and tornadoes, the design must withstand the plant design-basis loads for this event. | 3.9.3.1.1 |
| 3.9-6 | A COL applicant that references the US EPR design certification will identify any additional site-specific valves in Table 3.9.6-2 to be included within the scope of the IST program. | 3.9.6.3 |
| 3.9-7 | A COL applicant that references the U.S. EPR design certification will submit the preservice testing (PST) program and IST program for pumps, valves, and snubbers as required by 10 CFR 50.55a. | 3.9.6 |
| 3.9-8 | A COL applicant that references the US EPR design certification will identify any additional site-specific pumps in Table 3.9.6-1 to be included within the scope of the IST program. | 3.9.6.2 |
| 3.9-9 | COL applicant that references the U.S. EPR design certification will either use a piping analysis program based on the computer codes described in Section 3.9.1 and Appendix 3C or will implement a U.S. EPR benchmark program using models specifically selected for the U.S. EPR. | 3.9.1.2 |
| 3.9-10 | Pipe stress and support analysis will be performed by a COL applicant that references the U.S. EPR design certification. | 3.9.1.2 |

**Table 1.8-2—U.S. EPR Combined License Information Items**
**Sheet 17 of 40**

| Item No. | Description | Section |
|---|---|---|
| 3.12-4 | A COL applicant that references the U.S. EPR design certification will monitor pressurizer surge line temperatures during the first fuel cycle of initial plant operation to verify that the design transients for the surge line are representative of actual plant operations. | 3.12.5.10.1 |
| 3.12-5 | A COL applicant that references the U.S. EPR design certification will monitor the normal spray line temperatures during the first cycle of the first U.S. EPR initial plant operation to verify that the design transients for the normal spray are representative of actual plan operations unless data from a similar plant's operation determines that monitoring is not warranted. | 3.12.5.10.3 |
| 3.12-6 | ~~A COL applicant that references the U.S. EPR design certification will monitor the temperature of the main feedwater lines during the first cycle of the first U.S. EPR initial plant operation to verify that the design transients for the main feedwater lines are representative of actual plant operations unless data from a similar plant's operation determines that monitoring is not warranted.~~ Deleted | ~~3.12.5.10.4~~Deleted |
| 3.13-1 | A COL applicant referencing the U.S. EPR design certification will submit the inservice inspection program for ASME Code Class 1, Class 2, and Class 3 threaded fasteners, to the NRC prior to performing the first inspection. The program will identify the applicable edition and addenda of ASME Section XI and ensure compliance with the requirements of 10CFR50.55a(b)(2)(xxvii). | 3.13.2 |
| 3E-1 | A COL applicant that references the U.S. EPR design certification will address critical sections relevant to site-specific Seismic Category I structures. | 3E |
| 5.2-1 | Deleted | |
| 5.2-2 | A COL applicant that references the U.S. EPR design certification will identify additional ASME code cases to be used. | 5.2.1.2 |
| 5.2-3 | A COL applicant that references the U.S. EPR design certification will identify the implementation milestones for the site-specific ASME Section XI preservice and inservice inspection program for the reactor coolant pressure boundary, consistent with the requirements of 10 CFR 50.55a (g). The program will identify the applicable edition and addenda of the ASME Code Section XI, and will identify additional relief requests and alternatives to Code requirements. | 5.2.4 |
| 5.2-4 | A COL applicant that references the U.S. EPR design certification will develop procedures in accordance with RG 1.45, Revision 1. | 5.2.5.5 |

### Thermal Stratification, Cycling, and Striping

Thermal stratification, cycling, and striping (including applicable NRC Bulletins 79-13, 88-08, and 88-11) are described in Section 3.7 of Reference 2. The pressurizer surge line is analyzed with the main coolant loop piping and supports as described in Appendix 3C. As noted in ANP-10264NP-A, a COL applicant that references the U.S. EPR design certification will confirm that thermal deflections do not create adverse conditions during hot functional testing.

~~A COL applicant that references the U.S. EPR design certification will examine the feedwater line welds after hot functional testing prior to fuel loading and at the first refueling outage, in accordance with NRC Bulletin 79-13. A COL applicant that references the U.S. EPR design certification will report the results of inspections to the NRC, in accordance with NRC Bulletin 79-13.~~ Inspection of the feedwater line welds, in accordance with NRC Bulletin 79-13, is performed as part of the initial test program (Section 14.2.12.3.10). Additional information on feedwater line stratification is provided in Section 3.12.5.10.4.

### Environmental Fatigue

The effects of the environment on fatigue for Class 1 piping and components are addressed in FSAR Section 3.12 and in Section 3.4 of Reference 2.

#### 3.9.3.1.2 Load Combinations and Stress Limits for Class 1 Components

Table 3.9.3-1—Load Combinations and Acceptance Criteria for ASME Class 1 Components provides the loading combinations and corresponding stress design criteria per ASME Service Level for ASME Class 1 components.

#### 3.9.3.1.3 Load Combinations and Stress Limits for Class 2 and 3 Components

Table 3.9.3-2—Load Combinations and Acceptance Criteria for ASME Class 2 and 3 Components provides the loading combinations and corresponding stress design criteria per ASME Service Level for ASME Class 2 and 3 components.

#### 3.9.3.1.4 Load Combinations and Stress Limits for Class 1 Piping

Table 3-1 of Reference 2 provides the loading combinations and corresponding stress design criteria per ASME Service Level for ASME Class 1 piping.

#### 3.9.3.1.5 Load Combinations and Stress Limits for Class 2 and 3 Piping

Table 3-2 of Reference 2 provides the loading combinations and corresponding stress design criteria per ASME Service Level for ASME Class 2 and 3 piping.

### 3.12.5.10.4 Feedwater Line Stratification (NRC Bulletin 79-13)

NRC Bulletin 79-13 was issued as a result of a feedwater line cracking incident and the subsequent inspections resulting in discovery of cracks in the feedwater lines of several nuclear power plants. The primary cause of the cracking was determined to be thermal fatigue loading due to thermal stratification during low flow emergency feedwater and main feedwater injections.

The U.S. EPR main feedwater lines are designed to minimize thermal stratification. The main feedwater nozzle (located in the conical shell of the steam generator) and the adjacent feedwater line is angled downward from the horizontal to minimize the potential for thermal stratification. During steady-state operations, thermal stratification is prevented because of a continuous flow in the feedwater lines. During low flow actuation and flow shutdown, thermal stratification in the main feedwater line near the steam generator occurs. Monitoring of the main feedwater line temperatures in accordance with U.S. EPR FSAR Tier 2, Section 14.2, Test #195 will verify that the design transients are representative of actual operations and will also verify the absence of thermal stratification in the main feedwater lines. ~~A COL applicant that references the U.S. EPR design certification will monitor the temperature of the main feedwater lines during the first cycle of the first U.S. EPR initial plant operation to verify that the design transients for the main feedwater lines are representative of actual plant operations unless data from a similar plant's operation determines that monitoring is not warranted.~~

The emergency feedwater system (EFWS) is not actuated during normal operations. The EFWS actuation occurs only during reactor trip at full power with a subsequent return to full power (i.e., Upset Transient 1A, see Section 3.9.1.1.2), and during emergency and faulted plant operations (see Sections 3.9.1.1.3 and 3.9.1.1.4). The low frequency of occurrence of EFWS and the EFWS piping layout minimize thermal stratification during upset, emergency, and faulted plant operations.

### 3.12.5.11 Safety Relief Valve Design, Installation, and Testing

Section 3.8 of Reference 1 addresses the design and installation of pressure relief devices. Additional information is provided in Section 3.9.3.

### 3.12.5.12 Functional Capability

Section 3.5 of Reference 1 addresses conformance with NUREG-1367, "Functional Capability of Piping Systems" (Reference 5).

### 3.12.5.13 Combination of Inertial and Seismic Anchor Motion Effects

As noted in Section 3.3.1.4 of Reference 1, the design of Seismic Category I piping and supports includes analysis of the inertial and anchor movement effects of the safe

minimum nil-ductility temperature during the required system hold or examination period.

3.3 Pressurize the primary side as required to maintain less than maximum secondary to primary differential pressure.

3.4 Pressurize the SG to the pressure required by the technical manual.

3.5 Perform an inspection of designated items and record any discrepancies.

4.0 DATA REQUIRED

4.1 Record SG pressure and temperatures during performance of the test.

4.2 Record the location of any observed leakage.

5.0 ACCEPTANCE CRITERIA

5.1 The SGs hydrostatic test meets the requirements as stated in the SG technical manual and the ASME, "Boiler and Pressure Vessel Code," Section III.

### 14.2.12.3.10 Steam Generator Downcomer Feedwater System Water Hammer (Test #033)

1.0 OBJECTIVE

1.1 To demonstrate the absence of any significant water hammer during SG water level recovery following the exposure of the downcomer feedwater sparger to a steam environment and to inspect the feedwater line welds in accordance with NRC Bulletin 79-13.

2.0 PREREQUISITES

2.1 Construction activities on the EFWS and those sections of the feedwater system (MFWS) that are affected have been completed.

2.2 The feedwater control instrumentation and other appropriate permanently installed instrumentation have been calibrated and are functioning satisfactorily.

2.3 Main steam system (MSS) is available.

2.4 Appropriate AC and DC power sources are available.

2.5 RCS operating at nominal HZP (pressure and temperature) conditions.

3.0 TEST METHOD

3.1 Lower the SG water level below the feedwater and emergency feedwater headers but within the narrow range (NR) level indication band for a period of 30 minutes (no feedwater shall be introduced into the generator through the feedwater header during this period).

3.2 Monitor for noise or vibration by stationing personnel as appropriate.

3.3 Initiate feedwater flow to restore SG level in a manner that simulates automatic EFWS actuation.

3.4 Repeat the test using the startup, standby pump to restore SG level in a manner that simulates automatic actuation.

4.0 DATA REQUIRED

4.1 Visually inspect the accessible portions of feedwater piping and piping supports following the performance of the test to verify operability and conformance to design.

4.2 Visual inspection of SG sparger shall be performed prior to core load.

4.3 Perform radiographic examination, supplemented by ultrasonic examination as necessary to evaluate indications, of all feedwater nozzle-to-pipe welds and of adjacent pipe and nozzle areas (a distance equal to at least two wall thicknesses).

5.0 ACCEPTANCE CRITERIA

5.1 Perform a visual inspection consisting of both a quantitative and qualitative evaluation of feedwater piping, supports, and sparger and determine if the integrity of components has not been violated with performance of EFWS initiation testing.

5.1.1 The quantitative component of the evaluation is a post-test evaluation of the SG sparger for visual damage. The inspection will look for cracked welds and inspect the sparger by comparing as-built dimensions to post-test dimensions. Any dimensional differences will be evaluated. The specific allowable dimensional differences are not typically specified in the SG design package and are evaluated on a case-by-case basis if differences are noted.

5.1.2 The qualitative component evaluation consists of noise and vibration analysis. The source of noise and vibration may be indicative of EFW line voiding or two phase flow and can lead to future sparger degradation if not corrected.

5.2 Evaluation shall be in accordance with ASME Section III, Subsection NC, Article NC-5000. Radiography shall be performed to the 2T penetrameter sensitivity level, in lieu of Table NC-5111-1, with systems void of water.

5.2.1 In the event cracking is identified during examination of the nozzle-to-pipe weld, all feedwater line welds up to the first piping support or snubber outboard of the nozzle shall be volumetrically examined in accordance with the requirements of Sections 4.3 and 5.2 of this test.

### 14.2.12.16.3 Main, Startup and Emergency Feedwater Systems (Test #195)

1.0 OBJECTIVE

1.1 To record the operation of the following feedwater supplies during normal and transient conditions (e.g., plant trips, load swings):

1.1.1 Main feedwater.

1.1.2 Startup feedwater.

1.1.3 EFWS.

1.2 This procedure shall be repeated at the following plateaus:

1.2.1 ≤5 percent reactor power.

1.2.2 25 percent reactor power.

1.2.3 50 percent reactor power.

1.2.4 75 percent reactor power.

1.2.5 ≥98 percent reactor power.

1.3 Verify the absence of thermal stratification in the main feedwater lines.

2.0 PREREQUISITES

2.1 Establish list of parameters that indicate satisfactory feedwater operation. The list shall include as a minimum the following:

2.1.1 Feedwater pump status for each pump.

2.1.2 Feedwater flow, temperature, and pressure.

2.1.3 SG level, pressure, and component noise/vibration.

2.1.4 Reactor power, RCCA position, and RCS temperatures.

2.2 Install temporary instrumentation as necessary to measure system vibration in transient conditions.

2.3 Install temporary instrumentation to monitor thermal stratification on at least three sections of horizontal piping on each of the following systems:

2.3.1 Main feedwater.

- Fast Response RTD on top of horizontal piping section with ability to monitor locally.
- Fast response RTD on bottom of horizontal piping section with ability to monitor locally.

2.3.2 Startup feedwater.

- Fast response RTD on top of horizontal piping section with ability to monitor locally.
- Fast response RTD on bottom of horizontal piping section with ability to monitor locally.

2.3.3 EFWS.

- Fast response RTD on top of horizontal piping section with ability to monitor locally.
- Fast response RTD on bottom of horizontal piping section with ability to monitor locally.

3.0 TEST METHOD

3.1 Performance of the feedwater systems shall be monitored during standby, normal operation, transients, and trips.

3.2 Operate systems in a manner to include a full range of flows, including minimum and maximum conditions.

3.3 Check for water hammer noise using appropriately placed personnel or check for water hammer vibration using suitable instrumentation.

3.4 Check for signs of thermal stratification during periods of no or very low flow using the temporary installed instrumentation.

3.5 Verify that the following feedwater systems are capable of removing decay heat, residual heat from the metal mass, and RCP heat following shutdown:

3.5.1 Startup and shutdown feedwater.

3.5.2 Emergency feedwater.

3.6 Verify that the turbine bypass system is capable of removing residual heat (this step is only applicable at the 25% plateau).

3.7 Verify that the atmospheric dump valves are capable of removing residual heat (this step is only applicable at the 25% plateau).

4.0 DATA REQUIRED

4.1 Conditions of the measurement:

4.1.1 Reactor power.

4.1.2 RCS temperatures.

4.1.3 Pressurizer pressure.

4.1.4 SG levels and pressures.

4.1.5 Steam and feedwater flows.

4.1.6 Feedwater temperature and pressure.

4.1.7 RCCA position.

4.2 Attach a copy of isometric drawings to indicate the areas where thermal stratification instrumentation was installed.

5.0 ACCEPTANCE CRITERIA

5.1 The main, startup and EFWS perform as designed (refer to Section 10.4.7).

5.2 No effects due to water hammer are detected.

5.3 Thermal stratification is not detected.

5.4 The following feedwater systems demonstrate the design capability to remove decay heat, residual heat from the metal mass, and RCP heat following a reactor trip:

5.4.1 Startup and shutdown feedwater.

5.4.2 Emergency feedwater.

### 14.2.12.16.4 Natural Circulation (Test #196)

A COL applicant that references the U.S. EPR certified design will either perform the natural circulation test (Test #196) or provide justification for not performing the test. The need to perform the test will be based on evaluation of previous natural circulation test results and a comparison of reactor coolant system (RCS) hydraulic resistance coefficients applicable to normal flow conditions. Justification for not performing the test will be based on the following:

- Test results from the U.S. EPR reference prototype plant indicate that natural circulation flow rates are adequate for core decay heat removal, boron mixing, plant cooldown/ depressurization, and stable natural circulation conditions are maintained throughout the test.

- As-built plant and the U.S. EPR reference prototype plant configurations are the same relative to the general configuration of the piping and components in each reactor coolant loop, the general arrangement of the reactor core and internals, and similar elevation head represented by these components and the system piping.

- Hydraulic resistance coefficients applicable to normal flow conditions and temperature data, and loss of coolant flow delay-time data (as measured during the RCS flow measurement and coastdown test data in the post-core RCS flow baseline test (Test #183)) are comparable with the reference prototype plant.

- Results of the natural circulation test from the U.S. EPR reference prototype plant are incorporated into a plant-referenced simulator that meets the requirements of 10 CFR 55.46(c) and used in the operator training program to provide training on plant evaluation and abnormal events for each operating shift.

1.0 OBJECTIVE

1.1 To confirm that natural circulation flow shall remove decay heat from the reactor (no forced circulation from the RCPs).

1.2 To confirm boron mixing occurs under natural circulation conditions.

1.3 To determine the response to a sudden loss of forced RCS flow. This procedure shall be performed at the following plateau:

1.3.1 Less than or equal to five percent reactor power in accordance with RG 1.68.