ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Wednesday, January 21, 2009 5:06 PM
To: Getachew Tesfaye
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 115, FSAR Ch 14, Supplement 1 <a e>
Attachments: RAI 115 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided responses to 2 of the 20 questions of RAI No. 115 on November 26, 2008. The attached file, "RAI 115 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to 8 of the 18 remaining questions, as committed. Since the response file contains security-related sensitive information that should be withheld from public disclosure in accordance with 10 CFR 2.390, a public version is provided with the security-related sensitive information redacted. This email does not contain any security-related information. The unredacted SUNSI version is provided under separate email.

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 115 Questions 14.03.02-1, 14.03.02-2, 14.03.02-3, 14.03.02-4, 14.03.02-5, 14.03.02-6, 14.03.02-7, and 14.03.02-8.

The following table indicates the respective pages in the response document, "RAI 115 Supplement 1 US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 115 — 14.03.02-1	2	3
RAI 115 — 14.03.02-2	4	4
RAI 115 — 14.03.02-3	5	5
RAI 115 — 14.03.02-4	6	6
RAI 115 — 14.03.02-5	7	8
RAI 115 — 14.03.02-6	9	9
RAI 115 — 14.03.02-7	10	10
RAI 115 — 14.03.02-8	11	11

The schedule for technically correct and complete responses to the remaining 10 questions is unchanged and provided below:

Question #	**Response Date**
RAI 115 — 14.03.09-5	February 25, 2009
RAI 115 — 14.03.09-6	February 25, 2009
RAI 115 — 14.03.09-7	February 25, 2009
RAI 115 — 14.03.09-8	February 25, 2009
RAI 115 — 14.03.09-9	February 25, 2009
RAI 115 — 14.03.09-10	February 25, 2009
RAI 115 — 14.03.09-11	February 25, 2009
RAI 115 — 14.03.09-12	February 25, 2009
RAI 115 — 14.03.09-13	February 25, 2009
RAI 115 — 14.03.09-14	February 25, 2009

Sincerely,

(Russ Wells on behalf of)
Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, November 26, 2008 1:37 PM
To: 'Getachew Tesfaye'
Cc: DUNCAN Leslie E (AREVA NP INC); DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 115 (1054, 1048),FSAR Ch. 14

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 115 Response US EPR DC.pdf" provides technically correct and complete responses to 2 of the 20 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 115 Questions 14.03.02-9 and 14.03.05-7.

The following table indicates the respective pages in the response document, "RAI 115 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 115 — 14.03.02-1	2	2
RAI 115 — 14.03.02-2	3	3
RAI 115 — 14.03.02-3	4	4
RAI 115 — 14.03.02-4	5	5
RAI 115 — 14.03.02-5	6	6
RAI 115 — 14.03.02-6	7	7
RAI 115 — 14.03.02-7	8	8
RAI 115 — 14.03.02-8	9	9
RAI 115 — 14.03.02-9	10	11
RAI 115 — 14.03.05-7	12	12
RAI 115 — 14.03.09-5	13	13
RAI 115 — 14.03.09-6	14	14
RAI 115 — 14.03.09-7	15	15
RAI 115 — 14.03.09-8	16	16
RAI 115 — 14.03.09-9	17	17
RAI 115 — 14.03.09-10	18	18
RAI 115 — 14.03.09-11	19	19
RAI 115 — 14.03.09-12	20	20
RAI 115 — 14.03.09-13	21	22

RAI 115 — 14.03.09-14	23	23

A complete answer is not provided for 18 of the 20 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 115 — 14.03.02-1	January 21, 2009
RAI 115 — 14.03.02-2	January 21, 2009
RAI 115 — 14.03.02-3	January 21, 2009
RAI 115 — 14.03.02-4	January 21, 2009
RAI 115 — 14.03.02-5	January 21, 2009
RAI 115 — 14.03.02-6	January 21, 2009
RAI 115 — 14.03.02-7	January 21, 2009
RAI 115 — 14.03.02-8	January 21, 2009
RAI 115 — 14.03.09-5	February 25, 2009
RAI 115 — 14.03.09-6	February 25, 2009
RAI 115 — 14.03.09-7	February 25, 2009
RAI 115 — 14.03.09-8	February 25, 2009
RAI 115 — 14.03.09-9	February 25, 2009
RAI 115 — 14.03.09-10	February 25, 2009
RAI 115 — 14.03.09-11	February 25, 2009
RAI 115 — 14.03.09-12	February 25, 2009
RAI 115 — 14.03.09-13	February 25, 2009
RAI 115 — 14.03.09-14	February 25, 2009

Sincerely,

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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, October 29, 2008 8:18 AM
To: ZZ-DL-A-USEPR-DL
Cc: Edmund Kleeh; Richard Laura; David Jeng; Sujit Samaddar; Michael Miernicki; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 115 (1054, 1048),FSAR Ch. 14

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on October 21, 2008, and on October 29, 2008, 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 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: 134

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD41FD94F5)

Subject: Response to U.S. EPR Design Certification Application RAI No. 115, FSAR Ch 14, Supplement 1 <a e>
Sent Date: 1/21/2009 5:06:07 PM
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From: WELLS Russell D (AREVA NP INC)

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MESSAGE	6631	1/21/2009 5:06:21 PM
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Priority: Standard
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Response to

Request for Additional Information No. 115, Supplement 1

10/29/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 14.03.02 - Structural and Systems Engineering - Inspections, Tests, Analyses, and Acceptance Criteria
SRP Section: 14.03.05 - Instrumentation and Controls - Inspections, Tests, Analyses, and Acceptance Criteria
SRP Section: 14.03.09 - Human Factors Engineering - Inspections, Tests, Analyses, and Acceptance Criteria
Application Section: FSAR Ch 14

QUESTIONS for Construction Inspection and Allegations Branch (CCIB)
QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)

Question 14.03.02-1:

ITAAC Item 3.1 in Table 2.1.1-7

SRP 14.3 App. A IV.4.B states that Acceptance Criteria should be objective and unambiguous. The Commitment Wording and AC for Item 3.1 states, in part, that…"SBs 2 and 3 decoupling from RSB above elevation 0' 0" as described in Figures …2.1.1-8 and 2.1.1-10". A review of these Figures indicate that the decoupling is shown to extend below 0' 0". Which is correct, the wording …"above 0' 0"", or the Figures 2.1.1-8 and 2.1.1-10 which indicate decoupling below elevation 0' 0"?

In addition, should not the FB also be stated here as being decoupled from the RSB above elevation 0' 0" at its ceiling by the decoupling gap as shown on Figure 2.1.1-10?

Response to Question 14.03.02-1:

Both U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 3.1, Commitment Wording column, which indicates decoupling above elevation 0' 0," and U.S. EPR FSAR Tier 1, Figure 2.1.1-8 and Figure 2.1.1-10, which indicate decoupling below 0' 0" are correct. The commitment wording and figures refer to decoupling gaps in separate locations of the building; the first location is the gap between the Safeguards Building (SB) and the structure that houses the SBs, and the second location is the gap between the SBs and the Reactor Shield Building (RSB).

U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 3.1(b) and Item 3.1(c), Commitment Wording columns state, "(b) decoupling of the SBs and the FB from their respective structures at their exterior walls along the entire wall length and (c) SBs 2 and 3 decoupling from the RSB above elevation 0' 0" as described in this section, 2.1.1, and as shown on Figure 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."

U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 3.1(b) is described in the fourth paragraph of U.S. EPR FSAR Tier 1, Section 2.1.1: "As shown in Figures 2.1.1-4—Safeguard Buildings 2 and 3 Elevation +39 Feet and 2.1.1-8—Safeguard Buildings 2 and 3, SBs 2 and 3 are decoupled by a gap between the SBs external walls and their uppermost ceilings and the structure that houses these buildings." This statement refers to the gap between the SBs and the structure that houses the SBs, which extends the length of the wall and is shown to extend below 0' 0" in U.S. EPR FSAR Tier 1, Figure 2.1.1-8.

U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 3.1(c) is also described in the fourth paragraph of U.S. EPR FSAR Tier 1, Section 2.1.1: "The SBs and the RSB share the reinforced concrete cylindrical shell from the basemat to elevation 0 feet 0 inches; above this elevation the structures are physically separated by a seismic gap." This statement refers to the gap between the SBs and the RSB, which only exists above elevation 0' 0" as stated in the text and as shown in U.S. EPR FSAR Tier 1, Figure 2.1.1-8. .

Both the commitment wording indicating decoupling above elevation 0' 0" and the figures indicating decoupling below 0' 0" are correct because the commitment wording and figures refer to decoupling gaps in separate locations of the building. However, U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 3.1 will be revised to clearly identify the decoupling gap between SBs 2 and 3 and the RSB. U.S. EPR FSAR Tier 1, Figure 2.1.1-8 will be revised to add an arrow pointing to the decoupling gap between SBs 2 and 3 and the RSB.

The Fuel Building (FB) is also decoupled from the RSB above elevation 0' 0". The fifth paragraph of U.S. EPR FSAR Tier 1, Section 2.1.1 will be revised to clearly describe the decoupling gap between FB and the RSB. U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 3.1 will be revised to clearly identify the decoupling gap between FB and the RSB. U.S. EPR FSAR Tier 1, Figure 2.1.1-6 and Figure 2.1.1-10 will be revised to add an arrow pointing to the decoupling gap between the FB and the RSB.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.1.1, Table 2.1.1-7, Figure 2.1.1-6, Figure 2.1.1-8, and Figure 2.1.1-10 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-2:

ITAAC Item 4.2 in Table 2.1.1-7

SRP 14.3, App. A IV.4.B states that any differences between the design descriptions and the Commitment Wording of the ITAAC should be minimized unless intended to better conform the commitments in the design descriptions with the ITAAC format. The Commitment Wording of this ITAAC omits the wording "and safety related functions" after words "without loss of structural integrity" used in the design description in Section 2.1. The Commitment Wording, ITA, and AC should be revised to include the wording 'and safety related functions'.

Should the ITA and AC be split in two with an analysis and an inspection being performed? The analysis would verify that the NI structures will be Seismic Category I structures if they are constructed per the approved design, and the inspection would verify that the NI structures conform to the analysis and the approved design and are able to withstand design basis loads per Section 2.1.1, without loss of structural integrity.

This comment is also applicable to the following ITAAC:

ITAAC Item 4.3 in Table 2.1.2-2

ITAAC Item 4.3 in Table 2.1.5-2

Response to Question 14.03.02-2:

The following U.S. EPR FSAR Tier 1 items will be revised to add "and safety-related functions" to the commitment wording and to separate the analysis and inspection in the ITAAC:

- Table 2.1.1-7, Item 4.2.
- Table 2.1.2-2, Item 4.3.
- Table 2.1.5-2, Item 4.3.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 2.1.1-7, Table 2.1.2-2, and Table 2.1.5-2 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-3:

ITAAC Item 4.6 in Table 2.1.1-7

Why does the ITA not state that the inspection is of the as-built installation? It could state 'Inspection of RSB and RCB will be performed.'

Response to Question 14.03.02-3:

U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 4.6 will be revised to inspect the as-installed conditions in the Inspection, Analysis, or Test column.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 2.1.1-7 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-4:

ITAAC Item 4.8 in Table 2.1.1-7

SRP 14.3 App. A IV.4.B states that Acceptance Criteria should be objective and unambiguous. The AC for Item 4.8 lists room numbers UJA11 002, UJA11 005, UJA11 006, and UJA11-009 and refers to Figure 2.1.1-11. These room numbers are not listed on Figure 2.1.1-11. Similarly, room numbers UJA07 014 and UJA07 015 are referred on Figure 2.1.1-12, but these room numbers are not listed on Figure 2.2.2-12. The above two Figures should be revised to show the location of the room numbers identified in the AC, or justfy otherwise.

Response to Question 14.03.02-4:

U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 4.8, Figure 2.1.1-11, and Figure 2.1.1-12 will be revised to replace room numbers with room descriptions.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 2.1.1-7, Figure 2.1.1-11, and Figure 2.1.1-12 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-5:

ITAAC Item 3.1 in Table 2.1.3-1

SRP 14.3 App. A IV.4.B states that Acceptance Criteria should be objective and unambiguous. The Commitment Wording for Item 3.1 states, in part, that…"as shown on Figure 2.1.3-1, seismic separations are provided between the NAB and surrounding buildings". The AC for Item 3.1 states, in part, that…"The as-built NAB is separated from surrounding buildings as shown on Figure 2.1.3-1". Why doesn't the Item 3.1 ITAAC Commitment Wording state what minimum dimensions are required to permit seismic separation to exist between NAB and surrounding buildings, and the AC require that minimum dimensions be met to achieve desired seismic separation?

This is also applicable to following ITAAC:

ITAAC Item 3.2 in Table 2.1.4-1

Response to Question 14.03.02-5:

U.S. EPR FSAR Tier 2, Section 3.7.2.8 describes the methodology used to preclude interaction between Non-Seismic Category I structures with Seismic Category I structures. Because the Nuclear Auxiliary Building (NAB) and Radioactive Waste Building (RWB) are both Non-Seismic Category I structures, a minimum separation distance between these structures is not a critical interaction concern. However, the minimum separation distance between the NAB and the Nuclear Island (NI) common basemat structures and between the RWB and divisions 3 and 4 Emergency Power Generating Building (3/4EPGB) are critical minimum dimensions. Based on this methodology, the following revisions to the U.S. EPR FSAR will be made:

- U.S. EPR FSAR Tier 1, Section 2.1.3, Item 3.1 and Table 2.1.3-1, Item 3.1 will be revised to clarify that the separation distance is provided to preclude interaction between the buildings. U.S. EPR FSAR Tier 1, Table 2.1.3-1, ITAAC Item 3.1 will be revised to require a site-specific analysis to be performed and the site building layout to be verified to meet the minimum required separation distance.
- U.S. EPR FSAR Tier 1, Figure 2.1.3-1 will be revised to remove the identification of a separation distance between the NAB and RWB.
- U.S. EPR FSAR Tier 1, Section 2.1.4, Item 3.1 and Table 2.1.4-1, Item 3.1 will be revised to provide the minimum seismic separation distance.
- U.S. EPR FSAR Tier 1, Figure 2.1.4-1 will be revised to remove the identification of a separation distance between the NAB and RWB.
- U.S. EPR FSAR Tier 1, Figure 2.1.4-1 will be revised to add a separation distance between the RWB and 3/4EPGB.
- U.S. EPR FSAR Tier 2, Section 3.7.2.8, "Nuclear Auxiliary Building," will be revised to clarify the approach used to confirm that sufficient separation is provided to preclude interaction.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.1.3, Section 2.1.4, Table 2.1.3-1, Table 2.1.4-1, Figure 2.1.3-1 and Figure 2.1.4-1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Section 3.7.2.8 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-6:

ITAAC Item 3.3 in Table 2.1.1-7

The design commitment and AC refer to a flooding wall and water-tight door as described in Table 2.1.1-3. That table has four walls listed. Which wall does the ITAAC address?

Response to Question 14.03.02-6:

The ITAAC addresses the four walls listed and the water-tight door. Collectively, the walls and door listed in U.S. EPR FSAR Tier 1, Table 2.1.1-3 form a spreading area water ingression barrier and prevent ingress of water into the core melt spreading area.

U.S. EPR FSAR Tier 1, Section 2.1.1, Item 3.3 and Table 2.1.1-7, Item 3.3 will be revised to clarify the spreading area water ingression barrier.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.1.1 and Table 2.1.1-7 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-7:

ITAAC Item 4.1 in Table 2.2.2-2

This ITAAC states that EPGBs as-installed at site grade level....is at elevation 0' 0", as indicated on Figures 2.1.2-2 and 2.1.2-3. Grade elevation is shown on these figures but it is not correlated with an elevation of 0' 0". Please clarify what the the reference elevation is on these figures.

Response to Question 14.03.02-7:

The following U.S. EPR FSAR Tier 1 items will be revised to identify the site grade level of -1' 0":

- Section 2.1.1, Item 4.1 and Table 2.1.1-7, Item 4.1.
- Section 2.1.2, Item 4.1 and Table 2.1.2-2, Item 4.1.
- Section 2.1.5, Item 4.1 and Table 2.1.5-2, Item 4.1.
- Figure 2.1.2-2 and Figure 2.1.2-3. The reference elevation is the top of the concrete floor as 0' 0").

These changes are also applicable to other U.S. EPR FSAR Tier 1 figures that show site grade elevation. Therefore, U.S. EPR FSAR Tier 1, Figure 2.1.1-7, Figure 2.1.1-8, Figure 2.1.1-9, Figure 2.1.5-4, and Figure 2.1.5-5 will be revised to show the site grade level elevation at -1' 0". The reference elevation is the top of the concrete floor at 0' 0".

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.1.1, Section 2.1.2, Section 2.1.5, Table 2.1.1-7, Table 2.1.2-2, Table 2.1.5-2, Figure 2.1.1-7, Figure 2.1.1-8, Figure 2.1.1-9, Figure 2.1.2-2, Figure 2.1.2-3, Figure 2.1.5-4 and Figure 2.1.5-5 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-8:

ITAAC Item 4.9 in Table 2.1.1-7

The ITAAC requires an anaylsis to indicate that essential SSCs in RCB rooms in Table 2.1.1-4 are protected from the dynamic effects of pipe breaks. Should there not also be an inspection to determine whether the pipe whip restraints, that contain the pipes so as not to cause damage to the essential SSCs, are installed per the analysis? Revise ITAAC table accordingly.

Response to Question 14.03.02-8:

U.S. EPR FSAR Tier 1, Table 2.1.1-7, Item 4.9, Inspection, Test, or Analysis column will be revised to clarify analysis wording and to add an inspection.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 2.1.1-7 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

100 feet long by 115 feet high. The SB 4 structure has dimensions of approximately 87 feet out from the RSB wall by 100 feet long by 150 feet high. The primary function of the SBs is to provide physical separation between redundant divisions of safeguard equipment. The main control room (MCR) and technical support center (TSC) are located within SBs 2 and 3 as shown on Figure 2.1.1-5—Safeguard Buildings 2 and 3 Elevation +53 Feet. The remote shutdown station (RSS), which is separate from the MCR, is located within SB 3 as shown on Figure 2.1.1-4. Also located in the SBs are the reinforced concrete MFWSVS and MSV ~~and MFV~~ stations. Stair towers are provided between the different SBs and the SBs and FB. Above elevation 0 feet 0 inches, flooding pits and flood relief panels provide for water flow to lower building levels or outside to prevent water ingress into adjacent divisions. Below elevation 0 feet 0 inches, rooms within divisions have flooding mitigation interconnections so that the maximum released water volume can be distributed and stored in the lower building levels of the affected division.

14.03.02-1

The FB is a reinforced Seismic Category I safety-related concrete structure. It extends approximately 58 feet out from the RSB wall and is approximately 160 feet long by 140 feet high. The FB is located adjacent to the RSB at 180 degrees as shown on Figure 2.1.1-1. As shown in Figure 2.1.1-6—Fuel Building - View 1 and Figure 2.1.1-10—Fuel Building – View 2, the FB is decoupled by a gap between the FB external wall and its uppermost ceiling and the structure that houses the FB. The FB and the RSB share the reinforced concrete cylindrical shell from the basemat to elevation 0 feet 0 inches; above this elevation the structures are physically separated by a seismic gap. The primary function of the FB is to house new and spent fuel and provide radiation protection during normal operation by shielding areas of higher radiation from areas of lower radiation. The FB supports the vent stack, a steel structure approximately 12 feet 6 inches in diameter by 100 feet high located on top of the stair tower between the FB and SB 4. Stair towers are provided between the different SBs and the FB. These stair towers provide personnel access among the various elevations of the NI and tie together the buildings around the periphery of the RSB. Below elevation 0 feet 0 inches, rooms within divisions have flooding mitigation interconnections so that the maximum released water volume can be distributed and stored in the lower building levels of the affected division.

The RSB, the FB, and SBs 2 and 3 structures form an integrated contiguous surface barrier, as shown on Figure 2.1.1-1 and 2.1.1-2—Contiguous Barrier, designed to provide protection against external hazards including aircraft hazard and explosion pressure waves.

The NI foundation basemat is a heavily reinforced concrete slab, approximately 360 ft x 360 ft x 10 ft thick, which supports all NI structures including the RB, FB, and the SBs. The NI foundation basemat acts together with the RCB to maintain an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to maintain containment design conditions important to safety so that they are not exceeded for as long as postulated accident conditions require.

The RCB design includes consideration for severe accident mitigation. Downward expansion of the lower head is limited by concrete support structures provided at the bottom of the reactor cavity. These structures preserve sufficient space for the outflow of melt and the later formation of a molten pool in the reactor cavity. Installed barriers prevent water ingress into the core spreading area prior to the arrival of core melt, which 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.

14.03.02-6

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.

14.03.02-7

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:

- Normal plant operation (including dead loads, live loads, lateral earth pressure loads, equipment loads, hydrostatic, hydrodynamic, and temperature loads).
- External events (including rain, snow, flood, tornado, tornado-generated missiles, earthquake, aircraft hazard, and explosion pressure wave).

4.3 The RCB~~, is designed to retain its pressure boundary integrity associated with the design pressure~~ including the liner plate, maintains its pressure boundary integrity at the design pressure.

Table 2.1.1-7—Nuclear Island Inspections, Tests, Analyses, and Acceptance Criteria (57 Sheets)

	Commitment Wording	Inspection, Test or Analysis	Acceptance Criteria
3.1	The basic configuration of the NI structures includes: (a) an integrated contiguous barrier (b) decoupling of the SBs and the FB from their respective structures at their exterior walls along the entire wall length and the uppermost ceilings. (c) SBs 2 and 3 and the FB decoupling from the RSB above elevation 0' 0" as described in this 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.	An inspection of the as-installed basic configuration of the NI structures will be performed. 14.03.02-1	The basic configuration of the NI structures has the following features: (a) The RSB, SBs 2 and 3, and the FB share a common boundary exterior surface at the SBs and FB structures roofs and walls to form an integrated contiguous external surface for the RSB and SBs and FB structures as shown on Figures 2.1.1-1 and 2.1.1.-2. (b) SBs 2 and 3 and the FB are decoupled from their respective structures at the external SBs and FB walls along their entire length and SBs 2 and 3 from the RSB above the 0' 0" elevation as shown on Figures 2.1.1-4, 2.1.1-6, 2.1.1-8, and 2.1.1-10. (c) SBs 2 and 3 and the FB are decoupled from their structure at the upper most ceilings as shown on Figure 2.1.1-8 and 2.1.1-10.
3.2	Six rib support structures are provided at the bottom of the reactor cavity as shown on Figure 2.1.1-13.	Inspection of the reactor vessel cavity will be performed.	Six rib support structures are provided at the bottom of the reactor cavity as shown on Figure 2.1.1-13.

Table 2.1.1-7—Nuclear Island Inspections, Tests, Analyses, and Acceptance Criteria (~~5~~7 Sheets)

14.03.02-6

	Commitment Wording	Inspection, Test or Analysis	Acceptance Criteria
3.3	As described in Table 2.1.1-3, a~~A~~ flooding ~~wall~~barrier consisting of several walls~~,~~ ~~including a water tight door,~~ is provided to prevent ingress of water into the core melt spreading area~~ as described in Table 2.1.1-3~~. This wall barrier includes a watertight door that provides entry to the venting shaft of the spreading area.	Inspection of the RCB will be performed.	The RCB provides ~~a~~ flooding walls, including a water-tight door as described in Table 2.1.1-3.
3.4	Core melt cannot relocate to upper containment due to the existence of concrete barriers as shown on Figure 2.1.1-13.	Inspection of the RCB will be performed.	Concrete barriers are located within the RCB as shown on Figure 2.1.1-13.
4.1	The NI site grade level is located at elevation ~~0~~-1’ 0” as indicated on Figures 2.1.1-7, 2.1.1-8, 2.1.1-9 and 2.1.1-10	An inspection of the as-installed NI site grade level will be performed.	The as-installed NI site grade level is located at elevation ~~0~~-1’ 0” as indicated on Figures 2.1.1-7, 2.1.1-8, 2.1.1-9, and 2.1.1-10.
4.2	The NI structures are seismic Category I and are constructed to withstand design basis loads as specified in Section 2.1.1, without loss of structural integrity and safety-related functions.	(a) Analysis of the NI structures for the design basis loads will be performed (b) An ~~verification~~ inspection of the NI structures ~~design analysis~~ versus construction ~~records~~ drawings will be performed. Deviations from the approved design will be analyzed for design basis loads.	(a) The design of the NI structures will withstand the design basis loads without loss of structural integrity and safety related functions. (b) NI structures conform to the approved design and will withstand the design basis loads specified in Section 2.1.1, without loss of structural integrity and safety-related functions.

14.03.02-7

14.03.02-2

Table 2.1.1-7—Nuclear Island Inspections, Tests, Analyses, and Acceptance Criteria (57 Sheets)

Commitment Wording		Inspection, Test or Analysis	Acceptance Criteria
4.5	The NI structures include barriers for post-accident radiation shielding, as described in Section 2.1.1 and in Table 2.1.1-2.	An inspection of the as-installed NI accident radiation barriers will be performed.	The as-installed NI structures barriers that provide post-accident radiation shielding are as described in Table 2.1.1-2.
4.6	As described in Section, 2.1.1, the RSB and RCB are constructed of reinforced concrete and the RCB is pre-stressed.	14.03.02-3 Inspection of the RSB and RCB construction records as-installed conditions will be performed.	The RSB and RCB are constructed of reinforced concrete and the RCB is pre-stressed.
4.7	As described in Section 2.1.1, the RBA is separated from the SBs and the FB by barriers, doors, dampers and penetrations that have a minimum 3-hour fire rating.	(a) An analysis will be performed. (b) Inspection of barriers, doors, dampers and penetrations that separate the RBA from the SBs and FB will be performed. (c) Testing of dampers that separate the RBA from the SBs and FB will be performed. (d) An analysis will be performed.	(a) Completion of analysis that indicates barriers, doors, dampers, and penetrations that separate the RBA from the SBs and FB have a minimum 3-hour fire rating. (b) The as-built configuration of barriers, doors, dampers and penetrations that separate the RBA from the SBs and FB agrees with construction drawings. (c) Dampers close. (d) Completion of the post-fire safe shutdown analysis indicates that at least one success path comprised of the minimum set of SSC is available for safe shutdown.

Table 2.1.1-7—Nuclear Island Inspections, Tests, Analyses, and Acceptance Criteria (57 Sheets)

	Commitment Wording	Inspection, Test or Analysis	Acceptance Criteria
4.8	As described in Section 2.1.1, and shown on Figures 2.1.1-11 and 2.1.1-12, provisions are provided for water flow to the IRWST.	Inspection of the RCB will be performed.	The as-installed RCB configuration includes the following provisions: • As shown on Figure 2.1.1-11 rooms, the rooms labeled RCP Oil Collection Tank Areas for each loop UJA11 002, UJA11 005, UJA11 006, and UJA11 009 contain trapezoidal-shaped openings in the floor and are provided with weirs and trash racks. • As shown on Figure 2.1.1-12, Rooms UJA07 014 and UJA07 015 the two rooms labeled Areas for MHSI, LHSI & SAHRS Pipe Penetrations contain wall openings slightly above the floor to allow water flow into the IRWST.
4.9	Essential SSCsSSC in RCB rooms listed in Table 2.1.1-4 are protected from the dynamic effects of pipe breaks.	(a) An analysis will be performed that indicates essential SSCsSSC in RCB rooms listed in Table 2.1.1-4 are protected from the dynamic effects of pipe breaks. (b) An inspection of features providing protection for essential systems and components from the effects of piping failures versus construction drawings will be performed. Deviations from the construction drawings will be analyzed for design basis loads.	(a) Essential SSCsSSC in RCB rooms listed in Table 2.1.1-4 are protected from the dynamic effects of pipe breaks. (b) SSC in RCB rooms listed in Table 2.1.1-4 are protected from the dynamic effects of pipe breaks.

14.03.02-4

14.03.02-8

Figure 2.1.1-6—Fuel Building - View 1

Figure 2.1.1-7—Safeguard Building 1

Figure 2.1.1-8—Safeguard Buildings 2 and 3

Figure 2.1.1-9—Safeguard Building 4

Figure 2.1.1-10—Fuel Building - View 2

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Figure 2.1.1-11—Trapezoidal Op

Figure 2.1.1-12—Wal

14.03.02-7

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:

- Normal plant operation (including dead loads, live loads, lateral earth pressure loads, hydrostatic loads, hydrodynamic loads, and temperature 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.

Table 2.1.2–2—Emergency Power Generating Building Inspections, Tests, Analyses, and Acceptance Criteria (2 ~~Pages~~Sheets)

14.03.02-7

Commitment Wording		Inspection, Test or Analysis	Acceptance Criteria
2.1	The as-installed location of the EPGBs is as described in Section 2.1.2 and as shown on Figure 2.1.2-1.	An inspection of the EPGBs will be performed.	The as-installed location of the EPGBs is as shown on Figure 2.1.2-1.
3.1	Physical separation of the as-installed EPGBs is as described in Section 2.1.2 and as shown on Figure 2.1.2-1.	An inspection of the EPGBs will be performed.	The as-installed EPGBs are separated by the NI complex as shown on Figure 2.1.2-1.
4.1	The EPGBs as-installed site grade level, as described in Section 2.1.2, is at elevation ~~0'~~-1'-0" as indicated on Figures 2.1.2-2 and 2.1.2-3.	An inspection of EPGBs site grade level will be performed.	The as-installed EPGBs site grade level is at elevation ~~0'~~-1' 0" as indicated on Figures 2.1.2-2 and 2.1.2-3.
4.2	As described in Section 2.1.2, and Table 2.1.2-1, the as-installed configuration of the EPGBs provides for internal hazards barriers.	(a) An inspection of the EPGBs will be performed.	(a) The as-installed configuration of the EPGBs provides internal hazards barriers as described in Table 2.1.2-1.
		(b) An analysis will be performed.	(b) Completion of analysis that indicates that barriers, doors, dampers, and penetrations identified in Table 2.1.2-1 have a minimum 3-hour fire rating and mitigate the propagation of smoke to the extent that safe shutdown is not adversely affected.
		(c) Inspection of any doors, dampers and penetrations through the barriers listed in Table 2.1.2-1.	(c) The as-built configuration of any doors, dampers, and penetrations through the barriers listed in Table 2.1.2-1 agrees with construction drawings.

Table 2.1.2–2—Emergency Power Generating Building Inspections, Tests, Analyses, and Acceptance Criteria (2 ~~Pages~~Sheets)

Commitment Wording		Inspection, Test or Analysis	Acceptance Criteria
4.3	The EPGB structures are Seismic Category I and are designed and constructed to withstand design basis loads as specified in Section 2.1.2, without loss of structural integrity and safety-related functions.	(a) Analysis of the EPGB structures for the design basis loads will be performed. (b) An ~~verification~~ inspection of the EPGB structures ~~seismic design analysis~~ versus construction ~~records~~ drawings will be performed. Deviations from the approved design will be analyzed for design basis loads.	(a) The design of the EPGB structures will withstand the design basis loads without loss of structural integrity and safety related functions. (b) EPGB structures conform to the approved design and will withstand the design basis loads specified in Section 2.1.2 without loss of structural integrity and safety-related functions.

14.03.02-2

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Figure 2.1.2-2—Emergency Pow

2.1.3 Nuclear Auxiliary Building

1.0 Description

The Nuclear Auxiliary Building (NAB) is a reinforced-concrete structure that houses non-safety-related auxiliary systems required for normal power operation. There are no systems, structures, or components required for safe shutdown located in the NAB. The NAB is located adjacent to the Fuel Building (FB), the Safeguard Building (SB) Division 4, and the Radioactive Waste Building (RWB) as shown on Figure 2.1.3–1—Nuclear Auxiliary Building Location.

2.0 Arrangement

2.1 The NAB is located adjacent to the FB, SB Division 4, and the RWB as shown on Figure 2.1.3–1.

14.03.02-5

3.0 Mechanical Design Features

3.1 Seismic separations are provided between the NAB and ~~surrounding buildings~~ the NI common basemat structures as shown on Figure 2.1.3–1 with sufficient clearance to preclude seismic interaction between the NAB and NI common basemat structures.

4.0 System Inspections, Tests, Analyses, and Acceptance Criteria

4.1 Table 2.1.3–1—Nuclear Auxiliary Building Inspections, Tests, Analyses, and Acceptance Criteria specifies the inspections, tests, analyses, and acceptance criteria for the NAB.

Table 2.1.3-1—Nuclear Auxiliary Building Inspections, Tests, Analyses, and Acceptance Criteria

	Commitment Wording	Inspection, Test or Analysis	Acceptance Criteria
2.1	The location of the NAB is as described in Section 2.1.3 and as shown on Figure 2.1.3-1.	An inspection of the NAB will be performed.	The as-built NAB location is as shown on Figure 2.1.3-1.
3.1	Seismic separations are provided between the NAB and the NI common basemat as shown on Figure 2.1.3-1 with sufficient clearance to preclude seismic interaction between the NAB and NI common basemat structures. As described in Section 2.3.1 and shown on Figure 2.1.3-1, seismic separations are provided between the NAB and surrounding buildings.	a. An analysis will be performed based on site specific conditions to define the minimum acceptable separation. b. An inspection of the site layout for the building (prior to construction) will be performed to verify that the minimum acceptable separation is provided. An inspection of the NAB will be performed.	a. A report exists that defines the minimum acceptable separation prior to any settlement occuring. b. The site layout of the buildings provides the minimum separation required. The as-built NAB is separated from surrounding buildings as shown on Figure 2.1.3-1.

14.03.02-5

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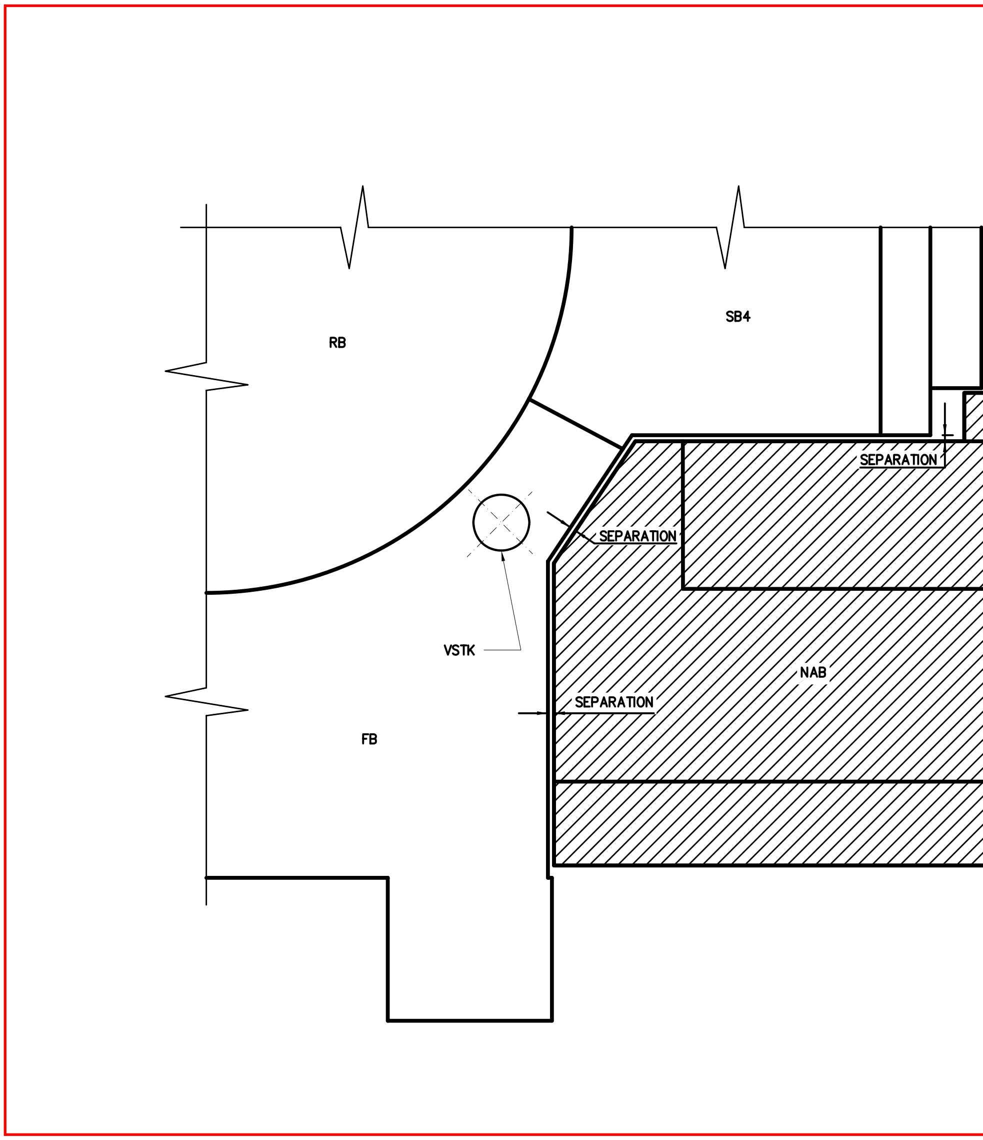
RB
SB4
SEPARATION
SEPARATION
VSTK
NAB
SEPARATION
FB

2.1.4 Radioactive Waste Building

1.0 Description

The Radioactive Waste Building (RWB) is a reinforced-concrete structure that houses non-safety-related liquid waste storage tanks, storage facilities, and associated support systems required for normal power operation. There are no systems, structures, or components required for safe shutdown in the RWB. The RWB is located adjacent to the Nuclear Auxiliary Building as shown in Figure 2.1.4-1—Radioactive Waste Building Location.

2.0 Arrangement

2.1 The physical arrangement of the RWB is shown in Figure 2.1.4-1.

3.0 Mechanical Design Features

14.03.02-5

3.1 ~~Seismic s~~Separation~~s~~ ~~are~~ is provided between the RWB and ~~surrounding buildings~~ 3/4EPGB as shown on Figure 2.1.4-1 with sufficient distance to preclude interaction between the RWB and 3/4EPGB.

4.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.1.4-1—Radioactive Waste Building Inspections, Tests, Analyses, and Acceptance Criteria specifies the inspections, tests, analyses, and associated acceptance criteria for the RWB.

Table 2.1.4-1—Radioactive Waste Building Inspections, Tests, Analyses, and Acceptance Criteria

	Commitment Wording	Inspection, Test or Analysis	Acceptance Criteria
2.1	The location of the RWB is as described in Section 2.1.4 and as shown on Figure 2.1.4-1.	An inspection of the RWB will be performed.	The as-installed location of the RWB is as shown on Figure 2.1.4-1.
3.21	As described in Section 2.1.4 and shown on Figure 2.1.4-1, seismic sSeparations are is provided between the RWB and 3/4EPGB as shown on Figure 2.1.4-1 with sufficient distance to preclude interaction between the RWB and 3/4EPGB. and surrounding buildings.	An inspection of the RWB will be performed.	The as-installed RWB is separated from surrounding buildings 3/4EPGB as shown on Figure 2.1.4-1. A minimum separation distance of 49.5 ft exists between the RWB and 3/4EPGB.

14.03.02-5

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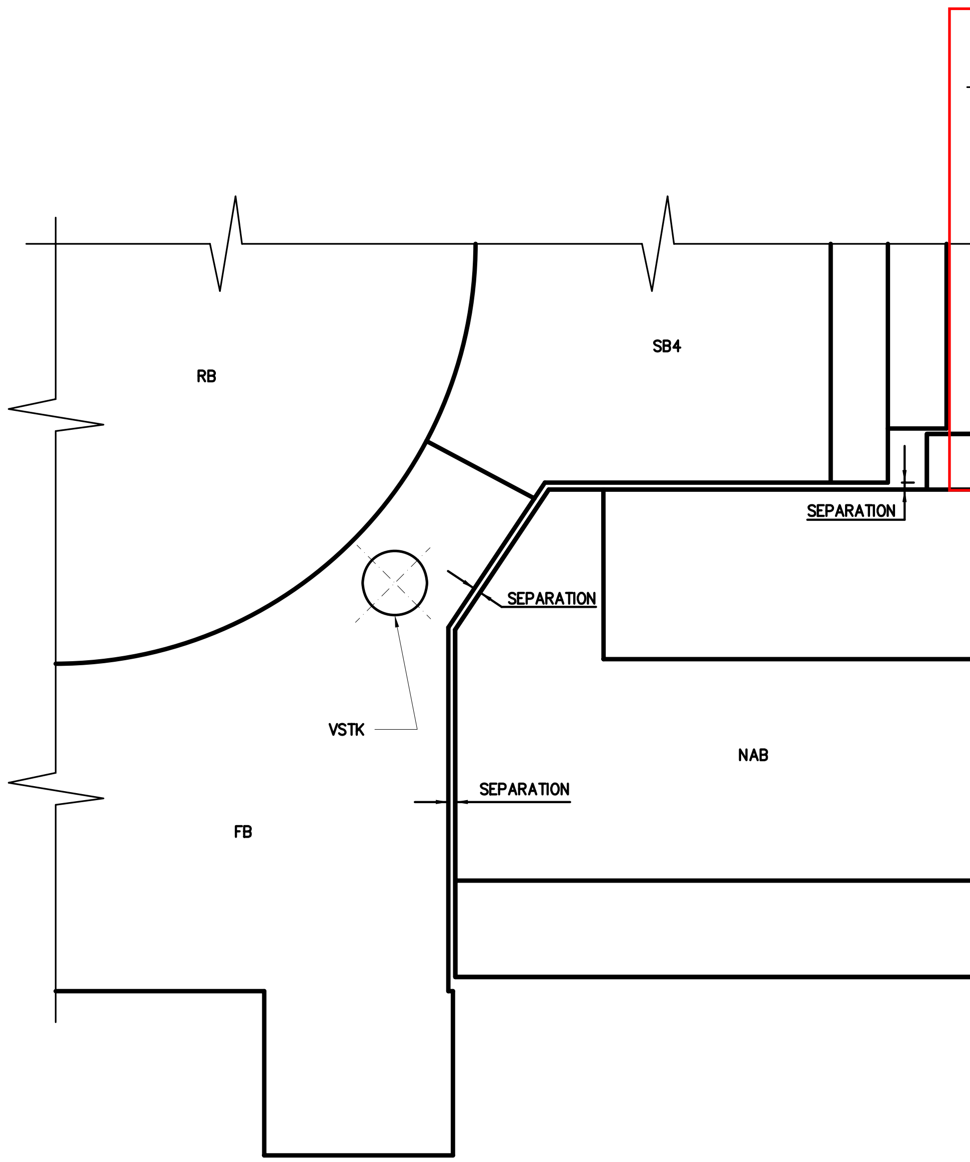
Figure 2.1.4-1—Radioactiv



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

14.03.02-7

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:

- Normal plant operation (including dead loads, live loads, lateral earth pressure loads, hydrostatic loads, hydrodynamic loads, and temperature 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 2.1.5-2—Essential Service Water Building Inspections, Tests, Analyses, and Acceptance Criteria

	Commitment Wording	Inspection, Test or Analysis	Acceptance Criteria
2.1	The as-installed basic configuration of the four ESWBs is as shown on Figure 2.1.5-1.	An inspection of the ESWBs will be performed.	The as-installed configuration of the ESWBs is that there are four separate ESWBs as shown on Figure 2.1.5-1.
3.1	As shown in Figure 2.1.5-1, physical separation of the two pairs of ESWBs is provided by the NI complex.	An inspection of the ESWBs will be performed.	The as-installed configuration of the ESWBs is that the two pairs of ESWBs are separated by the NI complex as shown on Figure 2.1.5-1.
3.2	Two of the ESWBs have missile protection shields provided for the safety-related fans and pumps as shown on Figures 2.1.5-2, 2.1.5-3, 2.1.5-4, and 2.1.5-5.	An inspection of the ESWBs will be performed. 14.03.02-7	The as-installed configuration of the ESWB's includes five missile protection shields for each ESWB located adjacent to the turbine building as shown on Figures 2.1.5-2, 2.1.5-3, 2.1.5-4, and 2.1.5-5.
4.1	The ESWBs site grade level is at elevation ~~0'~~ -1' 0" as shown on Figures 2.1.5-4 and 2.1.5-5.	An inspection of the ESWBs site grade level will be performed.	The as-installed ESWB site grade level is at elevation ~~0'~~ -1' 0" as shown 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	An inspection of the ESWBs will be performed.	The as-installed configuration of the ESWBs provides internal hazards barriers as described in Table 2.1.5-1
4.3	The ESWB structures are Seismic Category I and are designed and constructed to withstand design basis loads as specified in Section 2.1.5, without loss of structural integrity and safety-related functions.	a. Analysis of the ESWB structures for the design basis loads will be performed. b. A verification inspection of the ESWB structures ~~seismic~~ design analysis versus ~~construction records~~ as-installed conditions will be performed. Deviations from the approved design due to as-installed conditions will be analyzed for design basis loads.	a. The design of the ESWB structures will withstand the design basis loads without loss of structural integrity and safety related functions. b. ESWB structures conform to the approved design and withstand the design basis loads specified in Section, 2.1.5, without loss of structural integrity and safety-related functions.

14.03.02-2

Figure 2.1.5-4—Essential Se

- Conventional Seismic structures that have the potential to interact with Seismic Category I structures are assessed for collapse potential under SSE and tornado loading (acting independently). Seismic demand for the SSE is computed in accordance with ASCE 4-98, Reference 1 and the methodologies in Section 3.7.2 Seismic load combinations are developed in accordance with ASCE 43-05 (Reference 5), using a limiting acceptable condition for the structure characterized as short of collapse, but structurally stable (i.e., Seismic Design Category 5 - Limit State A) as specified in the Standard.

- For Conventional Seismic structures that have the potential to interact with Seismic Category I structures, the combined seismic deflection is less than the separation distance (i.e., gap) between the structures.

- In the case where damage to Category I ~~SSCs~~SSC cannot be precluded by the criteria above, the structure is classified as Seismic Category II and designed to the same criteria as Seismic Category I structures.

The seismic interaction criteria and assessment guidelines are summarized in Table 3.7.2-29 —Seismic Structural Interaction Criteria for Building Structures. The Vent Stack, NAB, Access Building (AB), and the Turbine Building (TB) are Conventional Seismic structures that have potential to interact with the NI Common Basemat Structures. Results of the seismic interaction assessment for those structures are presented below, with associated discussions of the Radioactive Waste Processing Building (RWPB) and Fire Protection Storage Tanks and Building.

Vent Stack

The vent stack is described in Section 3.7.2.4.2 as a steel structure approximately 100 ft high located on top of the stair towercase structure between the FB and SB 4 (see Figure 3B-1). The vent stack is classified as Seismic Category II and designed to the same requirements as Seismic Category I structures. The stack is also designed for design basis tornado loading. Therefore, the vent stack has no potential for adverse interaction with the NI Common Basemat Structures.

14.03.02-5

Nuclear Auxiliary Building

Figure 3B-1 shows that the separation gap between the Nuclear Auxiliary Building and the NI Common Basemat Structures is ~~a minimum of~~ 18 in. An evaluation of the potential for seismic interaction between the NAB and the NI Common Basemat Structures indicates that the maximum relative seismic displacement~~, based on absolute values,~~ between the two structures is ~~slightly~~ less than the gap dimension~~9 in, or approximately one-half of the separation distance~~. ~~The seismic induced displacements of NI Common Basemat Structures and NAB are calculated~~ The evaluation is performed using results from a series of nonlinear analyses ~~on~~using dynamic finite element models of each structure ~~with reduced degrees of freedom~~. The model used for ~~T~~the NI Common Basemat Structures is the nonlinear lumped parameter model described in the second of half of Section 3.8.5.4.2. A similar

14.03.02-5

nonlinear model was created for the NAB building based upon the linear lumped parameter stick model described in Section 3.7.2.3.1.2. Analyses were conducted for a coefficient of friction at the soil-structure interface of 0.5 and 0.7.~~and the NAB are modeled with five degrees of freedom each, consisting of three translations and two rotations (about the horizontal X-X and Y-Y axes). The reduced degree of freedom models capture the predominant structural and soil deformation modes, namely lateral displacements and rocking. The values of the masses, springs and dampers, as well as the geometry, are derived from the detailed finite element models of the respective structures.~~

To provide sufficient design margin to prevent collapse or unacceptable performance under SSE loading, the design forces and moments for critical structural elements of the NAB are modified in accordance with the guidance of Reference 5. A reduction in the forces and moments due to seismic effects is taken using an inelastic energy absorption factor (F_μ) from Table 5-1 of ASCE 43-05 (Section 5.) for reinforced concrete shear walls. The inelastic energy absorption factor is based on the Limit State A criterion of ASCE 43-05 where permanent distortion, short of collapse, is permitted. The factor is for seismic design criteria and, hence, no reduction in force and moments is taken for other load cases including tornado effects. The F_μ factor is applied to tension, in-plane shear, and out-of-plane bending moment. A value of $F_\mu = 2$ is adopted for in-plane bending moments and shear in conjunction with axial tension. Per Section C5.1.2.3 of ASCE 43-05, a value of $F_\mu = 1$ is used for out-of-plane shear in conjunction with axial tension. For elements subjected to combined axial force and bending, a value of $F_\mu = 2$ is only applied to moment. Applicable provisions and design criteria for RS structures are also applied in finalizing the design.

Access Building

[[The separation gaps between the AB and SBs 3 and 4 is 0.98 ft and 1.31 ft, respectively (see Figure 3B-1).]] The walls of the AB are not physically connected to the SBs except through crossovers (passageways) providing access to the SBs. SB 3 is protected by the aircraft hazard (ACH) shield wall which not only protects the structure but also isolates control room personnel from adverse impact effects. SB 4 is not protected by the ACH shield wall. The seismic interaction assessment of the AB confirms that the separation gaps between SBs 3 and 4 are sufficient to preclude interaction. The crossover passageways are designed to accommodate the differential displacements without imparting unacceptable loads to the supporting structures.

Turbine Building

[[The separation between the TB and NI Common Basemat Structures is approximately 30 ft (see Figure 3B-1).]] Seismic interaction between the TB and NI Common Basemat Structures is prevented through application of the following design approach, which is also summarized in Table 3.7.2-29.

- Design of the TB to the requirements of the International Building code, which invokes ACI 318 (Reference 6) for concrete structures.
- Use of AISC specification, “Seismic Provisions for Structural Steel Buildings (ANSI/AISC 341),” (Reference 7) for lateral load-carrying steel bracing. (This follows the guidance in ANSI/AISC 360, “Specifications for Structural Steel Buildings,” (Reference 7) for use of AISC 341 in a ‘High Seismic Application’ (Reference 9).
- Use of Appendix 11A, “Quality Assurance Provisions,” of ASCE Standard 7-05 for QA requirements for the lateral bracing system (Reference 9).

Structural collapse under SSE loading is prevented by using the limiting acceptance criteria of ASCE 43-05, Seismic Design Category 5 - Limit State A.

In addition, crossovers from the TB to the NI Common Basemat Structures are supported primarily by the walls or roof of the ACH shield structure. Seismic interaction through the crossover is between the TB and the ACH shield structure rather than with SBs 2 and 3. Design measures limit the interaction forces between the NI Common Basemat Structures and TB transmitted through the crossover structures. The ACH shield structure and design measures isolate control room personnel from adverse effects of the interaction forces generated through the crossover structures.

Radioactive Waste Processing Building

The RWPB has no significant potential to seismically interact with either the NI Common Basemat Structures or with the nearest Seismic Category I structure not on the common basemat (i.e., the EPGB) therefore, the RWPB is not evaluated for SSE. The NAB is located between the RWPB and the NI Common Basemat Structures and shields the NI Common Basemat Structures from potential interaction. Both the NAB and RWPB are classified as RS structures and are designed for the standard plant 1/2 SSE using criteria in RG 1.143 for RW-IIa structures. The resulting designs are ductile designs with inherent margin against catastrophic collapse under SSE. In addition, this same robust design provides inherent margin against progressive collapse of the NAB caused by seismic interaction with the RWPB. In addition, the evaluation of the NAB itself for seismic interaction with the NI Common Basemat Structures under SSE loading is described above. Therefore, the NAB shields the NI Common Basemat Structures from any adverse effect of collapse of the RWPB.

Potential interaction between the RWPB and EPGB is precluded by separation and by design and site selection and foundation design criteria for the RWPB. The RWPB is embedded ~~over 31.5 ft below grade~~a significant distance below grade and has a clear height above grade of +52.5 ft, while the clearance between the RWPB and EPGB is ~~52.06~~at least 49.5 ft (see Figure 3B-1). Therefore, the separation between the two is only ~~5.28 in.~~a small distance less than the height above grade of the RWPB. Failure of the RWPB in such a manner as to strike the EPGB is not considered credible due to the

14.03.02-5

separation distance and because of the seismic design for 1/2 SSE loading described above. In addition, site selection and foundation design criteria for the U.S. EPR standard plant ensure that the RWPB is founded on competent soils, while the embedded section 31.5 ft below grade provides additional stabilization against rotation.

14.03.02-5

[[Fire Protection Storage Tanks and Buildings]]

[[The Fire Protection Storage Tanks and Buildings are classified as Conventional Seismic Structures.]] RG 1.189 requires that a water supply be provided for manual firefighting in areas containing equipment for safe plant shutdown in the event of a SSE. Therefore, t[[The fire protection storage tanks and building are designed to provide system pressure integrity under SSE loading conditions. Seismic load combinations are developed in accordance with the requirements of ASCE 43-05 using a limiting acceptance condition for the structure characterized as essentially elastic behavior with no damage (i.e., Limit State D) as specified in the Standard.]]

The Fire Protection Storage Tanks and Buildings are site-specific structures. A COL applicant that references the U.S. EPR design certification will provide the seismic design basis for the sources of fire protection water supply for safe plant shutdown in the event of a SSE.

3.7.2.9 Effects of Parameter Variations on Floor Response Spectra

Uncertainties in seismic modeling, due to such items as uncertainties in material properties, mass properties, concrete cracking under normal loading, and structural and soil modeling techniques can affect the accuracy of floor response spectra calculated using any of the approaches for seismic analysis presented in Section 3.7.2.1. To compensate for the effect of these uncertainties, the ISRS for U.S. EPR Seismic Category I structures are broadened by ±15 percent. These broadened ISRS are used in the subsequent design of structural elements of those structures, including flexible floors and walls.

3.7.2.10 Use of Constant Vertical Static Factors

Vertical seismic loads are generated from the SSI analysis for use in the seismic design of U.S. EPR Seismic Category I structures and Seismic Category II structures. Therefore, there is no need for the use of constant vertical static factors in the design of those structures.

3.7.2.11 Method Used to Account for Torsional Effects

Torsional effects due to the eccentricity built into the stick models or 3D FEM of the structures are accounted for during the seismic SSI analysis. Additional seismic loads due to accidental torsion are accounted for as required by Standard Review Plan,