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Your ref: Docket No. 52-006  
Our ref: DCP\_NRC\_003018

August 20, 2010

Subject: AP1000 Response to Open Item (SRP3)

Westinghouse is submitting a response to the NRC Open Item (OI) on SRP Section 3. This OI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following OI(s):

OI-SRP3.9.1-EMB1-07 R3

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

A handwritten signature in black ink, appearing to read "Robert Sisk".

Robert Sisk, Manager  
Licensing and Customer Interface  
Regulatory Affairs and Strategy

/Enclosure

1: Response to Open Item on SRP Section 3

D063  
NRS

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ENCLOSURE 1

Response to Open Item on SRP Section 3

# AP1000 TECHNICAL REPORT REVIEW

## Response to SER Open Item (OI)

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OI Response Number: OI-SRP3.9.1-EMB1-07  
Revision: 3

### Question:

#### Revision 3:

The staff believes that a comprehensive training program should be in place for WESTEMS along with procedures for ensuring that outputs are correct and repeatable.

#### Revision 2:

#### Follow-up question #1 (WEC Response provided in Rev. 2 of this Open Item):

The WESTEMS manual does not adequately address manually removing the peak and valley stress points. The manual provides no control over removal so that the results obtained are not predictable and repeatable.

#### Follow-up question #2 (WEC Response provided in Rev. 2 of this Open Item):

The WESTEMS NB-3600 analysis heavily relies on user determined options and manual selection of the stress peaks and valleys.

#### Revision 1:

In the response of OI-SRP3.9.1-EMB1-07, Westinghouse stated that "The user does not modify peak and valley times/stresses without configuration control. All peak and valley selection is recorded in the final configured output files so that inputs and outputs can be verified according to the QA process."

It is noted that the interactive WESTEMS allowing the user to manually modify the peak and valley times/stresses. The echo printout of the stress peak/valley modifications does not provide technical basis to modify the stress result calculated by WESTEMS. The staff requests Westinghouse to explain how to control the user operation for the modification and provide the technical basis for stress modification. Since the modifications are saved as revised inputs to the interactive fatigue analysis or in a file for fatigue reanalysis, the technical justification for modification should be provided by the analyst in the print out or recorded in file. The staff notes that the inclusion of peaks editor may imply that WESTEMS cannot select peak/valley locations adequately. Therefore, the peaks editor is required to modify the WESTEMS



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peak/valley stress results. The staff requests Westinghouse to discuss why peak editor is required to modify the peak/valley stress calculated by WESTEMS.

### Revision 0:

WESTEMS program provided an option to eliminate peak/valley points during calculation. The staff noted that the computer output should not be modified after executing the program. The staff requested the applicant to provide the configuration control and limitations of the program for this option. This concern is identified as **Open Item OI-SRP3.9.1-EMB1-07**.

In its response to RAI-SRP3.9.1-EMB1-07, the applicant indicated that WESTEMS provides various tools and options for the user to select the appropriate peak and valley points for the fatigue evaluation. It noted that the use of the WESTEMS peak time selection tools and options, as well as the interactive peaks editor, does not involve user modification of the fatigue analysis results output files. The applicant also noted that these tools allow the user to modify parameters of the peak time selection process and/or ultimately the peak and valley times/stresses used in the final analysis. The modifications are saved as revised inputs to the interactive fatigue analysis or in a file for fatigue reanalysis. The applicant is requested to discuss how the interactive WESTEMS allowing the user to manually modify the peak and valley times/stresses without the configuration control and documentation changes record satisfies the quality assurance requirements in accordance with 10 CFR 50 Appendix B and ASME NQA-1. **This is related to OI-SRP3.9.1-EMB1-07.**

### References:

1. ADAMS "Chapter 3 SER," ML092150664.
2. WESTEMS™ User's Manual Version 4.5, Volume 2, Rev. 0, "Design Analysis," Westinghouse Electric Company, 2007.
3. LTR-PAFM-10-100, "WESTEMS Version 4.5.2 User's Manual Addendum 3: Peak and Valley Selection and Documentation Guidelines."

### Westinghouse Response:

### Revision 3:



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This open item response is being revised in order to document the development and/or enhancement of WEC quality controls on WESTEMS including training, user qualification, procedures for performing and verifying analyses and program documentation (user's manual and addenda).

The following actions are performed to close this open item:

- A detailed draft version of a WEC Level 3 Quality Procedure for application and verification of NB-3600 analyses in WESTEMS has been developed. This draft procedure has been made available for NRC review at the WEC Twinbrook Office.
- A sample calculation to confirm implementation of this procedure for performing and verifying NB-3600 analyses in WESTEMS is being developed and will be made available for NRC review at the WEC Twinbrook Office upon completion.
- The WESTEMS Training Program has been enhanced to include a more comprehensive presentation on performing and verifying NB-3600 analyses in WESTEMS. Additional detail is provided on the peak selection and peak editing tools within the program. The training slides have been made available for NRC review at the WEC Twinbrook Office.
- A user qualification checklist specific to WESTEMS analysis has been developed in order to document users that are qualified to perform and/or verify both standard and non-standard type analyses in WESTEMS. This has been made available at the WEC Twinbrook Office for NRC review.
- Two addenda to the user's manual have been developed in order to provide users with more detailed guidance on the peak selection and peak editing tools within the program. These addenda have been submitted for NRC review.
- A verification checklist has been developed to be added to WESTEMS calculations in order for the verifier to document specific program inputs and analysis methods were verified in accordance with the developed procedure. This has been made available at the WEC Twinbrook Office for NRC review.



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### Revision 2:

This open item response has been revised to respond to two (2) follow-up questions by the NRC following staff review of the submitted Rev. 1 response and related documentation provided to the WEC Twinbrook Office. The follow-up questions are labeled as 1 and 2 above and are answered in succession below.

The user instruction referred to in Rev. 1 of this open item response (and made available at the WEC Twinbrook Office for staff review) has been approved as an addendum to the WESTEMS User's Manual Version 4.5 (Reference 2) and has been added as Reference 3 to this response. This document is proprietary and will be submitted on the docket at the request of the NRC separate from this response.

### Response to follow-up question #1:

The WESTEMS™ User's Manual Version 4.5 Volume 2 (Reference 2) addresses peak time editing in Section 8.11 for NB-3200 analysis and in Section 10.6 for NB-3600 analysis. The WESTEMS™ analysis output files provide information regarding peak times selected by the program and peak times edited by the user. In Revision 1 of this Open Item response, additional user instructions are provided in a User's Manual Addendum (Reference 3) with explicit instructions for output files and information to be documented with respect to the peak and valley times used in the analyses. This document has been made available for staff review at the WEC Twinbrook Office. Also, as stated above, this addendum will be submitted on the docket in a separate transmittal.

### Response to follow-up question #2:

The WESTEMS™ peak and valley selection algorithm is designed to assist the user in selection of peak and valley times, mirroring a process that previously used a combination of automated and manual steps in classic piping fatigue analyses. The method used in the NB-3600 module provides users with options to reflect similar processes used in past Westinghouse evaluations for piping component design fatigue analyses.

Because design fatigue analysis is highly dependent on the transient input histories, and the transient input histories are dependent on users, the nature of NB-3600 stress equations requires user selection of methods to process the user inputs. As stated previously, the automated peak and valley time selection algorithm is designed to select more peak and valley times that would be typically selected using a manual process. This is to protect against missing valid peak and valley times.



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As a result, the user is also provided a controlled process to edit peak times for the final analysis run to remove redundant peaks, and to save the results of the entire process along with justification in the analysis documentation. Guidelines for this process are provided in a User's Manual Addendum (Reference 3) with explicit instructions for output files and information to be documented with respect to the peak and valley times used in the analyses. This addendum was referred to in the Revision 1 response to this Open Item and provided to the WEC Twinbrook Office for Staff Review. As mentioned above, this addendum will also be submitted on the docket in a separate transmittal.

It should also be noted that most piping fatigue analyses may be accomplished using the conservative application of the maximum Moment Stress Range input option, where user interaction and required options are minimal. In the case of some components that require more detailed analysis methods for qualification, typically by using more precise assignment of applicable moment loads to each transient, it is expected that more user involvement should be required in a tool intended for general use. This expectation is consistent with the historical approach to piping fatigue analysis. It is also consistent with other applications of general purpose software, such as the ANSYS fatigue module, where the user is responsible for transient load inputs and definition of event time histories for the selection of peak and valley stress states.

### Revision 1:

This open item response has been revised to respond to the follow-up request by the NRC to the Rev. 0 response.

The ability for the user to edit stress peak and valley times is provided because the total set of peaks and valleys selected by the automated algorithm in WESTEMS™ is somewhat dependent on the user definition of the transient inputs and because the algorithm is designed to be conservative in the selection process. If the user determines that the conservative set of peaks and valleys is acceptable for qualification, no further action is required. On the other hand, the user has the ability to perform a more detailed evaluation by removing conservatism with the editing process and to document the justification for the final set of peaks and valleys for analysis. The revised peaks and valleys may be used in another execution of the program using the new input file to produce the final analysis for documentation.

Guidelines for accomplishing this process and the required analysis documentation are provided in a separate draft document, "WESTEMS™ Peak Selection Guidelines," which has been made available for staff review at the Westinghouse Twinbrook Office. This instruction will be included in the analysis plan for the AP1000 piping analyses and will also be incorporated in the next revision of the WESTEMS™ User Manual.



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#### Revision 0:

Although WESTEMS™ provides various tools and options for the user to select the appropriate peak and valley points for the fatigue evaluation, it is important to note that the use of the WESTEMS™ peak time selection tools and options, as well as the interactive peaks editor, does not involve user modification of the fatigue analysis results output files. These tools allow the user to modify parameters of the peak time selection process and/or ultimately the peak and valley times used in the final analysis. The modifications are saved as revised inputs to the interactive fatigue analysis or in a file for fatigue reanalysis. These user modifications are reflected in the echo of inputs in fatigue analysis results files and/or in an intermediate fatigue analysis input file that is saved for use in reanalysis. When the fatigue analysis is run or re-run in the program, a separate set of analysis output files is created with the configuration control information, the echo of inputs, including the peak and valley time and stress information, and the fatigue stress range and usage factor calculation outputs. These analysis results output files constitute the quality assurance (QA) record for the analysis and include the program configuration control information, an echo of all of the analysis inputs, including time histories, selected peak and valley times and stress quantities, and details of the stress range and usage factor calculations. These analysis records, together with the program user's documentation, provide sufficient documentation for independent verification of the fatigue analysis inputs and results, as required by the Westinghouse QA process. No additional information is needed to satisfy the QA requirements.

#### Response to follow-up question:

The user does not modify peak and valley times/stresses without configuration control. All peak and valley selection is recorded in the final configured output files so that inputs and outputs can be verified according to the QA process.

#### Design Control Document (DCD) Revision:

None

#### PRA Revision:

None

#### Technical Report (TR) Revision:

None