



Tennessee Valley Authority, 1101 Market Street, LP 5A, Chattanooga, Tennessee 37402-2801

September 5, 2008

10 CFR 52.79

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

In the Matter of)
Tennessee Valley Authority)

Docket No. 52-014 and 52-015

**BELLEVILLE COMBINED LICENSE APPLICATION – RESPONSE TO REQUEST FOR
ADDITIONAL INFORMATION – SEISMIC DESIGN PARAMETERS**

Reference: Letter from Brian Hughes (NRC) to Andrea L. Sterdis (TVA), Request for
Additional Information Letter No. 110 Related to SRP Section 03.07.01 for the
Belleville Units 3 and 4 Combined License Application, dated August 7, 2008

This letter provides the Tennessee Valley Authority's (TVA) response to the Nuclear Regulatory
Commission's (NRC) request for additional information (RAI) items included in the reference
letter.

A response to each NRC request in the subject letter is addressed in the enclosure which also
identifies any associated changes that will be made in a future revision of the BLN application.

If you should have any questions, please contact Tom Spink at 1101 Market Street, LP5A,
Chattanooga, Tennessee 37402-2801, by telephone at (423) 751-7062, or via email at
tespink@tva.gov.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 5th day of Sep, 2008.

Andrea L. Sterdis
Manager, New Nuclear Licensing and Industry Affairs
Nuclear Generation Development & Construction

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cc: See Page 2

DOB5
NRO

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cc: (w/Enclosure)

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C. R. Pierce, SNC
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Responses to NRC Request for Additional Information letter No. 110 dated August 7, 2008
(8 pages, including this list)

Subject: Seismic design parameters in the Final Safety Analysis Report

<u>RAI Number</u>	<u>Date of TVA Response</u>
03.07.01-01	This letter – see following pages
03.07.01-02	This letter – see following pages Supplement expected by September 30, 2008
03.07.01-03	This letter – see following pages

Associated Additional Attachments / Enclosures

Attachment 03.07.01-01A

Pages Included

3 pages (not numbered)

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NRC Letter Dated: August 7, 2008

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 03.07.01-01

3.7 SEISMIC DESIGN

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

Add Subsection 3.7.1.1.1 as follows: (BLN SUP 3.7-3)

“3.7.1.1.1 Design Ground Motion Response Spectra

Figures 3.7-201 and 3.7-202 show a comparison of the horizontal and vertical site-specific ground motion response spectra (GMRS) to the certified seismic design response spectra (CSDRS), respectively. The horizontal and vertical response spectra were developed at the top of a hypothetical outcrop of competent material at the elevation of the AP1000 basemat as described in Section 2.5.2.4.4. Bedrock at 588.6 ft. (NAVD 88), the elevation of the AP1000 basemat, has a shear wave velocity that exceeds 9,200 feet per second as described in Section 2.5.4.7; thus no site response analysis was required to develop the GMRS.

As shown on Figure 3.7-201, the horizontal GMRS exceeds the CSDRS at frequencies of about 15 to 80 hertz. Peak ground acceleration at 100 hertz is about 0.24g. As shown on Figure 3.7-202, the vertical GMRS exceeds the CSDRS at frequencies of about 20 to 85 hertz.

The high frequency exceedances described above are within the seismic design margin of the AP1000, and will not adversely affect the systems, structures, or components of the plant.”

RAI: In the last sentence of BLN SUP 3.7-3, the applicant states: “The high frequency exceedances described above are within the seismic design margin of the AP1000, and will not adversely affect the systems, structures, or components of the plant.” However, the applicant has not provided the technical basis for this conclusion. The staff requests the applicant to submit a detailed description of the technical basis for this statement, including supporting quantitative response comparisons.

BLN RAI ID: 1121

BLN RESPONSE:

Westinghouse has performed the evaluation that demonstrated that the high frequency response is non-damaging to structures, systems and components of the plant. The documentation that supports the conclusion is given below.

The seismic analysis for the AP1000 design has been developed using the AP1000 Certified Seismic Design Response Spectra (CSDRS) that is described in the AP1000 DCD Section 3.7.1.1 (tier 2). As described in DCD Appendix 3I, the hard rock high frequency (HRHF) ground motion response spectra (GMRS) for some sites is not enveloped by the AP1000 CSDRS. Westinghouse selected a generic HRHF spectrum that envelopes many candidate AP1000 sites, including BLN. Updated FSAR Figures 3.7-201 and 3.7-202 (Attachment 03.07.01-01A) demonstrate that the BLN site-specific GMRS is enveloped by the Westinghouse HRHF spectra. The evaluated HRHF GMRS is given in Westinghouse Technical Report 144 (TR144) that documents AP1000 DCD changes to Tier 1 Figures 5.03 and 5.04 as well as changes to Tier 2 Figures 3I.1-1 and 3I.1-2. From the evaluation performed and documented in Westinghouse Technical Report 115 (TR115) it was concluded that the HRHF GMRS input is not damaging to equipment and structures qualified by analysis for AP1000 CSDRS, and that the normal design practices result in an AP1000 design that is safer and more conservative than that which would

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result if designed for the high frequency input.

The evaluation described above is intended to address the "Staff Guidance/Position on Addressing High Frequency Ground Motion Evaluations" provided in Section 4 of the NRC document "Interim Staff Guidance on Seismic Issues Associated with High Frequency Ground Motion in Design Certification and Combined License Applications Purpose" (ISG-01) which supplements the guidance provided to the staff in Section 3.7.1, "Seismic Design Parameters," of NUREG-0800, "Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants (NPPs)," regarding the review of seismic design information submitted to support design certification (DC) and combined license (COL) applications.

As indicated above, the site specific (BLN GMRS) exceedances of the AP1000 CSDRS are within the seismic design margin of the AP1000 HRHF GMRS and will not adversely affect the systems, structures or components of the plant. The necessary COLA FSAR revisions to reflect the analyses described above are included in the Application Revisions section below.

This response is PLANT-SPECIFIC.

ASSOCIATED BLN COL APPLICATION REVISIONS:

1. COLA Part 2, FSAR Chapter 2, Section 2.0, Table 2.0-201, Seismic – SSE entries will be revised from:

SSE	SSE free field peak ground acceleration of 0.30 g with modified Regulatory Guide 1.60 response spectra. Seismic input is defined at finished grade, except for sites where the nuclear island is founded on hard rock.	Peak ground acceleration = 0.24g High frequency exceedances of the horizontal ground motion response spectra has been evaluated by Westinghouse and these exceedances are within the seismic design margin of the AP1000 and will not adversely affect the systems, structures or components of the plant.	Subsection 3.7.1.1.1 Figure 3.7-201	Yes
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To read:

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SSE	<p>SSE free field peak ground acceleration of 0.30 g with modified Regulatory Guide 1.60 response spectra^(g,h) (See Figures 5.0-1 and 5.0-2). Seismic input is defined at finished grade, except for sites where the nuclear island is founded on hard rock. If the site-specific spectra exceed the response spectra in Figures 5.0-1 and 5.0-2 at any frequency, or if soil conditions are outside the range evaluated for AP1000 design certification, a site-specific evaluation can be performed. This evaluation will consist of a site-specific dynamic analysis and generation of in-structure response spectra at key locations to be compared with the floor response spectra of the certified design at 5-percent damping. The site is acceptable if the floor response spectra from the site-specific evaluation do not exceed the AP1000 spectra for each of the locations or the exceedances are justified.</p> <p>The hard rock high frequency (HRHF) ground motion spectra (GMRS) are shown in Figure 5.0-3 and Figure 5.0-4 defined at the foundation level for 5% damping. The HRHF GMRS provide an alternative set of spectra for evaluation of site specific GMRS. A site is acceptable if its site specific GMRS fall within the AP1000 HRHF GMRS.</p>	<p>Peak ground acceleration = 0.24g</p> <p>High frequency exceedances of the horizontal ground motion response spectra have been evaluated by Westinghouse. The site specific exceedances (BLN GMRS) are within the seismic design margin of the AP1000 (DCD HRHF GMRS) and will not adversely affect the systems, structures or components of the plant.</p>	<p>Subsection 3.7.1.1.1 Figure 3.7-201 Figure 3.7-202</p>	<p>Yes</p>
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2. COLA Part 2, FSAR Chapter 2, Section 2.0, Table 2.0-201, Seismic – SSE entries will be revised from:

f) With ground response spectra as given in DCD Figures 3.7.1-1 and 3.7.1-2. Seismic input is defined at finished grade except for sites where the nuclear island is founded on hard rock.

To read:

g) With ground response spectra as given in DCD Figures 3.7.1-1 and 3.7.1-2. Seismic input is defined at finished grade except for sites where the nuclear island is founded on hard rock.

h) Sites that fall within the hard rock high frequency GMRS given in DCD Figures 3.1.1-1 and 3.1.1-2 are acceptable.

3. COLA Part 2, FSAR Chapter 3, Subsection 3.7.1.1.1, last paragraph, will be revised from:

The high frequency exceedances described above are within the seismic design margin of the AP1000, and will not adversely affect the systems, structures, or components of the plant.

To read:

Similar high-frequency exceedances were evaluated by Westinghouse in DCD Appendix 3I using a hard rock spectrum (shown as WEC generic hard rock spectrum in Figures 3.7-201 and 3.7-202). In Figures 3.7-201 and 3.7-202, it can be seen that the horizontal and vertical GMRS are below the corresponding horizontal and vertical WEC generic hard rock spectrum for all frequencies. As described in DCD Appendix 3I, generic hard rock spectrum high frequency exceedances (and therefore the site specific exceedances) are within the seismic design margin of the AP1000 and will not adversely affect the systems, structures, or components of the plant.

4. COLA Part 2, FSAR Chapter 3, Section 3.7, Figures 3.7-201 and 3.7-202 will be revised to reflect a comparison of the AP1000 CSDRS, the AP1000 HRHF GMRS, and the site specific GMRS as shown in

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Attachment 03.07.01-01A.

ASSOCIATED ATTACHMENTS/ENCLOSURES:

Attachment 03.07.01-01A

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NRC Letter Dated: August 7, 2008

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 03.07.01-02

3.7.2.12 Methods for Seismic Analysis of Dams

Add the following text to the end of DCD Subsection 3.7.2.12: (BLN COL 3.7-1)

“The evaluation of existing and new dams whose failure could affect the site interface flood level specified in DCD Subsection 2.4.1.2, is included in Subsection 2.4.4.”

RAI: The staff requires clarification about the seismic classification of dams and the analysis methods and acceptance criteria that have been applied in the “evaluation of existing and new dams whose failure could affect the site interface flood level specified in DCD Subsection 2.4.1.2,.....” The staff requests the applicant to provide the following information for BLN COL 3.7-1:

- (a) Are there any Seismic Category I dams associated with the Bellefonte site? If so, describe the analysis methods and acceptance criteria that have been applied to confirm they do not collapse under the GMRS.
- (b) What organization has jurisdictional responsibility for the dams whose failure in an earthquake could affect the site flood level? Is there an established seismic design basis for these dams? If so, please describe it.
- (c) In estimating the maximum site flood level, including seismic effects on these dams, have all dams been assumed to fail under the effects of the site GMRS? If not, describe in detail the technical basis for making determinations of complete failure, partial failure, and no failure under the effects of the site GMRS.

BLN RAI ID: 1122

BLN RESPONSE:

- a) There are no seismic Category I dams associated with the Bellefonte site.
- b) Response to be provided in a future submittal.
- c) Response to be provided in a future submittal.

This response is PLANT-SPECIFIC.

ASSOCIATED BLN COL APPLICATION REVISIONS:

No COLA revisions have been identified associated with this portion of the response.

ASSOCIATED ATTACHMENTS/ENCLOSURES:

None associated with this portion of the response.

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NRC Letter Dated: August 7, 2008

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NRC RAI NUMBER: 03.07.01-03

3.7.2.8.1 Annex Building

Add the following text to the end of DCD Subsection 3.7.2.8.1: (STD SUP 3.7-4)

“The annex building is designed so that it will not collapse and damage the safety related auxiliary and shield building.”

RAI: In STD SUP 3.7-4, the RCOL applicant states: “The annex building is designed so that it will not collapse and damage the safety related auxiliary and shield building.” The staff notes that

- (1) AP1000 DCD Rev. 15, Section 2.7.2.8.1 states: “The annex building is classified as seismic Category II.”
- (2) AP1000 DCD Rev. 16, Section 2.7.2.8.1 states: “The portion of the annex building adjacent to the nuclear island is classified as seismic Category II.”
- (3) AP1000 DCD Rev. 15 and 16, Section 3.7.2, 3rd paragraph, states: “Seismic Category II building structures are designed for the safe shutdown earthquake using the same methods and design allowables as are used for seismic Category I structures.”

The staff requests the applicant to clarify why this supplemental statement has been added, and specifically identify

- (a) the Bellefonte-specific Seismic Category of the annex building;
- (b) the seismic analysis methods and acceptance criteria that have been applied; and
- (c) the technical justification for any deviations from “...the same methods and design allowable as are used for seismic Category I structures.”

BLN RAI ID: 1123

BLN RESPONSE:

The supplemental statement was added to address a Regulatory Guide 1.206 guidance statement that indicates the COLA FSAR should provide a description of the interaction of nonseismic Category I structures with seismic Category I structures. Since the Annex Building design is adequately addressed in the incorporated DCD discussion, the supplemental statement will be removed, clarifying that this subsection of the DCD is incorporated without departures or supplements.

- (a) The portion of the annex building adjacent to the nuclear island is classified as seismic Category II (as indicated in the incorporated by reference AP1000 DCD Subsection 3.7.2.8.1).
- (b) The seismic Category II building structures are designed for the safe shutdown earthquake using the same methods and design allowables as are used for seismic Category I structures (as indicated in the incorporated by reference AP1000 DCD Subsection 3.7.2, third paragraph).
- (c) There are no deviations from “...the same methods and design allowable as are used for seismic Category I structures.”

For clarity, the supplemental statement in FSAR Subsection 3.7.2.8.1 will be removed as shown in the Application Revisions section below.

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This response is expected to be STANDARD for the S-COLAs.

ASSOCIATED BLN COL APPLICATION REVISIONS:

COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.8.1 will be revised to omit the following statement (note that this supersedes previously provided Errata items affecting this sentence):

The annex building is designed so that it will not collapse and damage the safety related auxiliary and shield building.

ASSOCIATED ATTACHMENTS/ENCLOSURES:

None

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(3 pages including this cover sheet)

Revised COLA FSAR Figures 3.7-201 and 3.7-202



