



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

August 1, 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

**BELLEFONTE COMBINED LICENSE APPLICATION – RESPONSE TO REQUEST FOR  
ADDITIONAL INFORMATION – HYDROLOGY**

Reference: Letter from Joseph Sebrosky (NRC) to Andrea L. Sterdis (TVA), Request for  
Additional Information Letter No. 064 Related to SRP Section 02.04.02 for the  
Bellefonte Units 3 and 4 Combined License Application, dated July 3, 2008

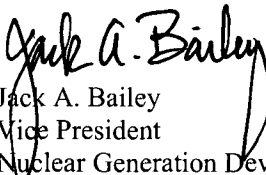
This letter provides the Tennessee Valley Authority’s (TVA) response to the Nuclear Regulatory  
Commission’s (NRC) request for additional information (RAI) items included in the reference  
letter.

A response to the 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 Phillip Ray at 1101 Market Street, LP5A,  
Chattanooga, Tennessee 37402-2801, by telephone at (423) 751-7030, or via email at  
pmray@tva.gov.

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

Executed on this 1<sup>ST</sup> day of Aug, 2008.

  
Jack A. Bailey  
Vice President  
Nuclear Generation Development

Enclosure  
cc: See Page 2

DO85  
NRW

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August 1, 2008

cc: (Enclosures)

J. P. Berger, EDF  
J. M. Sebrosky, NRC/HQ  
E. Cummins, Westinghouse  
S. P. Frantz, Morgan Lewis  
M.W. Gettler, FP&L  
R. Grumbir, NuStart  
P. S. Hastings, NuStart  
P. Hinnenkamp, Entergy  
M. C. Kray, NuStart  
D. Lindgren, Westinghouse  
G. D. Miller, PG&N  
M. C. Nolan, Duke Energy  
N. T. Simms, Duke Energy  
K. N. Slays, NuStart  
G. A. Zinke, NuStart

cc: (w/o Enclosure)

B. C. Anderson, NRC/HQ  
M.M. Comar, NRC/HQ  
B. Hughes/NRC/HQ  
R. G. Joshi, NRC/HQ  
R. H. Kitchen, PGN  
M.C. Kray, NuStart  
A. M. Monroe, SCE&G  
C. R. Pierce, SNC  
R. Reister, DOE/PM  
L. Reyes, NRC/RII  
T. Simms, NRC/HQ

Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

Responses to NRC Request for Additional Information letter No. 064 dated July 3, 2008  
(10 pages, including this list)

Subject: Hydrology as described in the Final Safety Analysis Report

<u>RAI Number</u>	<u>Date of TVA Response</u>
02.04.02-01	This letter – see following pages
02.04.02-02	This letter – see following pages
02.04.02-03	This letter – see following pages
02.04.02-04	This letter – see following pages
02.04.02-05	This letter – see following pages
02.04.02-06	This letter – see following pages
02.04.02-07	This letter – see following pages
02.04.02-08	This letter – see following pages

Associated Additional Attachments / Enclosures

None

Pages Included

Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

**NRC Letter Dated: July 3, 2008**

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER: 02.04.02-01**

TVA should justify use of the Cristofano methodology to model dam embankment breaching and document their justification for use of this method. TVA needs to also provide a copy of the Cristofano reference. This issue is associated with Attachment 5, item 47, of the May 13-16, 2008, hydrology-related safety site trip report dated June 12, 2008 (ADAMS accession number ML081610308).

Note: Subsequent to the hydrology-related safety site trip the staff received a May 23, 2008, letter from the U.S. Department of the Interior Bureau of Reclamation regarding the use of the Cristofano method (see ADAMS ML081570447). The letter states in part that "the method developed in 1965, by Eugene A. Cristofano of the Bureau of Reclamation for computing the erosion rate for failure of an earthfill dam is no longer being actively used by our agency."

**BLN RAI ID: 667**

**BLN RESPONSE:**

TVA provided an explanation at the June 23 workshop regarding the use of the Cristofano Methodology to model dam embankment breaching. TVA uses this methodology to determine the time at which embankment failure occurs. TVA has consistently assumed complete and instantaneous failure of earthen dams in model simulations that overtop embankments at the time embankment failure occurs, which is determined from the DBREACH computer code. While TVA agrees that the Bureau of Reclamation no longer actively uses this methodology, TVA considers the assumption of complete and instantaneous failure to be conservative.

A copy of the Cristofano reference will be attached to (and additional justification for its use will be included in) the software Verification and Validation documentation. The V&V documentation related to DBREACH and the use of this methodology will be available for review by February 27, 2009.

This response is PLANT-SPECIFIC.

**ASSOCIATED BLN COL APPLICATION REVISIONS:**

No COLA revisions have been identified associated with this response.

**ASSOCIATED ATTACHMENTS/ENCLOSURES:**

None

Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

**NRC Letter Dated: July 3, 2008**

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER: 02.04.02-02**

TVA should provide the NRC staff with Geographic Information System shape files of the new cross sections used in the updated simulated open channel hydraulics (SOCH) for Chickamauga, Nickajack and Guntersville reservoirs. This issue is associated with Attachment 5, item 49, of the May 13 -16, 2008, hydrology-related safety site trip report dated June 12, 2008 (ADAMS accession number ML081610308).

**BLN RAI ID: 668**

**BLN RESPONSE:**

TVA provided the GIS shape files on CD at the June 23 Workshop held in Knoxville.

This response is PLANT-SPECIFIC.

**ASSOCIATED BLN COL APPLICATION REVISIONS:**

No COLA revisions have been identified associated with this response.

**ASSOCIATED ATTACHMENTS/ENCLOSURES:**

None

Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

**NRC Letter Dated: July 3, 2008**

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER: 02.04.02-03**

TVA should provide diagrams of dam cross sections for: 1) the tributary dams found to be controlling during seismic events, and 2) all main stem dams. The diagrams should clearly show flood levels and assumed sections of the dam that fail and how they are postulated to fail for the given event. TVA should also include a diagram of the Dallas Bay area above Chickamauga Dam such that the diagram shows how at high reservoir levels this area will provide a flow path for bypassing the Chickamauga Dam. TVA needs to perform sensitivity runs to evaluate the impacts of modifying the Chickamauga lock. TVA should also consider how potential impacts from future modifications of the Chickamauga lock should be captured in the Bellefonte 3 and 4 licensing basis. This issue is associated with Attachment 5, item 50, of the May 13-16, 2008, hydrology-related safety site trip report dated June 12, 2008 (ADAMS accession number ML081610308).

**BLN RAI ID: 669**

**BLN RESPONSE:**

Simplified diagrams for the main stem dams were developed and provided as attachments to Revision 1 to the White Paper submitted to NRC on July 25, 2008. Drawings obtained from the River Operations Blue Book, for the four tributary dams in which seismic failure scenarios define the controlling PMF levels from seismic considerations, were also included in Revision 1 to the White Paper. The four tributary dams are Fontana, Blue Ridge, Hiwassee, and Apalachia. Aerial photographic views were provided of the Dallas Bay breach area, showing the flow path and bypass around the Chickamauga Dam.

The final configuration of the Chickamauga Dam (after modifications associated with the new lock are completed) will be used for the analyses supporting BLN Units 3 and 4. The impact of the lock modifications includes the permanent removal of five of the 18 available spillways. Lock modifications and thus spillway impacts are planned to be completed prior to BLN commercial operation date. TVA will provide final wording concerning Chickamauga Dam configuration on BLN PMF flood levels in the draft FSAR markup, previously committed to be submitted December 31, 2008.

This response is PLANT-SPECIFIC.

**ASSOCIATED BLN COL APPLICATION REVISIONS:**

COLA revisions associated with this response have not been finalized and will be provided as indicated.

**ASSOCIATED ATTACHMENTS/ENCLOSURES:**

None

Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

**NRC Letter Dated: July 3, 2008**

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER: 02.04.02-04**

The applicant should clarify in the final safety analysis report the wind wave runup calculation from the U.S. Army Corps of Engineers reference (Coastal Engineering Manual). This issue is associated with Attachment 5, item 51, of the May 13-16, 2008, hydrology-related safety site trip report dated June 12, 2008 (ADAMS accession number ML081610308).

**BLN RAI ID: 670**

**BLN RESPONSE:**

The FSAR is revised to clarify that adjustments to the selected wind speed were made using the U.S. Army Corps of Engineers guidance identified as Reference 231. Reference 231 is the U.S. Army Corps of Engineers Coastal Engineering Manual. The FSAR Subsection 2.4.3.6, first paragraph, currently states that wave height, setup, and run-up are estimated using U.S. Army Corps of Engineers guidance identified as Reference 231.

This response is PLANT-SPECIFIC.

**ASSOCIATED BLN COL APPLICATION REVISIONS:**

COLA Part 2, FSAR. Chapter 2, Section 2.4.3.6, 2<sup>nd</sup> paragraph will be revised from:

The 2-year annual extreme mile wind speed was adjusted for duration, based on effective fetch length, level, over land or, over water, and stability.

To read:

The 2-year annual extreme mile wind speed was adjusted for duration using the U.S. Army Corps of Engineers guidance (Reference 231), and was based on effective fetch length, level, over land or, over water, and stability.

**ASSOCIATED ATTACHMENTS/ENCLOSURES:**

None

Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

**NRC Letter Dated: July 3, 2008**

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER: 02.04.02-05**

TVA should check consistency between winds speeds reported in Section 2.3 and wind speed used in Subsection 2.4.3.6 of the final safety analysis report (FSAR) and make appropriate changes to the FSAR. This issue is associated with Attachment 5, item 52, of the May 13-16, 2008, hydrology-related safety site trip report dated June 12, 2008 (ADAMS accession number ML081610308).

**BLN RAI ID: 671**

**BLN RESPONSE:**

According to guidance provided by ANSI/ANS-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites," the 2-year wind speed is combined with precipitation events to determine coincident wind wave activity. The wind speed identified in FSAR Subsection 2.4.3.6 is the extreme mile, 2-year return period wind speed for the site. The wind speeds provided in FSAR Section 2.3 reflect return periods other than the 2-year return period. Therefore, the wind speed provided in FSAR Subsection 2.4.3.6 to determine coincident wind wave activity is consistent with applicable guidance and does not conflict with the data provided in FSAR Section 2.3.

This response is PLANT-SPECIFIC.

**ASSOCIATED BLN COL APPLICATION REVISIONS:**

No COLA revisions have been identified associated with this response.

**ASSOCIATED ATTACHMENTS/ENCLOSURES:**

None



Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

**NRC Letter Dated: July 3, 2008**

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER: 02.04.02-06**

TVA should provide a sensitivity run to investigate the effects of peaking each sub-basin unit hydrograph to account for non-linear behavior of the watershed during the probable maximum flood (PMF). This sensitivity run is discussed in the summary of the May 13-16, 2008, hydrology-related safety site trip report dated June 12, 2008 (ADAMS accession number ML081610308).

**BLN RAI ID: 728**

**BLN RESPONSE:**

TVA has performed sensitivity runs using a non-V&V version of the SOCH code and presented the findings at the June 23 workshop in Knoxville. The results from the non-V&V code sensitivity runs indicated that peaking of the unit hydrographs by 20% resulted in less than a 1 inch higher PMF level at the BLN site, thus indicating that the length and complexity of the Tennessee River Basin upstream of BLN attenuates uncertainties in unit hydrograph development. TVA will replicate the SOCH simulation run using the final V&V version of the code, and the results of this sensitivity run will be documented in a calculation.

This response is PLANT-SPECIFIC.

**ASSOCIATED BLN COL APPLICATION REVISIONS:**

No COLA revisions have been identified associated with this response.

**ASSOCIATED ATTACHMENTS/ENCLOSURES:**

None

Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

**NRC Letter Dated: July 3, 2008**

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER: 02.04.02-07**

During the May 13-16, 2008, hydrology-related safety site trip the staff identified eleven items that should be clarified/corrected in the April 17, 2008 draft white paper (ADAMS accession number ML081120497) before the white paper is finalized. This issue is associated with Attachment 5, item 54, of the May 13 -16, 2008, hydrology-related safety site trip report dated June 12, 2008 (ADAMS accession number ML081610308).

- 1) Appendix A figures present observed elevations that fall outside the guide curves. TVA will expand their discussion of these figures in the next version of the white paper to explain these variations.
- 2) Section 4.1, last paragraph (Page 11) refers to “studies done by others and unpublished work by TVA.” TVA is to provide clarification of these studies in the white paper and provide copies of the studies for staff review during the June 23, 2008 Knoxville trip.
- 3) Using figure 7 and 8 as an example, curves are identified as being “reproduced by composite unit graph.” TVA is to provide an explanation in the text where further information on how these figures were developed can be found.
- 4) On figure 10, TVA is to resolve whether or not the “Blue dots” represent real data.
- 5) On figure 12, TVA is to explain the note on the graph that states “Hoch’s estimated inflow.”
- 6) Using figure 13 as an example, TVA is to develop text to describe the method used to develop the curve.
- 7) Page 27 section 4.2.1 TVA is to clarify overall text on what is meant by stable model and stability criteria and tie this discussion to page 32.
- 8) Page 32, last paragraph TVA is to change the word “disadvantage” to “advantage.”
- 9) Page 36 Section 4.2.5 first paragraph last sentence TVA is to clarify the the relationship between HEC-2 and the SOCH code.
- 10) Figure 30 through figure 39, TVA will clarify the run sequence associated with these figures in the white paper.
- 11) In Section 5.3 TVA is to expand the white paper discussion regarding work crew access for reservoir operations during and after the antecedent storm and will include a discussion of the Memorandum of Understanding with the US Army Corps of Engineers.

**BLN RAI ID: 672**

**BLN RESPONSE:**

The items 1 through 11 listed under this RAI have been corrected, added or addressed as necessary in the Revision 1 to the Hydrology White Paper, submitted to NRC on July 25, 2008. A summary of the changes made is provided in the following listing which corresponds to the items listed in the question.

- 1) Explanatory notes have been added to the Appendix A figures and text added on page 12 to explain the presence of observed elevations (median elevations) falling outside the guide curves.

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TVA letter dated August 1, 2008  
RAI Responses

- 2) References 1, 2, and 3, related to unit hydrograph linearity, were added.
- 3) Additional detail regarding the development of “composite hydrographs” was added to Section 4.1.1.
- 4) The unit hydrograph figures were replaced with more readily read and understood figures, removing certain spurious information.
- 5) The unit hydrograph figures were replaced with more readily read and understood figures, removing certain spurious information.
- 6) Additional detail regarding the development of “composite hydrographs” was added to Section 4.1.1.
- 7) Additional wording was added to Section 4.2.1 to clarify what is meant by “Stable model.”
- 8) An incorrect word, “disadvantage,” was replaced with the correct word “advantage.”
- 9) Additional wording was added to Section 4.2.5 to clarify the relationship between HEC-RAS (or HEC2) and the SOCH code.
- 10) The section showing run sequences was clarified and expanded to provide additional detail regarding the SOCH simulation run sequences.
- 11) Additional wording was added to Section 5.3 to better detail the crew access and the agreements in place with the U.S. Army Corps of Engineers.

This response is PLANT-SPECIFIC.

**ASSOCIATED BLN COL APPLICATION REVISIONS:**

No COLA revisions have been identified associated with this response.

**ASSOCIATED ATTACHMENTS/ENCLOSURES:**

None

Enclosure  
TVA letter dated August 1, 2008  
RAI Responses

**NRC Letter Dated: July 3, 2008**

**NRC Review of Final Safety Analysis Report**

**NRC RAI NUMBER: 02.04.02-08**

During the May 13-16, 2008, hydrology-related safety site trip the staff and TVA identified nine commitments in the applicant's draft white paper dated April 17, 2008 (ADAMS accession number ML081120497) regarding the simulated open channel hydraulics (SOCH) code used in the probable maximum flood and dam breach analysis. These commitments relate to future actions by TVA. The purpose of this question is to track these commitments to resolution. This issue is associated with Attachment 5, item 53, of the May 13 -16, 2008, hydrology-related safety site trip report dated June 12, 2008 (ADAMS accession number ML081610308).

A location for the commitments in the white paper is as follows:

- 1) Bottom of page 34 last sentence includes a commitment for a comparative analysis.
- 2) Cover letter for the white paper indicates that an update will be provided the week of May 26, 2008.
- 3) Page 52, section 5.3.1, first paragraph last sentence includes a commitment regarding the verification process.
- 4) Page 60 last paragraph contains a commitment regarding the verification process.
- 5) Page 62 first and second bullets contain commitments regarding bathymetry data.
- 6) Page 62 contains commitments regarding the analysis of the 2003.
- 7) Page 62 contains commitments regarding updating and verifying hydrographs.
- 8) Page 62 contains commitments that updated models will be used.
- 9) Page 62 contains commitments regarding reservoir operating guides and spillway rating curves being reviewed.

**BLN RAI ID: 673, 674, 675, 676, 677, 678, 679, 680, 681**

**BLN RESPONSE:**

As discussed with the NRC on May 15, the revision of the White Paper was extended to a date after the Workshop to allow any issues resulting from the Workshop to be captured in the White Paper Revision, and to allow better focusing of resources and efforts on Workshop preparation. These commitments were listed in an Attachment to the cover letter submitting the White Paper revision to NRC on July 25, 2008. The attachment listing the commitments will be periodically updated until the commitments are complete.

This response is PLANT-SPECIFIC.

**ASSOCIATED BLN COL APPLICATION REVISIONS:**

No COLA revisions have been identified associated with this response.

**ASSOCIATED ATTACHMENTS/ENCLOSURES:**

None