ArevaEPRDCPEm Resource

From:	Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent:	Friday, February 13, 2009 5:30 PM
To:	Getachew Tesfaye
Cc:	BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)
Subject:	Response to U.S. EPR Design Certification Application RAI No. 109, Supplement 1
Attachments:	RAI 109 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided responses to 4 of the 7 questions of RAI No. 109 on December 15, 2008. The attached file, "RAI 109 Supplement 1 Response US EPR DC.pdf," provides technically correct and complete responses to 2 of the remaining 3 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 109 Supplement 1 Question 03.05.01.01-1, and 03.05.01.02-1.

The following table indicates the respective pages in the response document, "RAI 109 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 109 — 03.05.01.01-1	2	6
RAI 109 — 03.05.01.02-1	7	8

A complete answer is not provided for 1 of the 7 questions. The schedule for a technically correct and complete response to the remaining question is unchanged and provided below:

Question #	Response Date
RAI 109 — 03.05.01.03-2	February 20, 2009

Sincerely,

Ronda Pederson
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AREVA NP Inc.
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From: WELLS Russell D (AREVA US)
Sent: Monday, December 15, 2008 7:30 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. 109, FSAR Ch 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 109 Response US EPR DC.pdf" provides technically correct and complete responses to 4 of the 7 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 109 Questions 03.04.01-1, 03.04.01-2, 03.04.01-3, 03.05.01.01-1, and 03.05.01.02-1.

The following table indicates the respective pages in the response document, "RAI 109 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 109 — 03.04.01-1	2	2
RAI 109 — 03.04.01-2	3	3
RAI 109 — 03.04.01-3	4	5
RAI 109 — 03.05.01.01-1	6	9
RAI 109 — 03.05.01.02-1	10	11
RAI 109 — 03.05.01.03-2	12	12
RAI 109 — 03.05.01.03-3	13	14

A complete answer is not provided for 3 of the 7 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 109 — 03.05.01.01-1.a	February 13, 2009
RAI 109 — 03.05.01.01-1.c	February 13, 2009
RAI 109 — 03.05.01.01-1.e	February 13, 2009
RAI 109 — 03.05.01.01-1.g	February 13, 2009
RAI 109 — 03.05.01.02-1.b	February 13, 2009
RAI 109 — 03.05.01.03-2.a	February 20, 2009
RAI 109 — 03.05.01.03-2.b	February 20, 2009
RAI 109 — 03.05.01.03-2.c	February 20, 2009
RAI 109 — 03.05.01.03-2.d	February 20, 2009

Sincerely,

(Russ Wells on behalf of)

Ronda Pederson
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, November 14, 2008 10:31 AM
To: ZZ-DL-A-USEPR-DL
Cc: Chang Li; Stephen Campbell; David Shum; John Segala; John Honcharik; David Terao; Michael Miernicki; Joseph Colaccino; John Rycyna; Tarun Roy
Subject: U.S. EPR Design Certification Application RAI No. 109 (1523, 1524,1525, 1128, 1129, 1419), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on October 20, 2008, and discussed with your staff on November 4, 2008. No change was made to the draft RAI 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: 220

Mail Envelope Properties (5CEC4184E98FFE49A383961FAD402D31A9FF05)

Subject: Response to U.S. EPR Design Certification Application RAI No. 109, Supplement 1
Sent Date: 2/13/2009 5:30:28 PM
Received Date: 2/13/2009 5:30:31 PM
From: Pederson Ronda M (AREVA NP INC)

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Files	**Size**	**Date & Time**
MESSAGE	4889	2/13/2009 5:30:31 PM
RAI 109 Supplement 1 Response US EPR DC.pdf		185326

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

Response to

Request for Additional Information No. 109, Supplement 1

11/14/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.04.01 - Internal Flood Protection for Onsite Equipment Failures
SRP Section: 03.05.01.01 - Internally Generated Missiles (Outside Containment)
SRP Section: 03.05.01.02 - Internally Generated Missiles (Inside Containment)
SRP Section: 03.05.01.03 - Turbine Missiles
Application Section: FSAR Ch. 3

QUESTIONS for Balance of Plant Branch 2 (ESBWR/ABWR) (SBPB)
QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

Question 03.05.01.01-1:

a. GDC 4, in part, requires SSCs to be protected from internally generated missiles. Maintenance equipment that is not secured or removed from an area is a potential gravitational missile source. However, evaluation of internal missiles outside containment resulting from failures of plant equipment and components, and unsecured maintenance equipment has not been provided.

   Provide an assessment of potential gravitational missiles generated outside containment and discuss the measures provided to prevent the impact of a falling object on safety-related SSCs. Also, revise the FSAR Tier 2 Table 1.8.2, “U.S. EPR Combined License Information items,” to include a COL information item to establish/provide procedures which ensure that equipment, such as a hoist that is required during maintenance, be either removed or seismically restrained following maintenance to prevent it from becoming a missile. Include this information in the FSAR and provide a markup in your response.

b. To ensure that the EPR design minimizes potential missile generation, in FSAR Tier 2 Section 3.5.1.1.3 AREVA states that high energy fluid systems and components are designed according to the requirements of the ASME BPV Code, Section III or VIII. ASME BPV Code, Section III specifies that valves with removable bonnets be the pressure seal-type or have bolted bonnets; therefore, valves that only have threaded connections between the body and bonnet are not used in high energy systems. The above statement is valid for Section III, Division 1, Class 1 components, however, Section III, Division 1, Class 2 Components allow threaded connections (NC-3266) and threaded bonnets on pressure relief valves with inlet connections NPS 2 and less (Section NC-3595.4 & ND-3595.4). In FSAR Tier 2 Table 3.2.2-1, AREVA shows Class 2 and 3 components located in high energy applications.

   Clarify the above FSAR discrepancy on valve bonnet connection types allowed in high energy systems. Include this information in the FSAR and provide a markup in your response. This RAI also applies to systems inside containment. Include this information in the FSAR and provide a markup in your response.

c. GDC 4, in part, requires SSCs to be protected from internally generated missiles. FSAR Tier 2 Section 3.5.1.1.3 states that portable and temporary gas cylinders, as well as gas cylinders that are periodically replaced in safety-related areas, are built in compliance with the regulations for seamless steel cylinders, as required by the U.S. Department of Transportation. As discussed in NUREG/CR-3551, portable compressed gas cylinders pose a significant missile hazard if not properly controlled, secured or restrained. However, evaluation of internal missiles outside containment resulting from unsecured and non-seismically restrained compressed gas cylinders during a seismic event has not been provided.

   Provide an assessment of potential missiles generated outside containment resulting from unsecured and non-seismically restrained compressed gas cylinders during a seismic event and discuss the measures provided to prevent the impact of such missiles on safety-related SSCs. Also, revise the FSAR Tier 2 Table 1.8.2 to include a COL information item to establish/provide procedures which ensure that pressurized gas cylinders be either removed or seismically restrained during power operation to prevent them from becoming missiles. Include this information in the FSAR and provide a markup in your response.

d. GDC 4, in part, requires SSCs to be protected from internally generated missiles. Missiles resulting from piping failures have not been addressed. A guillotine break of a high energy line could cause the piping attachments to become missile sources. Provide a discussion regarding if a postulated guillotine break of a high-energy line outside containment could become a potential missile source, and discuss the measures provided to prevent the impact of such missiles on safety-related SSCs. Include this information in the FSAR and provide a markup in your response.

e. GDC 4, in part, requires SSCs to be protected from internally generated missiles. Acceptance, in part, is based on adequately identifying credible missile sources. FSAR Tier 2 Section 3.5.1.1.3 states missile generation from hydrogen gas sources are minimized by equipment placement, line routing and adequate ventilation. However, FSAR Tier 2 Table 3.2.2-1 indicates that hydrogen piping and components are non-safety related and non-seismic. Failure of these hydrogen piping and components during a seismic event could cause hydrogen to accumulate in area of stagnant air flow, explode and generate a missile.

   Discuss the impact of hydrogen piping failures in the areas where the piping is routed for missile generation. Provide an evaluation to verify that no stagnant air pockets exist in areas that have hydrogen piping. Include this information in the FSAR and provide a markup in your response.

f. GDC 4, in part, requires SSCs to be protected from internally generated missiles. Where barriers are used to protect SSCs from internal missiles, the design is considered acceptable if it meets RG 1.115 Position C.3. Compliance to Position C.3 includes submittal of dimensioned plans and elevations that include wall and slab thickness and materials of pertinent structures. Provide drawings to show the above cited information. Include this information in the FSAR and provide a markup in your response.

g. Per Section II of SRP 3.5.1.1, regulation 10 CFR 52.47(b) (1) requires that a DC application 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.

   FSAR Tier 2 Section 3.5.1.1 describes the Areva's approach to identify potential missiles, determine the statistical significance of potential missiles, and provide measures for SSCs requiring protection against the effects of missiles outside containment. However, Sections 2.1 - Structures, 2.2 – Nuclear Island Systems, 2.3 – Severe Accident Systems, 2.4 – Instructmentation and Control Systems, 2.5 – Electric Power, 2.6 – HVAC Systems, 2.7 – Support Systems , 2.8 – Steam and Power Conversion Systems, 2.9, - Radioactive Waste Management, and 2.10 – Other systems of the FSAR Tier 1 Chapter 2.0, “System based design Descriptions and ITAAC,” do not contain design commitments or inspections, tests, analyses, and acceptance criteria to verify that SSCs outside containment are designed and constructed in accordance with the requirements as described in FSAR Tier 2 Section 3.5.1.1 to prevent or mitigate the effects of internally generated missiles outside containment.

   Therefore, provide an ITAAC that requires the COL applicant to perform a walk-down of the SSCs and to ensure that SSCs described in the above cited sections are protected from internally generated missiles (outside containment) in accordance with the requirements as described in FSAR Tier 2 Section 3.5.1.1. Also, identify which of the

SSCs are outside and which of the SSCs are inside the containment. Include this information in the FSAR and provide a markup in your response.

Response to Question 03.05.01.01-1:

a. For gravitational missiles outside containment, all non-seismic items in the area of essential systems are evaluated as discussed in U.S. EPR FSAR Tier 2, Section 3.7.3.8.1. This section requires such items to be shown as acceptable by either separation distance, by a barrier, or classified as Seismic Category II.

   For maintenance equipment, a paragraph referencing a COL action item will be added to U.S. EPR FSAR Tier 2, Section 3.5.1.1.3 as shown on the attached markup. In addition, Item 3.5-1 of U.S. EPR FSAR Tier 2, Table 1.8-2 will be modified to have the COL Applicant provide procedural controls for this equipment.

b. In high energy systems designed to ASME Section III, Class 1, Class 2, or Class 3, valves with removable bonnets for valve sizes larger than two-inches, will be the pressure seal-type or have bolted bonnets. In high energy systems designed to ASME Section III, Class 1, Class 2 or Class 3, valves sized two-inches and smaller with removable bonnets, except for Class 2 or Class 3 relief valves, will be the pressure seal-type or have bolted bonnets. Relief valves with an inlet piping connection two-inches and smaller may have threaded body-to-bonnet connections in accordance with ASME Section III, Division 1, Sections NC-3595.4 and ND-3595.4.

   ASME Section III, Division 1, Section NC-3266 deals with the connection between a pipe or tube to a pressure vessel, not with allowing threaded connections between a valve body and bonnet. U.S. EPR FSAR Tier 2, Section 3.5.1.1.3 states that thermowells and other instrument wells, vents, drains, test connections, and other fittings in high energy systems are welded to the piping or pressurized equipment.

   Valve body-to-bonnet connections for ASME Section III valves will be the same for inside and outside containment.

c. For compressed gas cylinders used in the U.S. EPR, a paragraph referencing a COL action item will be added to U.S. EPR FSAR Tier 2, Section 3.5.1.1.3 as shown on the attached markup. In addition, item 3.5-1 of U.S. EPR FSAR Tier 2, Table 1.8-2 will be modified to have the COL Applicant provide procedural controls for these items.

d. Missiles generated from high energy line breaks (HELB) have not been specifically addressed in U.S. EPR FSAR Tier 2, Section 3.5.1. U.S. EPR FSAR Tier 2, Sections 3.5.1.1.1 and 3.5.1.2.1 each refer to U.S. EPR FSAR Tier 2, Section 3.6, which describes protection against dynamic effects of HELB.

   SRP 3.6.1 and 3.6.2, as well as BTP 3-3 and 3-4 describe the requirements to perform rupture evaluations and provide the required protection where needed. These documents do not specifically address missiles created by the dynamic effects of HELBs. They do however, require the evaluation of these dynamic effects on essential system SSC. As a result of any jet impingement or pipe whip impact to intermediate items of significant size or weight, such potential missiles due to these intermediate items coming loose would need to be considered in these evaluations.

e. The Fuel Building (FB) is the only building that contains both hydrogen gas piping and essential systems SSC. The hydrogen piping is routed in rooms separate from essential system SSC, as currently stated in U.S. EPR FSAR Tier 2, Section 3.5.1.1.3..

f. In compliance with RG 1.115, Position C.3, the dimensioned plans and elevations showing wall and slab thicknesses for the standard plant structures are included in U.S. EPR FSAR Tier 2, Appendix 3B. The materials for these structures are provided in U.S. EPR FSAR Tier 2, Section 3.8.

g. U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 4.2 commits that Nuclear Island (NI) common basemat structures will be constructed to withstand design basis loads as specified in U.S. EPR FSAR Tier 1, Section 2.1.1, without loss of structural integrity and safety-related functions. The design basis loads include internal hazards such as internally generated missiles; however, internal hazards are not listed in the description of the design basis loads in U.S. EPR FSAR Tier 1, Section 2.1.1, Item 4.2. U.S. EPR FSAR Tier 1, Section 2.1.1, Item 4.2 text will be revised to include a description of the loads due to design basis internal events, including internally generated missiles.

   In addition, U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 4.4, requires separation to be provided between the four Safeguard Buildings (SB) and the FB so that internal hazard effects are contained within the SB or FB of origination.

   ITAAC items noted above require NI common basemat structures to be able to withstand internally generated missiles and provide separation to contain within the building of origin the effects of internal hazards such as internally generated missiles. Because ITAAC requires protection against internally generated missiles for SSC inside or outside of containment, it is not necessary to identify in the U.S. EPR FSAR whether or not a specific SSC is inside or outside of containment.

   For the Emergency Power Generating Building (EPGB) in U.S. EPR FSAR Tier 1, Table 2.1.2-2, Item 4.2 and Item 4.3, U.S. EPR FSAR Section 2.1.2, Item 4.3 will be revised to include a description of design basis internal events loads, including those of internally generated missiles.

   For the Essential Service Water Building in U.S. EPR FSAR Tier 1, Table 2.1.5-2, Item 4.2 and Item 4.3, U.S. EPR FSAR Tier 1, Section 2.1.5, Item 4.3 text will be revised to include a description of design basis internal events loads, including those of internally generated missiles.

FSAR Impact:

a. U.S. EPR FSAR Tier 2, Section 3.5.1.1.3 and item 3.5-1 of Table 1.8-2 will be revised as described in the response and indicated on the enclosed markup.

b. U.S. EPR FSAR Tier 2, Section 3.5.1.1.2 and Section 3.5.1.1.3 will be revised as described in the response and as indicated on the enclosed markup.

c. U.S. EPR FSAR Tier 2, Section 3.5.1.1.3 and item 3.5-1 of Table 1.8-2 will be revised as described in the response and indicated on the enclosed markup.

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

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

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

g. U.S. EPR FSAR Tier 1, Section 2.1.1, Section 2.1.2, and Section 2.1.5 will be revised as described in the response and indicated on the enclosed markup.

Greyed out text indicates question was previously answered in RAI #109.

Question 03.05.01.02-1:

a. GDC 4 requires that SSCs are protected from internally generated missiles. In FSAR Tier 2, Revision 1, Section 3.5.1.2.3 the applicant states, “Even though potential CRDM missiles are deemed non-credible as described in Section 3.5.1.2.2, the Closure Head Equipment (CHE) is designed to retain the CRDMs so that they are prevented from becoming a missile should the CRDM nozzle flange or pressure housing fail. Therefore, SSCs inside containment are designed to withstand a postulated CRDM missile, even though this event is deemed non-credible.” Clarify in the FSAR if the in containment SSCs are capable of withstanding a CRDM missile impact.

b. In accordance with SRP Section 3.5.1.2, regulation 10 CFR 52.47(b) (1) requires that a DC application 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.

FSAR Tier 2, Revision 1, Section 3.5.1.2 describes the AREVA’s approach to identify potential missiles, determine the statistical significance of potential missiles, and provide measures for SSCs requiring protection against the effects of missiles inside containment.

However, FSAR Tier 1, Revision 1, Chapter 2.0, “System Based Design Description of ITAAC” does not contain design commitments or inspections, tests, analyses, and acceptance criteria to verify that SSCs inside containment are designed and constructed in accordance with the requirements as described in FSAR Tier 2, Revision 1, Section 3.5.1.2 to prevent or mitigate the effects of internally generated missiles inside containment.

Therefore, provide an ITAAC that requires the COL applicant to perform a walk-down of the SSCs and to ensure that SSCs are protected from internally generated missiles (inside containment) in accordance with the requirements as described in FSAR Tier 2, Revision 1, Section 3.5.1.2. Include this information in the FSAR and provide a markup in your response.

Response to Question 03.05.01.02-1:

a. In compliance with GDC 4, U.S. EPR design provides a concrete missile shield over the refueling canal to absorb impact of control rod ejection due to postulated failure of a control rod drive mechanism (CRDM) housing as stated in U.S. EPR FSAR Tier 2, Section 3.8.3.1.7. The missile shield provides a barrier between CRDM and other SSC inside containment such that SSC beyond the missile shield are not required to be designed to withstand a CRDM missile impact.

U.S. EPR FSAR Tier 2, Section 3.5.1.2.3 will be revised by adding:

“Even though potential CRDM missiles are deemed non-credible as described in Section 3.5.1.2.2, the concrete missile shield over the refueling canal is designed to absorb impact of a control rod ejection due to postulated failure of a CRDM nozzle flange or pressure housing thereby providing adequate protection of other SSC inside containment.”

Therefore, the containment SSC are properly protected from a CRDM missile impact.

b. See response to Question 03.05.01.01-1g.

FSAR Impact:

a. U.S. EPR FSAR Tier 2, Section 3.5.1.2.3 will be revised as described in the response and as indicated on the enclosed markup.

b. U.S. EPR FSAR Tier 1, Section 2.1.1, Section 2.1.2 and Section 2.1.5 will be revised as described in the response to Question 03.05.01.01-1g and indicated on the enclosed markup.

Greyed out text indicates question was previously answered in RAI #109.

U.S. EPR Final Safety Analysis Report Markups

could lead to steam explosion. Installed barriers prevent core melt relocation to the upper containment, which could lead to direct containment heating.

2.0 Arrangement

2.1 The as-installed basic configuration of the NI structures is as described in Section 2.1.1, 1.0 Description, and as shown on Figures 2.1.1-1, 2.1.1-3—Reactor Building, 2.1.1-4, and 2.1.1-5.

3.0 Key Design Features

3.1 The basic configuration of the NI structures includes: (a) an integrated contiguous barrier (b) decoupling of SBs 2 and 3 and the FB from their respective structures at their exterior walls along the entire wall length and at the SBs 2 and 3 upper ceiling and (c) SBs 2 and 3 decoupling from the RSB above elevation 0 feet, 0 inches as described in Section 2.1.1, and as shown on Figures 2.1.1-1, 2.1.1-2, 2.1.1-4, 2.1.1-6, 2.1.1-8 and 2.1.1-10—Fuel Building - View 2.

3.2 Six rib support structures, provided at the bottom of the reactor cavity, as shown on Figure 2.1.1-13—Concrete Barriers and Rib Support Structures, limit lower reactor pressure vessel head deformation due to thermal expansion and creep during severe accident mitigation.

3.3 As described in Table 2.1.1-3—Spreading Area Water Ingression Barrier, a flooding ~~wall~~ barrier consisting of several walls is provided to prevent ingress of water into the core melt spreading area. This ~~wall~~ barrier includes a watertight door that provides entry to the venting shaft of the spreading area.

3.4 Core melt cannot relocate to the upper containment due to the existence of concrete barriers as shown on Figure 2.1.1-13.

4.0 Mechanical Design Features, Seismic 1E Classifications

4.1 The NI site grade level is located at elevation ~~0~~ -1 ~~feet~~foot, 0 inches as indicated on Figures 2.1.1-7—SB 1, 2.1.1-8, 2.1.1-9—SB 4, and 2.1.1-10.

4.2 The NI as-installed basic configuration structural supports, including critical sections, are S~~s~~eismic Category I and are constructed to withstand design basis loads without loss of structural integrity and safety-related functions. The design basis loads are those loads associated with:

03.05.01.01-1 and 03.05.01.02-1

- Normal plant operation (including dead loads, live loads, lateral earth pressure loads, equipment loads, hydrostatic, hydrodynamic, and temperature loads).
- Internal events (including internal flood loads, accident pressure loads, accident thermal loads, accident pipe reactions, and pipe break loads – including reaction loads, jet impingement loads, and missle impact loads).
- External events (including rain, snow, flood, tornado, tornado-generated missiles, earthquake, aircraft hazard, and explosion pressure wave).

4.0 Mechanical Design Features, Seismic 1E Classifications

4.1 The EPGBs site grade level is at elevation ~~0 feet~~ 1 foot 0 inches, as indicated on Figure 2.1.2–2—Emergency Power Generating Building - View 1 and Figure 2.1.2–3—Emergency Power Generating Building - View 2.

4.2 The EPGBs are separated to address internal hazards, including fire and flood as described in Table 2.1.2–1—EPGB Separation for Internal Hazards.

4.3 The EPGBs as-installed basic configuration structural supports are Seismic Category I and are designed and constructed to withstand design basis loads without loss of structural integrity and safety-related functions. The design bases loads are those loads associated with the following:

03.05.01.01-1 and 03.05.01.02-1

- Normal plant operation (including dead loads, live loads, lateral earth pressure loads, hydrostatic loads, hydrodynamic loads, and temperature loads).
- Internal events (including internal flood loads, accident pressure loads, accident thermal loads, accident pipe reactions, and pipe break loads – including reaction loads, jet impingement loads, and missle impact loads).
- External events (including rain, snow, flood, tornado, tornado-generated missiles, and earthquake).

5.0 Interface Requirements

There are no interface requirements for the EPGBs.

6.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.1.2–2—Emergency Power Generating Building Inspections, Tests, Analyses, and Acceptance Criteria specifies the inspections, tests, analyses, and associated acceptance criteria for the EPGBs.

two ESWBs located adjacent to the Turbine Building have five missile protection shields provided for the safety-related fans and pumps; these ESWBs are positioned favorably outside the low-trajectory hazard zone for turbine missiles.

4.0 Mechanical Design Features, Seismic 1E Classifications

4.1 The ESWBs site grade level is at elevation ~~0~~ -1 ~~feet~~foot, 0 inches as indicated on Figures 2.1.5-4 and 2.1.5-5.

4.2 ESWBs are separated to address internal hazards, including fire and flood as described in Table 2.1.5-1—ESWB Separation For Internal Hazards.

4.3 The ESWBs as installed basic configuration structural supports are Seismic Category I and are designed and constructed to withstand design basis loads without loss of structural integrity and safety-related functions. The design basis loads are those loads associated with:

03.05.01.01-1 and 03.05.01.02-1

- Normal plant operation (including dead loads, live loads, lateral earth pressure loads, hydrostatic loads, hydrodynamic loads, and temperature loads).
- Internal events (including internal flood loads, accident pressure loads, accident thermal loads, accident pipe reactions, and pipe break loads – including reaction loads, jet impingement loads, and missle impact loads).
- External events (including rain, snow, flood, tornado, tornado-generated missiles, and earthquake).

5.0 Interface Requirements

There are no interface requirements for the ESWB structures.

6.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.1.5-2—Essential Service Water Building Inspections, Tests, Analyses, and Acceptance Criteria (2 Sheets) specifies the inspections, tests, analyses, and associated acceptance criteria for the ESWBs.

Table 1.8-2—U.S. EPR Combined License Information Items
Sheet 11 of 43

Item No.	Description	Section	Action Required by COL Applicant	Action Required by COL Holder
3.3-2	A COL applicant that references the U.S. EPR design certification will demonstrate that failure of site-specific structures or components not included in the U.S. EPR standard plant design, and not designed for wind loads, will not affect the ability of other structures to perform their intended safety functions.	3.3.1	Y	
3.3-3	A COL applicant that references the U.S. EPR design certification will demonstrate that failure of site-specific structures or components not included in the U.S. EPR standard plant design, and not designed for tornado loads, will not affect the ability of other structures to perform their intended safety functions.	3.3.2	Y	
3.4-1	A COL applicant that references the U.S. EPR design certification will confirm the potential site specific external flooding events are bounded by the U.S. EPR design basis flood values or otherwise demonstrate that the design is acceptable.	3.4.3.2	Y	
3.4-2	A COL applicant that references the U.S. EPR design certification will perform a flooding analysis for the ultimate heat sink makeup water intake structure based on the site-specific design of the structures and the flood protection concepts provided herein.	3.4.3.10	Y	
3.4-3	A COL applicant that references the U.S. EPR design certification will define the need for a site-specific permanent dewatering system.	3.4.3.11	Y	
3.5-1	A COL applicant that references the U.S. EPR design certification will describe controls to confirm that compressed gas cylinders and unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be removed from ~~containment~~safety-related building areas prior to operation, moved to a location where it is not a potential hazard to ~~SSCs~~SSC important to safety, or seismically restrained to prevent it from becoming a missile.	3.5.1.2.3 3.5.1.1.3	Y	

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inspections, quality control during fabrication and erection, and prudent operation of the components.

- Rotating components that operate less than two percent of the time are non-credible sources for missiles. Motors on valve operators and pumps in systems that rarely operate are deemed non-credible as potential missiles by this exclusion criterion. This exclusion is similar to an exclusion of lines that have limited operating time in high energy conditions.

- Components or portions of components that are not credible missile sources are also non-credible sources of missiles when struck by a falling object.

3.5.1.1.3 Missile Prevention and Protection Outside Containment

Missile generation is prevented to the extent practical throughout the U.S. EPR by implementing the design requirements described in this section. Safety-related equipment is designed to contain rotating parts in the equipment housing in the event that a component fails. High energy fluid systems and components are designed according to the requirements of the ASME BPV Code, Sections III or VIII, References 8 or 9. In high energy systems, valves with removable bonnets, for valve sizes larger than 2 inches, will be the pressure seal-type or have bolted bonnets. In high energy systems, valves sized 2 inches and smaller with removable bonnets, except for Class 2 and Class 3 relief valves, will be the pressure seal-type or have bolted bonnets. Relief valves with an inlet piping connection 2 inches and smaller may have threaded body-to-bonnet connections in accordance with ASME Section III, Division 1, Sections NC-3595.4 and ND-3595.4. Valves with threaded body-to-bonnet connections will be used only in non-high energy systems.~~ASME BPV Code, Section III, Reference 8 requires that valves with removable bonnets be the pressure seal-type or have bolted bonnets; therefore, valves that only have threaded connections between the body and bonnet are not used in high energy systems.~~ Valves located in high energy systems have at least two stem retention features. Besides having threads, acceptable features for missile prevention on the valve stem include back seats or power actuators, such as air or motor operators. Thermowells and other instrument wells, vents, drains, test connections, and other fittings in high energy systems are welded to the piping or pressurized equipment. Completed joints are required to have greater design strength than the parent metal.

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Permanent high-pressure gas cylinders installed in safety-related areas are designed in accordance with ASME BPV Code, Sections III or VIII, References 8 or 9. Portable and temporary gas cylinders, as well as gas cylinders that are periodically replaced in safety-related areas, are built in compliance with the regulations for seamless steel cylinders, as required by the U.S. Department of Transportation. A COL Applicant that references the U.S. EPR design certification will describe controls to confirm that unsecured compressed gas cylinders will be either removed or seismically supported when not in use to prevent them from becoming missles.

Missiles from hydrogen gas sources that could potentially interfere with safe-shutdown equipment or release significant amounts of radioactivity are minimized by careful placement of equipment, supply line routing, and proper ventilation. The storage area for plant gases is situated a sufficient distance from the Nuclear Island (NI) so that a hydrogen explosion could not create more hazardous missiles than the tornado missile spectra that the plant is designed to resist. Battery compartments are ventilated to prevent an accumulation of hydrogen gas. Hydrogen supply lines are routed through compartments with non-safety-related systems and components. Plant heating, ventilation, and air conditioning systems provide air movement.

The effects of potential internally generated missiles are minimized by the separation and the redundancy of safety-related systems throughout the U.S. EPR. Four Safeguard Buildings provide operability of vital plant systems in the event that problems or maintenance occur simultaneously in up to three of the Safeguard Building areas. Redundancy and separation are provided by the four emergency diesel generators (EDG) and four Ultimate Heat Sink (UHS) and Essential Service Water (ESW) trains.

Missile barriers are provided between redundant trains of equipment that are housed adjacent to one another. Section 3.5.3 describes missile barrier design procedures. Components within one train of a system with redundant trains need not be protected from missiles originating from within the same train.

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A COL Applicant that references the U.S. EPR design certification will describe controls to confirm that unsecured maintenance equipment, including that required for maintenance and that are undergoing maintenance, will be either removed or seismically supported when not in use to prevent it from becoming a missle.

3.5.1.2 Internally Generated Missiles Inside Containment

The following sections describe credible and non-credible internally generated missile sources and missile prevention and protection inside containment.

3.5.1.2.1 Credible Internally Generated Missile Sources Inside Containment

Credible internally generated missile sources inside containment are similar to those identified in Section 3.5.1.1.1, including the failure of rotating equipment and pressurized components in high energy systems. Internally generated missiles inside containment are not postulated to occur simultaneously with other plant accidents.

Missile protection is based on the energy created from rotating components at a 120 percent overspeed condition, unless other conditions exist that limit the potential for overspeed.