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Cranberry Township, Pennsylvania 16066  
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Your ref: Project No. 0794  
Our ref: DCP\_NRC\_003239

February 26, 2013

Subject: Westinghouse Response to Requests for Additional Information (RAIs) on  
WCAP-17577, Rev. 1

References:

- 1) Westinghouse Letter No. DCP\_NRC\_003224, "Transmittal of WCAP-17577, 'Topical Report on ASME Section III Piping Fatigue Analysis Utilizing the WESTEMSTM Computer Code,' Revision 1, for Safety Evaluation, dated September 28, 2012.
- 2) NRC Letter, "Acceptance for Review of Westinghouse's Topical Report WCAP-17577-P, Revision 1, 'Topical Report on American Society of Mechanical Engineers Section III Piping Fatigue Analysis Utilizing the WESTEMSTM Computer Code,'" dated November 13, 2012. (ADAMS Accession No. ML12310A052)

Westinghouse Electric Company, LLC is submitting responses to Requests for Additional Information (RAIs) received on WCAP-17577, "Topical Report on ASME Section III Piping Fatigue Analysis Utilizing the WESTEMSTM Computer Code," (Reference 1) to the Document Control Desk. The responses are submitted in support of the NRC review and safety evaluation of this topical report. This transmittal meets the milestone date for RAI responses to be received in order for the NRC to complete the safety evaluation of the use of WESTEMSTM for performing fatigue analysis on the AP1000® Class 1 piping in accordance with the schedule outlined in the acceptance letter (Reference 2).

This submittal contains proprietary information of Westinghouse Electric Company LLC. In conformance with the requirements of 10 CFR Section 2.390, as amended, of the Commission's regulations, we are enclosing with this submittal one copy of the Application for Withholding, AW-13-3625 (non-proprietary, Enclosure 1), and one copy of the associated Affidavit (non-proprietary, Enclosure 2) with Proprietary Information and Copyright Notices. The affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission. Pursuant to 10 CFR 50.30(b), Proprietary and Non-Proprietary responses to RAI-WSTM-001 are submitted as Enclosures 3 and 4, Proprietary and Non-Proprietary responses to RAI-WSTM-008 are submitted as Enclosures 5 and 6, and Proprietary and Non-Proprietary responses to RAI-WSTM-009 are submitted as Enclosures 7 and 8. Correspondence with respect to the affidavit or Application for Withholding should include our reference number AW-13-3625 and should be addressed to James A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company, LLC, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

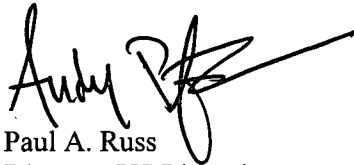
TOOT  
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The following RAI responses are submitted via this transmittal:

RAI-WSTM-001-P  
RAI-WSTM-001-NP  
RAI-WSTM-008-P  
RAI-WSTM-008-NP  
RAI-WSTM-009-P  
RAI-WSTM-009-NP

Questions or requests for additional information related to the content of these RAIs should be directed to Westinghouse. Please direct questions to the undersigned.

Very truly yours,



*for*  
Paul A. Russ  
Director, US Licensing

/Enclosures

1. AW-13-3625 "Application for Withholding Proprietary Information from Disclosure," dated February 26, 2013
2. AW-13-3625, Affidavit, Proprietary Information Notice, Copyright Notice dated February 26, 2013
3. Response to RAI-WSTM-001-P (Proprietary)
4. Response to RAI-WSTM-001-NP (Non-proprietary)
5. Response to RAI-WSTM-008-P (Proprietary)
6. Response to RAI-WSTM-008-NP (Non-proprietary)
7. Response to RAI-WSTM-009-P (Proprietary)
8. Response to RAI-WSTM-009-NP (Non-proprietary)

cc: B. Baval - U.S. NRC  
M. Tonacci - U.S. NRC  
P. Russ - Westinghouse  
J. McInerney - Westinghouse

ENCLOSURE 1

AW-13-3625

APPLICATION FOR WITHHOLDING  
PROPRIETARY INFORMATION FROM DISCLOSURE



Westinghouse Electric Company  
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Your ref: Project No. 0794  
Our ref: AW-13-3625

February 26, 2013

APPLICATION FOR WITHHOLDING PROPRIETARY  
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Westinghouse Response to Requests for Additional Information (RAIs) on  
WCAP-17577, Rev. 1

The Application for Withholding is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of Paragraph (b) (1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and is customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10 CFR Section 2.390, Affidavit AW-13-3625 accompanies this Application for Withholding, setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to this Application for Withholding or the accompanying affidavit should reference AW-13-3625 and should be addressed to James A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania, 16066.

Very truly yours,

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

Robert B. Sisk  
Program Manager Korea/UAE

ENCLOSURE 2

AFFIDAVIT

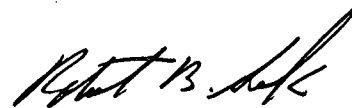
AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

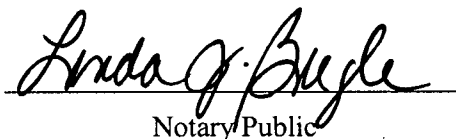
Before me, the undersigned authority, personally appeared Robert B. Sisk, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:



Robert B. Sisk  
Program Manager Korea/UAE

Sworn to and subscribed  
before me this 26<sup>th</sup> day  
of February 2013.

COMMONWEALTH OF PENNSYLVANIA  
Notarial Seal  
Linda J. Bugle, Notary Public  
City of Pittsburgh, Allegheny County  
My Commission Expires June 18, 2013  
Member, Pennsylvania Association of Notaries

  
Notary Public

- (1) I am Program Manager Korea/UAE, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.
- (2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse "Application for Withholding" accompanying this Affidavit.
- (3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.
- (4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.
  - (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.
  - (ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

    - (a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

- (b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.
- (c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.
- (d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.
- (e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.
- (f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

- (a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.
- (b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.
- (c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.



- (d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.
  - (e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.
  - (f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.
- (iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.
- (iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.
- (v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in attachment to DCP\_NRC\_003239, Westinghouse Response to Requests for Additional Information (RAIs) on WCAP-17577, Rev. 1."

This information is part of that which will enable Westinghouse to:

- (a) Manufacture and deliver products to utilities based on proprietary designs.
- (b) Advance the AP1000 Design and reduce the licensing risk for the application of the AP1000 Design Certification
- (c) Determine compliance with regulations and standards

- (d) Establish design requirements and specifications for the system.

Further this information has substantial commercial value as follows:

- (a) Westinghouse plans to sell the use of similar information to its customers for purposes of plant construction and operation.
- (b) Westinghouse can sell support and defense of safety systems based on the technology in the reports.
- (c) The information requested to be withheld reveals the distinguishing aspects of an approach and schedule which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar digital technology safety systems and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

### **PROPRIETARY INFORMATION NOTICE**

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

### **COPYRIGHT NOTICE**

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.390 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

ENCLOSURE 4

Response to RAI-WSTM-001-NP

(Non-proprietary)

## Westinghouse Non-Proprietary Class 3

# WESTINGHOUSE TOPICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

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RAI Response Number: WSTM-001-NP

Revision: 0

### Question:

Section 2.1 of the WESTEMS topical report WCAP-17577-P, Revision 1 (TR) (ML12275A1150) discusses the applicant's resolution of regulatory issues that were raised in previous NRC audits. Of note, in response to OI [open item]-SRP3.9.1-EMB-07, discussed on Page 2-1 of the report, the application states that the WESTEMS computer code consists of a two phased fatigue analyses. The first phase was performed to calculate stress time history for each individual transient, selects peak and valley times, and calculates fatigue results from all transient pairs associated with the selected peak and valley times. The second phase includes an optional step for editing of the input peak and valley set based on identified conservatisms.

However, the staff noted in Reference 17 of the topical report, "Audit Report on the Use of WESTEMS™ Software in the Salem Nuclear Generating Station, Units 1 and 2, License Renewal Application (TAC Nos. ME1834 and ME1836)," March 30, 2011 (ML110871243) that the fatigue cumulative usage factor (CUF) from the WESTEMS online monitoring module was eight times the design CUF value obtained by the WESTEMS design analysis module while the design CUF value is considered to be the worst case. The staff also noted that WESTEMS program algorithm produces additional peak and valley sets that may lead to overly conservative CUF results

For staff to understand the need of user's controlled modification, Westinghouse is requested to provide the root cause of generating the redundant and additional peak and valley times. Please discuss whether the additional redundant times were created due to certain program algorithms deficiencies, if so, describe, and also describe how the additional redundant times are generated due to those cases listed in TR Section 4.1.5 and whether there are other transient cases than those in Section 4.1.5.

### Westinghouse Response:

#### NB-3600:

Section 4.1.5 of the Topical Report (WCAP-17577) discusses the three known sources of potential redundant peaks that may occur for an NB-3600 fatigue analysis in WESTEMS™.

- [ ]<sup>a,c</sup>
- Phasing of thermal (Ta-Tb,  $\Delta T1$ ,  $\Delta T2$ ), pressure, or moment portions of the stress response may cause successive peaks for the same loading event.

## Westinghouse Non-Proprietary Class 3

### WESTINGHOUSE TOPICAL REPORT REVIEW

#### Response to Request For Additional Information (RAI)

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- [

] <sup>a,c</sup>

[

] <sup>a,c</sup>

The “root cause” for each of the three identified occurrences of redundant peaks that can occur in an NB-3600 analysis is explained in the following three sections of this response. It is important to note that the redundant peaks do not occur due to a deficiency in the program algorithm. These peak redundancies, as described below, are well understood and are a product of the program conservatively ensuring that all unique peaks are identified and accounted for in the fatigue evaluation.

The three cases of redundant peaks for an NB-3600 analysis are described below, with an example of each case taken from analyses documented in the validation of WESTEMS™ version 4.5.6 (CN-PAFM-12-20 Revision 0, Reference 10 of WCAP-17577).

NB-3600 Redundancy: [

] <sup>a,c</sup>

The first “root cause” of redundant peaks can be attributed to transient definitions. The transient definitions may [

] <sup>a,c</sup> This is captured as the first bulleted item in Section 4.1.5, Peak Selection and Analysis Control, of WCAP-17577.

Section 5.1.1 of WCAP-17577 reviews the validation testing that was done to confirm the peak selection operation for WESTEMS™ NB-3600 analyses. [

] <sup>a,c</sup>

The test case summarized considers a step loading and return of temperature, pressure, and moment conditions. The transient temperature load is defined such that there is sufficient time for the through-wall temperatures to return to steady state conditions. The temperature, pressure, moment conditions at the beginning of the transient are the same as at the end. The stress response is shown in Figure 5-4 of WCAP-17577, included below, which is a plot of the



WESTINGHOUSE TOPICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

[

] <sup>a,c</sup>

a,c

[

] <sup>a,c</sup> The analyst is able to review the input conditions and

## WESTINGHOUSE TOPICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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determine instances where redundancies may occur and can limit the analysis from retaining these redundant peaks with the user options for each transient.

#### NB-3600 Redundancy: Phasing of Stress Contributions

The second "root cause" of redundant peaks can be attributed to the stress response of a transient load excursion. The stress response to a single transient excursion may result in multiple extreme states being captured in the time period following the excursion, due to phasing of the various portions of the stress response. For example, for a component with a large discontinuity, the thermal discontinuity stress range ( $T_a$ - $T_b$  term) will typically maximize later than the shock stress range ( $\Delta T_1$  and  $\Delta T_2$  terms), such that their [

] <sup>a,c</sup> In this case, only one of these peak times needs to be included in the fatigue evaluation to represent the stress cycle caused by the load change. The relative impacts of such effects are a function of the component geometry and materials and potentially the transient load inputs determined by the user.

The validation case summarized in Section 5.1.1 of WCAP-17577 (and discussed previously with respect to the [ ] <sup>a,c</sup>) also demonstrates an occurrence of the thermal stress phasing effect causing a redundant peak. In this example, [

] <sup>a,c</sup> Further review of the interaction between thermal stress contributions indicated that this can be attributed to the phasing effect, discussed as follows:

a,c



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### WESTINGHOUSE TOPICAL REPORT REVIEW

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The transient being considered includes thermal, pressure, and moment effects, but it is the thermal stress terms that contribute to this instance of phasing redundancy. Plots of the individual thermal stress term contributions ( $T_a - T_b$ ,  $\Delta T_1$ , and  $\Delta T_2$ ) are shown below to depict the phasing characteristics.



## Westinghouse Non-Proprietary Class 3

### WESTINGHOUSE TOPICAL REPORT REVIEW

#### Response to Request For Additional Information (RAI)

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] <sup>a,c</sup>

[

] <sup>a,c</sup> Therefore, these two peak times are redundant, since both represent the same stress cycle caused by the load change. By including both peak times for this transient, the fatigue analysis conservatively includes twice the number of cycles for this stress state. Therefore, the analyst is able to review these conditions, determine such redundancies, and limit the analysis from retaining the redundant peaks.

NB-3600 Redundancy: [

] <sup>a,c</sup>

The third "root cause" of redundant peaks can be attributed to numerical noise. To reduce the effects of numerical noise in the [

] <sup>a,c</sup> This is captured as the third bulleted item in Section 4.1.5, Peak Selection and Analysis Control, of WCAP-17577.

Section 5.3.2 of the WCAP-17577 reviewed the validation testing that was done to confirm the operation of the [

] <sup>a,c</sup>

## WESTINGHOUSE TOPICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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a,c

The ASME Code methodology to determine maximum alternating stress cycles would require only one peak time representing each load change and resulting stress cycle to be included in the fatigue evaluation. The characteristics of the software algorithm described above can result in two, nearly identical, stress states to be chosen as peaks for the same load excursion. By including the additional peak times for each of these cases, the fatigue analysis conservatively includes twice the number of cycles for each stress state.

## WESTINGHOUSE TOPICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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#### NB-3200:

As discussed in Section 4.2 of the Topical Report (WCAP-17577) there are only two known potential causes of redundant peaks that may occur for an NB-3200 fatigue analysis in WESTEMS™.

- [ ]<sup>a,c</sup>

- [ ]<sup>a,c</sup> Redundant peaks may be retained depending on the phasing between Sn and Sp for each load excursion.

The “root cause” for each of the two identified occurrences of redundant peaks that can occur in an NB-3200 analysis is explained in the following two sections of this response. It is important to note that the redundant peaks do not occur due to a deficiency in the program algorithm. These peak redundancies, as described below, are well understood and are a product of the program conservatively ensuring that all unique peaks are identified and accounted for in the fatigue evaluation.

The two cases of redundant peaks for an NB-3200 analysis are discussed below, with an example of each case taken from a test analysis performed as part of a WESTEMS™ NB-3200 benchmark.

NB-3200 Redundancy: [ ]<sup>a,c</sup>

The first “root cause” of redundant peaks can be attributed to transient definitions. The transient definitions may [

]<sup>a,c</sup>

An example of this redundancy is shown below as Figure 1.

## WESTINGHOUSE TOPICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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Figure 1: Example [

] <sup>a,c</sup>

[

<sup>a,c</sup> The analyst is able to review the input conditions and determine instances where such redundancies may occur and can limit the analysis from including these redundant peaks in the fatigue analysis. This is identified in Section 4.2 of WCAP-17577 as a means of conservatism to ensure that all unique peaks are identified by the program and considered in the fatigue evaluation.



## WESTINGHOUSE TOPICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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#### NB-3200 Redundancy: Phasing of $S_n$ and $S_p$ Stress Histories

The second "root cause" of redundant peaks can be attributed to phasing of Primary Plus Secondary Stress and Total Stress for a transient load excursion. ASME fatigue usage is based on alternating stress,  $S_a$ , which is determined from the Total stress range and the  $K_e$  penalty factor. The  $K_e$  penalty factor is based on the Primary plus Secondary stress range. [

] <sup>a,c</sup> the thermal stress contributions to  $S_n$  and  $S_p$  can be separated by a period of time. For example, the thermal discontinuity stress will typically maximize later than the shock stress due to a given temperature load excursion. Both types of thermal stress are included in  $S_p$ , but only thermal discontinuity stress is included in  $S_n$ . Therefore the  $S_n$  peak time can lag the  $S_p$  peak time in response to the same load excursion. This phasing of the  $S_n$  and  $S_p$  stress histories can result in different  $S_n$  and  $S_p$  peak times being selected in response to the same transient load excursion. This is identified in Section 4.2 of WCAP-17577 as a means of conservatism to ensure that all unique peaks are identified by the program and considered in the fatigue evaluation.

The analyst will conservatively allow both times to be included in the initial fatigue evaluation. This allows for any [

] <sup>a,c</sup> The user is therefore provided options to reduce this conservatism if necessary.

For a given load excursion, the methods of the ASME Code (NB-3216 and NB-3222.4(e)(5)) require only one peak time to be selected to represent the corresponding stress cycle in its contribution to the maximum alternating stress in a stress range pair. The software algorithm can conservatively result in two redundant stress states (from  $S_p$  and  $S_n$ ) to be chosen as peaks for the same event. This is illustrated by the circled points of Figure 2 below.

## WESTINGHOUSE TOPICAL REPORT REVIEW

### Response to Request For Additional Information (RAI)

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Figure 2: Example [

] <sup>a,c</sup>

[

<sup>a,c</sup> The WESTEMS™ peak selection algorithm conservatively includes both peaks in the initial analysis. By including both peak times for this load excursion, the fatigue analysis conservatively includes twice the number of cycles for this stress state. [

] <sup>a,c</sup>

The program outputs provide the analyst with the peak selection and fatigue pairing information to determine the impact of any redundancies, and to reduce these conservatisms, where justified, using the program options.

**Westinghouse Non-Proprietary Class 3**

**WESTINGHOUSE TOPICAL REPORT REVIEW**

**Response to Request For Additional Information (RAI)**

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**Topical Report (TR) Revision:**

None

**Supporting References Revision:**

None



ENCLOSURE 6

Response to RAI-WSTM-008-NP

(Non-Proprietary)

## Westinghouse Non-Proprietary Class 3

### WESTINGHOUSE TOPICAL REPORT REVIEW

#### Response to Request For Additional Information (RAI)

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RAI Response Number: WSTM-008-NP  
Revision: 0

#### Question:

The staff noted that the flowchart Figure 4-5, Process Flowchart For WESTEMS NB-3600 Peak Review and Editing, does not provide justification or criteria that support the decision points in the flowchart. For example;

- The process flowchart indicates that “if peak does not correspond to a load excursion, Eliminate this peak”. The applicant did not provide technical justification why this peak is a redundant peak.
- The flowchart indicates that “if two or more peak times exist for the same load excursion, then eliminate redundant peaks “A” and “B””. The applicant also did not provide technical justification for elimination.

The staff is asking the applicant provide technical justification for the elimination of the redundant peaks described in Figure 4-5.

#### Westinghouse Response:

As described in this request, WCAP-17577 Figure 4-5 includes two decision points that can lead to deletion of a peak time selected by the automated process. The flowchart step to “review each peak or valley selected” first directs the user to determine if the “peak corresponds to a load excursion.” If it does not, the peak may be deleted. The criterion for this decision is identifying if the peak was caused by an independent load excursion, which results in a stress cycle. If it was not, the justification for its elimination is that the stress cycle is already accounted for in the fatigue evaluation and does not need to be counted twice. Figure 1 illustrates such a case. [

] <sup>a,c</sup>

## Westinghouse Non-Proprietary Class 3

### WESTINGHOUSE TOPICAL REPORT REVIEW

#### Response to Request For Additional Information (RAI)

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Figure 1

An example illustrating where this test is applicable is provided in the response to RAI WSTM-001 in the case for "NB-3600 Redundancy: [ ]<sup>a,c</sup> This uses the example from Section 5.3.2 of WCAP-17577. In general, when the user can identify peaks that are not a result of the transient load excursion, there is justification for editing the peak from the fatigue analysis.

The second decision point in question is in the next stage of the review process, where the flow chart directs the user to determine if "two or more peak times exist for the same load excursion." The criterion for this case is that multiple peaks were selected in the stress response due to a single load excursion, and the [

] <sup>a,c</sup> One example of this is due to the phasing differences of the shock effects and through-wall/discontinuity effects as discussed in Section 4.1.5 of WCAP-17577. Another example would be a small fluctuation of the applied loading. This is illustrated in Figure 2.

When peaks A and B are examined according to the flowchart, they are identified as redundant since they are the response to the same load excursion. [

## Westinghouse Non-Proprietary Class 3

### WESTINGHOUSE TOPICAL REPORT REVIEW

#### Response to Request For Additional Information (RAI)

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] <sup>a,c</sup>

This final selection [

] <sup>a,c</sup> It should be noted that the flowchart indicates that only one of two redundant peaks, A or B, may be deleted, and not both. In this example, the [

] <sup>a,c</sup> A detailed example of a similar case is provided in the response to RAI WSTM-001 in the case for "NB 3600 Redundancy: Phasing of Stress Contributions."

Application of these decision points and their justification for specific problems are documented in the calculation note by the analyst and independently verified according to Westinghouse quality procedures.

] <sup>a,c</sup>

Figure 2

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**Topical Report (TR) Revision:**

None

**Supporting References Revision:**

None

ENCLOSURE 8

Response to RAI-WSTM-009-NP

(Non-Proprietary)



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RAI Response Number: WSTM-009-NP  
Revision: 0

#### Question:

In Figure 4-4, the stress filter check was used for peak selection option process. The staff is requesting the applicant to explain the process to ensure the critical (maximum stress for peak, minimum stress for valley) points are retained for both NB-3600 and NB-3200.

#### Westinghouse Response:

The following response describes the application of the stress filter in the WESTEMS™ peak selection algorithm to prevent the retention of redundant peaks and the process used to retain the “critical” peak and valley times for the significant portions of the stress history corresponding to each transient event for both NB-3600 and NB-3200 applications. “Critical” peak and valley times are understood to mean those (maximum and minimum) extremes of a given stress cycle that result in relative maximum alternating stress intensity when paired with other stress cycle extreme times in the fatigue evaluation, consistent with NB-3216.

For both an NB-3600 analysis and an NB-3200 analysis, retention of the “critical” peaks is accomplished in two ways:[

] <sup>a,c</sup>

It is important to clarify that the function of the stress filter in a WESTEMS™ NB-3200 analysis is different from that of the stress filter in a WESTEMS™ NB-3600 analysis due to the difference in peak selection methodology. Therefore, NB-3600 and NB-3200 are addressed separately.

#### NB-3600:

[

] <sup>a,c</sup> When a stress filter is needed to eliminate certain analysis conservatisms in the [ <sup>a,c</sup>, the stress filter value is

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determined in accordance with Westinghouse procedural guidelines. Application of the stress filter is reviewed by the analyst and independently verified to ensure that the "critical" peaks corresponding to all loading excursions are correctly included in the fatigue analysis.

When redundancies occur in a WESTEMS™ NB-3600 analysis, as discussed in the response to WSTM-001, there are a number of options available to the analyst for limiting or eliminating these redundancies. The option to apply a stress filter affects the [

] <sup>a,c</sup> This process is depicted in Figure 4-4 of WCAP-17577.

The following example reviews how the stress filter can apply to a typical case representing a redundancy due to [

] <sup>a,c</sup> This example is intended to provide an understanding of the step-by-step functionality of the stress filtering process [

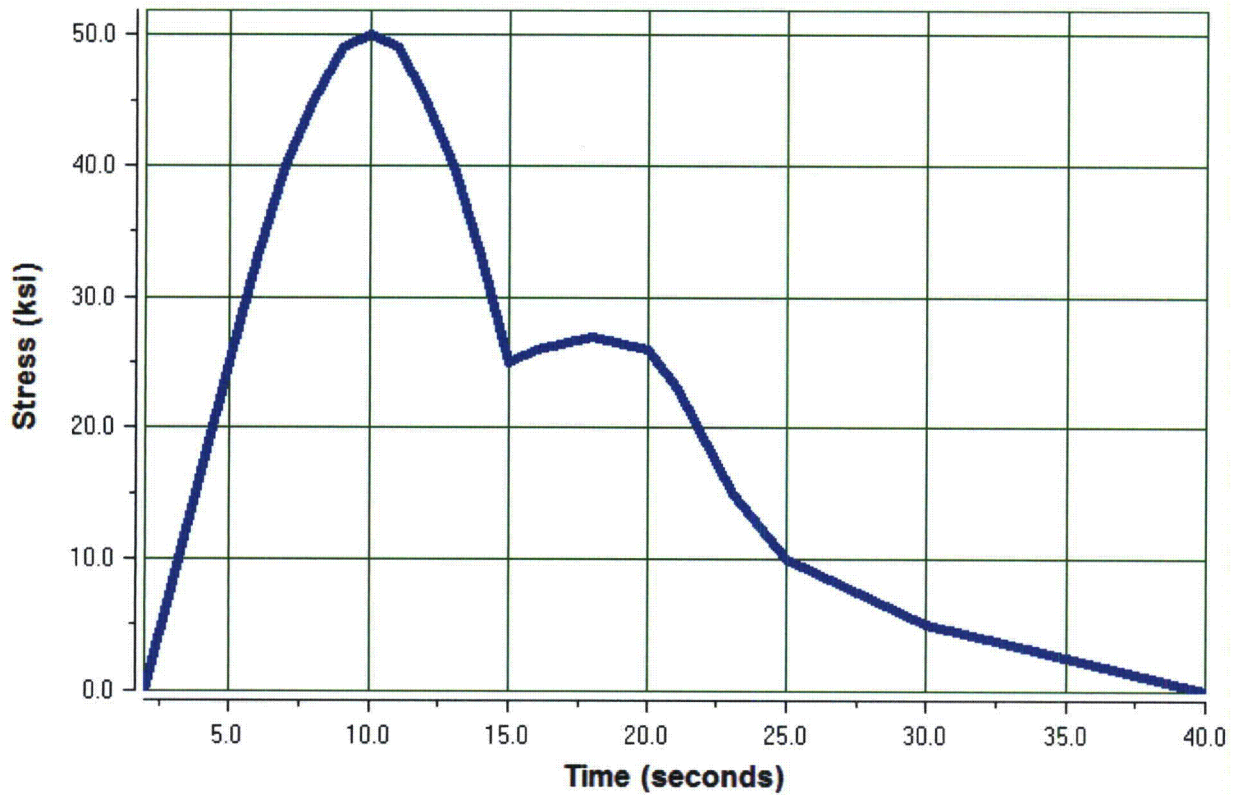
Understanding how the stress filter is applied is necessary for the analyst to [



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[

] <sup>a,c</sup>

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The application of the stress filter is also subject to procedural controls followed by the analyst. In order to ensure that each load excursion is accounted for, the analyst must conform to the following guidelines from Section 5.1.3.3 of the NB-3600 fatigue analysis procedure, PSDR-QP-4.7:[

] <sup>a,c</sup> review of the final peaks are documented in the analysis calculation. The independent verification of this calculation, in accordance with Westinghouse policies and procedures, ensures that the “critical” peaks corresponding to all loading excursions are correctly included in the fatigue analysis.

#### **NB-3200:**

Section 14.0 of the WESTEMS™ 4.5.6 User Manual describes the NB-3200 peak selection process. The stress filter in an NB-3200 analysis is applied [

] <sup>a,c</sup> WESTEMS™ will calculate the time histories of Sn and Sp and [

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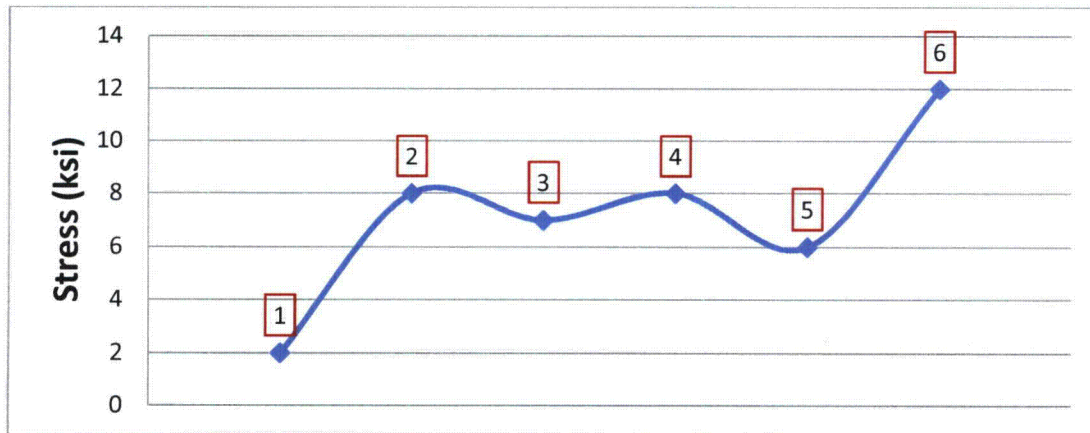
] <sup>a,c</sup>

An example of the process is provided below considering the following [ <sup>a,c</sup>

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[

]a,c

a,c

The NB-3200 analyst must conform to the following guidelines that will be included in the WESTEMS™ NB-3200 analysis procedure section of the WESTEMS™ User Manual that is

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being produced in response to RAI WSTM-006 in order to ensure that each load excursion is accounted for:[

] <sup>a,c</sup> review of the final peaks are documented in the analysis calculation. The independent verification of this calculation, in accordance with Westinghouse policies and procedures, ensures that the peaks corresponding to all loading excursions are correctly included in the fatigue analysis.

These procedural controls also ensure that that the critical points are retained as peaks in the fatigue analysis.

#### Topical Report (TR) Revision:

None

#### Supporting References Revision:

None