RESOLUTION OF WESTINGHOUSE COMMENTS ON DRAFT SAFETY EVALUATION FOR TOPICAL REPORT (TR) WCAP-17721-P, REVISION 0, AND WCAP-17721-NP, REVISION 0, "WESTINGHOUSE CONTAINMENT ANALYSIS METHODOLOGY - PWR [PRESSURIZED WATER REACTOR] LOCA [LOSS-OF-COOLANT ACCIDENT] MASS AND ENERGY RELEASE CALCULATION METHODOLOGY"

WESTINGHOUSE ELECTRIC COMPANY (WESTINGHOUSE)

PROJECT NO. 700

ATTACHMENT 1

By letter dated July 8, 2015, Westinghouse provided comments on the draft safety evaluation (SE) for Topical Report (TR) WCAP-17721-P, Revision 0, and WCAP-17721-NP, Revision 0 (WCAP-17721-P/NP, Revision 0), "Westinghouse Containment Analysis Methodology - PWR LOCA Mass and Energy Release Calculation Methodology." Some information in the draft SE for this TR was identified as proprietary; therefore, the draft of this SE will not be made publicly available. The following are the U.S. Nuclear Regulatory Commission (NRC) staff's resolution of these comments:

Draft SE comments for TR WCAP-17721-P/NP, Revision 0:

1. The last sentence of Section 1.0, paragraph 3, reads:

> Because the treatment is more mechanistic, the conservative assumptions used in the previously approved methods are not needed, which ultimately results in lower calculated peak containment pressures and temperatures.

Westinghouse proposed the following change for the last sentence of Section 1.0, paragraph 3:

> Because the treatment is more mechanistic, the conservative assumptions used in the previously approved methods are not needed, which ultimately results in lower calculated long term containment pressures and temperatures.

NRC Resolution for Comment 1 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The last sentence of Section 1.0, paragraph 3, is changed to read:

> Because the treatment is more mechanistic, the conservative assumptions used in the previously approved methods are not needed, which ultimately results in lower calculated long term containment pressures and temperatures.

2. The last sentence of Section 3.0, paragraph 3, reads:

> By satisfying these criteria, the NRC staff will demonstrate that there is reasonable assurance that the calculations of the M&E release rates for a large-break LOCA will be performed in a manner that conservatively establishes the containment design.

Westinghouse proposed the following change to the last sentence of paragraph 3 of Section 3.0:

> By satisfying these criteria, the NRC staff will demonstrate that there is reasonable assurance that the calculations of the M&E release rates for a large-break LOCA will be performed in a manner that conservatively establishes the containment design response.

NRC Resolution for Comment 2 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds the proposed change acceptable.

The last sentence of paragraph 3 of Section 3.0 is changed to read:

> By satisfying these criteria, the NRC staff will demonstrate that there is reasonable assurance that the calculations of the M&E release rates for a large-break LOCA will be performed in a manner that conservatively establishes the containment design response.

3. Westinghouse proposed the following proprietary markings for the last sentence of the second paragraph of Section 3.1.1:

> To ensure that the figure of merit is calculated appropriately, certain inputs are biased during each analysis depending on the figure of merit. One example of input biasing is the **[ ]**

NRC Resolution for Comment 3 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

The last sentence of the second paragraph of Section 3.1.1 is changed to read:

To ensure that the figure of merit is calculated appropriately, certain inputs are biased during each analysis depending on the figure of merit. One example of input biasing is the **[ ]**

4. Westinghouse proposed the following proprietary markings for the last sentence of the third paragraph of Section 3.1.1:

[ ] may or may not be assumed depending on the analysis being performed.

NRC Resolution for Comment 4 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

Last sentence of the paragraph 3, Section 3.1.1, is changed to read:

[ ] may or may not be assumed depending on the analysis being performed.

5. Westinghouse proposed the following proprietary markings for the last sentence of the fourth paragraph of Section 3.1.1:

For containment peak pressure and EQ analysis, the figures of merit are the peak containment pressure and temperature. To ensure these are conservatively calculated, Westinghouse assumes **[ ]** The result is a higher steaming rate than if **[ ]** which results in higher containment pressure and temperatures. For NPSHa analysis, the figure of merit is sump temperature. To ensure that the sump temperature is conservatively calculated, Westinghouse assumes **[ ]** The result is less steam and more hot water than **[ ]** which results in higher containment sump temperatures.

NRC Resolution for Comment 5 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

Paragraph 4, Section 3.1.1, is changed to read:

> For containment peak pressure and EQ analysis, the figures of merit are the peak containment pressure and temperature. To ensure these are conservatively calculated, Westinghouse assumes **[** **]** The result is a higher steaming rate than if **[** **]** which results in higher containment pressure and temperatures. For NPSHa analysis, the figure of merit is sump temperature. To ensure that the sump temperature is conservatively calculated, Westinghouse assumes **[** **]** The result is less steam and more hot water than **[** **]** which results in higher containment sump temperatures.

6. The last paragraph of Section 3.1.2, reads:

> When the codes are coupled iteratively, WC/T and a containment code (GOTHIC or LOTIC1) are run in a standalone mode using the following process:
>
> 1. A back pressure is assumed.
> 2. The back pressure is input into WC/T to calculate the M&E release.
> 3. That calculated M&E release is used in a standalone containment code to calculate a new back pressure (GOTHIC or LOTIC1).
> 4. Steps 2 and 3 are repeated until the change in the back pressure is within some small margin.

Westinghouse proposed the following change and proprietary markings for the last paragraph of Section 3.1.2:

> When the codes are coupled iteratively for a dry containment application, WC/T and a containment code (GOTHIC) are run in a standalone mode using the following process:

1. A back pressure is assumed.
2. The back pressure is input into WC/T to calculate the M&E release.
3. That calculated M&E release is used in a standalone containment code to calculate a new back pressure (GOTHIC).
4. Steps 2 and 3 are repeated until the change in the back pressure is within some small margin.

WC/T will use a **[ ]** backpressure curve for ice condenser applications.

NRC Resolution for Comment 6 on Draft SE:

The NRC staff reviewed the Westinghouse proposed change and proprietary markings and finds them acceptable.

Last paragraph of Section 3.1.2, is changed to read:

When the codes are coupled iteratively for a dry containment application, WC/T and a containment code (GOTHIC) are run in a standalone mode using the following process:

1. A back pressure is assumed.
2. The back pressure is input into WC/T to calculate the M&E release.
3. That calculated M&E release is used in a standalone containment code to calculate a new back pressure (GOTHIC).
4. Steps 2 and 3 are repeated until the change in the back pressure is within some small margin.

WC/T will use a **[ ]** backpressure curve for ice condenser applications.

7. Second and third paragraphs of Section 3.2.1.6 read:

In the initial submittal (Reference 1), Westinghouse stated that **[ ]**

Because Westinghouse is using **[ ]**, the NRC staff has determined that the metal-water reactor rate has been adequately modeled. The NRC staff has concluded that this criterion has been satisfied.

Westinghouse proposed the following changes for the second and third paragraphs of Section 3.2.1.6. Also, Westinghouse stated that areas previously marked as proprietary by NRC staff in order to protect potential proprietary information, do not contain proprietary information to Westinghouse:

> In the initial submittal (Reference 1), Westinghouse stated that while WC/T has multiple metal-water models in place, it will use the Baker-Just equation.
>
> Because Westinghouse is using the required model, the NRC staff has determined that the metal-water reactor rate has been adequately modeled. The NRC staff has concluded that this criterion has been satisfied.

NRC Resolution for Comment 7 on Draft SE:

The NRC staff reviewed the Westinghouse proposed changes and finds them acceptable.

Second and third paragraphs of Section 3.2.1.6 are changed to read:

> In the initial submittal (Reference 1), Westinghouse stated that while WC/T has multiple metal-water models in place, it will use the Baker-Just equation.
>
> Because Westinghouse is using the required model, the NRC staff has determined that the metal-water reactor rate has been adequately modeled. The NRC staff has concluded that this criterion has been satisfied.

8. Westinghouse proposed the following proprietary markings for the second sentence of the second paragraph of Section 3.2.2.2:

> Any large break will eventually release the same amount of M&E over a longer period of time, but the double ended break releases this M&E faster as each side flows into containment and **[**
>
> **]**

NRC Resolution for Comment 8 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

Second sentence of paragraph 2, Section 3.2.2.2, is changed to read:

> Any large break will eventually release the same amount of M&E over a longer period of time, but the double ended break releases this M&E faster as each side flows into containment and **[ ]**

9. The second and third paragraphs of Section 3.2.2.3 read:

> Because Westinghouse is using an analytical approach which is similar to a currently approved ECCS evaluation model, the NRC staff has determined that the subcompartment analysis has been adequately modeled. The NRC staff has concluded that this criterion has been satisfied.
>
> To avoid potential confusion, the NRC staff is not approving to perform subcompartment analysis separate from that used during a larger-break LOCA. Such considerations were beyond the NRC staff's scope of review.

Westinghouse proposed to include "M&E release for" between "the" and "subcompartment" in the first sentence of the second paragraph of Section 3.2.2.3.

NRC Resolution for Comment 9 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The second and third paragraphs of Section 3.2.2.3, is changed to read:

> Because Westinghouse is using an analytical approach which is similar to a currently approved ECCS evaluation model, the NRC staff has determined that the M&E release for subcompartment analysis has been adequately modeled. The NRC staff has concluded that this criterion has been satisfied.
>
> To avoid potential confusion, the NRC staff is not approving WC/T to perform subcompartment analysis separate from that used during a larger-break LOCA. Such considerations were beyond the NRC staff's scope of review.

10. The second sentence of the first paragraph of Section 3.2.3 read:

> Westinghouse added that during this phase, the containment pressure has increased substantially due to the rapid M&E release.

Westinghouse proposed to include "(for a dry containment)" between "pressure" and "has" in the second sentence of the first paragraph of Section 3.2.3.

NRC Resolution for Comment 10 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The second sentence of the first paragraph of Section 3.2.3 is changed to read:

> Westinghouse added that during this phase, the containment pressure (for a dry containment) has increased substantially due to the rapid M&E release.

11. The second paragraph of Section 3.2.5.3 reads:

> Westinghouse responded to RA-SNPB-9 by describing an experiment that was used specifically to capture the behavior of steam quenching by injecting water into cold leg under post-accident conditions. The comparisons between the test data and WC/T demonstrate that the code **[**
>
> **]**

Westinghouse proposed clarification to the last sentence of that paragraph of Section 3.2.5.3, and indicated that previously marked as proprietary text is not proprietary.

NRC Resolution for Comment 11 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The second paragraph of Section 3.2.5.3 is changed to read:

> Westinghouse responded to RAI-SNPB-9 by describing an experiment that was used specifically to capture the behavior of steam quenching by injecting water into cold leg under post-accident conditions. The comparisons between the test data and WC/T demonstrate that the code does a reasonable job of predicting the bulk fluid conditions during quenching. Specifically, Westinghouse provided WC/T comparisons to test data for fluid temperatures in the cold leg downstream of the injection location.

12. The third sentence of the second paragraph of Section 3.2.6.2 reads:

> Specifically, **[**
>
> **]**

Westinghouse proposed the following clarification to the last sentence of that paragraph of Section 3.2.6.2: "Specifically, Westinghouse provided WC/T comparisons to test data for fluid temperatures in the cold leg downstream of the injection location."

NRC Resolution for Comment 12 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The third sentence of the second paragraph of Section 3.2.6.2 is changed to read:

> Specifically, Westinghouse provided WC/T comparisons to test data for fluid temperatures in the cold leg downstream of the injection location.

13. Westinghouse proposed the following proprietary markings for the third through sixth sentences of the second paragraph of Section 3.2.7.1:

> The long-term decay heat is calculated outside of WC/T, but uses an **[**
>
> **]**

NRC Resolution for Comment 13 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

14. The second paragraph of Section 3.2.8.1 reads:

> Because Westinghouse's approved and new M&E evaluation model have very little response change to the hot-leg break, the confirmatory analysis focused on the cold-leg and pump-suction breaks. Both TRACE and WC/T predicated similar in the exiting flow rates out of both sides of the break.

Westinghouse proposed the following clarification to the last sentence of that paragraph of Section 3.2.8.1: "…similar flow rates exiting both sides of the break."

NRC Resolution for Comment 14 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The third sentence of the second paragraph of Section 3.2.8.1 is changed to read:

> Because Westinghouse's approved and new M&E evaluation model have very little response change to the hot-leg break, the

confirmatory analysis focused on the cold-leg and pump-suction breaks. Both TRACE and WC/T predicted similar flow rates exiting both sides of the break.

15. The first paragraph of Section 3.3.1.1 reads:

> This criterion is partially addressed in Sub-Sections 3.2.3.1, "Initial Mass of Water," and 3.2.7, "Reactor Internals Heat Transfer," above. In the initial submittal (Reference 1), Westinghouse also stated that **[**
>
> **]**

Westinghouse proposed the following clarification to the third sentence of that paragraph of Section 3.3.1.1: "**[** **]**"

NRC Resolution for Comment 15 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The third sentence of the first paragraph of Section 3.3.1.1 is changed to read:

> This criterion is partially addressed in Sub-3.2.3.1, "Initial Mass of Water," and 3.2.7, "Reactor Internals Heat Transfer," above. In the initial submittal (Reference 1),), Westinghouse also stated that **[**
>
> **]**

16. The first paragraph of Section 3.3.1.8 reads:

> In the initial submittal (Reference 1), Westinghouse stated that **[**
>
> **]**

Westinghouse proposed the following clarification to the first paragraph of Section 3.3.1.8:

> In the initial submittal (Reference 1), Westinghouse stated that **[**
>
> **]** Through the RAI process, Westinghouse determined that the steam generators **[**
>
> **]**

NRC Resolution for Comment 16 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The first paragraph of Section 3.3.1.8 is changed to read:

> In the initial submittal (Reference 1), Westinghouse stated that **[**
>
> **]**
>
> Through the RAI process, Westinghouse determined that the steam generators **[**
>
> **]**

17. Westinghouse proposed the following proprietary markings for the second and third paragraphs of Section 3.3.2.5:

> Westinghouse responded to RAI-SNPB-15 by discussing the steady state calculation which is used to obtain the SG secondary side pressure. For this calculation **[ ]** This assumption results in a conservatively high SG heat transfer which acts to increases the secondary side calculated pressure. Further, during the audit conducted on April 8-9, 2015 (Reference 18), Westinghouse confirmed that the reactor power used for the steady state calculation was the **[ ]**
>
> Because Westinghouse is considering the **[ ]** and is using an assumption which results in a greater than expected heat transfer in the SG resulting in a larger secondary side pressure, the NRC staff has determined the SG pressure has been adequately modeled. The NRC staff has concluded that this criterion has been satisfied.

NRC Resolution for Comment 17 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

18. Westinghouse proposed the following proprietary markings for the second and third paragraphs of Section 3.3.2.9:

> Westinghouse responded to RAI-SNPB-16 by clarifying that the initial temperature is set to the **[ ]** and the initial volume is set to the **[ ]**
>
> Because Westinghouse had selected values which are consistent with common practice and which result in the **[ ]** the NRC staff has determined the safety injection tanks have been adequately modeled. The NRC staff has concluded that this criterion has b **b**een satisfied.

NRC Resolution for Comment 18 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

19. Westinghouse proposed the following proprietary markings for the second and third paragraphs of Section 3.3.4.1:

> In the initial submittal (Reference 1), Westinghouse stated that the M&E evaluation model uses the same nodalization as the ECCS evaluation model. However, Westinghouse did not provide justification that the nodalization used for the ECCS evaluation model would be appropriate for the M&E evaluation model. Additionally, Westinghouse **[**
>
> **]**
>
> Therefore, this issue was formed into RAI-SNPB-17.

NRC Resolution for Comment 19 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

20. The last two sentences of the first paragraph of Section 3.3.4.4 read:

> However, Westinghouse did demonstrate that the dynamic pump model used in the ECCS evaluation model is appropriate for use in the M&E evaluation model or how assuming a locked rotor results in a conservative prediction of the M&E released to containment. Therefore, this issue was formed into RAI-SNPB-24.

Westinghouse proposed the following clarification to the last two sentences of the first paragraph of Section 3.3.4.4:

> However, Westinghouse did not demonstrate that the dynamic pump model used in the ECCS evaluation model is appropriate for use in the M&E evaluation model or how assuming a locked rotor results in a conservative prediction of the M&E released to containment. Therefore, this issue was formed into RAI-SNPB-24.

NRC Resolution for Comment 20 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review.

The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The last two sentences of the first paragraph of Section 3.3.4.4 are changed to read:

> However, Westinghouse did not demonstrate that the dynamic pump model used in the ECCS evaluation model is appropriate for use in the M&E evaluation model or how assuming a locked rotor results in a conservative prediction of the M&E released to containment. Therefore, this issue was formed into RAI-SNPB-24.

21. Westinghouse proposed the following proprietary markings for the first paragraph of Section 3.3.5.3:

> In the initial submittal (Reference 1), Westinghouse stated break liquid and vapor flow rates are calculated based on the upstream RCS conditions at the break. For peak pressure calculations the vapor component is maximized by **[**
>
> **]** For minimum NPSHa, the liquid component is maximized by assuming **[ ]** which would result in higher water temperatures in the containment sump and a reduced net positive suction head available.

NRC Resolution for Comment 21 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

22. The last sentence of the fourth paragraph of Section 3.3.6.1 reads: "This is a condition on the approval of the WC/T M&E evaluation model."

Westinghouse proposed the following clarification to the fourth paragraph of Section 3.3.6.1: "This is a limitation on the approval of the WC/T M&E evaluation model."

NRC Resolution for Comment 22 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision helps to maintain the consistency with the Section 5.0, and clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The last two sentences of the first paragraph of Section 3.3.6.1 are changed to read: "This is a limitation on the approval of the WC/T M&E evaluation model."

23. Westinghouse proposed the following proprietary clarification to the fourth paragraph of Section 3.3.6.1:

> Because Westinghouse has demonstrated that WC/T can be coupled with GOTHIC though the explanation of how information is shared between the codes, through a sensitivity study which demonstrated that the containment pressure is insensitive to the difference in the time steps, and because Westinghouse is either mechanistically calculating the back pressure directly with GOTHIC, or is iterating on the M&E release with WC/T using an appropriate code to calculate the back pressure **[ ]** the NRC staff has determined that the PWR backpressure has been adequately modeled. The NRC staff has concluded that this criterion has been satisfied.

NRC Resolution for Comment 23 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The fourth paragraph of Section 3.3.6.1 is changed to read:

> Because Westinghouse has demonstrated that WC/T can be coupled with GOTHIC though the explanation of how information is shared between the codes, through a sensitivity study which demonstrated that the containment pressure is insensitive to the difference in the time steps, and because Westinghouse is either mechanistically calculating the back pressure directly with GOTHIC, or is iterating on the M&E release with WC/T using an appropriate code to calculate the back pressure **[ ]** the NRC staff has determined that the PWR backpressure has been adequately modeled. The NRC staff has concluded that this criterion has been satisfied.

24. The last sentence of the second paragraph of Section 3.3.7.2 reads:

> The correlations chosen were familiar to the NRC and would be expected to result in a reasonable estimate of the heat transfer from the core.

Westinghouse proposed the following clarification to the last sentence of the second paragraph of Section 3.3.7.2:

> The correlations chosen were familiar to the NRC and would be expected to result in a reasonable estimate of the heat transfer from the primary metal.

NRC Resolution for Comment 24 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The last sentence of the second paragraph of Section 3.3.7.2 is changed to read:

> The correlations chosen were familiar to the NRC and would be expected to result in a reasonable estimate of the heat transfer from the primary metal.

25. The second and third sentences of the fourth paragraph of Section 3.3.7.2 read:

> This metal included the RCS upper heat and pressurizer metal, as well as metal in the upper regions of the SGs. As this metal is not in direct contact with the coolant transfers, its heat is either conducted to other metal which is in direct contact with the coolant or its heat is directly transferred to the containment via natural convection and radiation.

Westinghouse proposed the following clarification to the second and third sentences of the fourth paragraph of Section 3.3.7.2:

> This metal included the vessel upper head and pressurizer metal, as well as metal in the upper regions of the SGs. As this metal is

> not in direct contact with the coolant, its heat is either conducted to other metal which is in direct contact with the coolant or its heat is directly transferred to the containment via natural convection and radiation.

NRC Resolution for Comment 25 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The second sentence and third sentences of the fourth paragraph of Section 3.3.7.2 are changed to read:

> This metal included the vessel upper head and pressurizer metal, as well as metal in the upper regions of the SGs. As this metal is not in direct contact with the coolant, its heat is either conducted to other metal which is in direct contact with the coolant or its heat is directly transferred to the containment via natural convection and radiation.

26. The fifth sentence of the third paragraph of Section 3.3.7.3 reads: "Outside of this validated range, the Lee-Ryley correlation will be used."

    Westinghouse proposed the following clarification to the fifth sentence of the third paragraph of Section 3.3.7.3:

> Outside of this validated range, the Lee-Ryley correlation will be used by reverting back to the "WC/T standard" SG tube heat transfer logic.

NRC Resolution for Comment 26 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The fifth sentence of the third paragraph of Section 3.3.7.3 is changed to read:

> Outside of this validated range, the Lee-Ryley correlation will be used by reverting back to the "WC/T standard" SG tube heat transfer logic.

27. The eighth through eleventh sentences of the sixth paragraph of Section 3.3.7.3 read:

> For mass fluxes, **[**
>
> **]**
> Therefore, Westinghouse proposed to use this conservative estimate of CHF, **[**
> **]** Westinghouse demonstrated that this results in a conservative estimate of the CHF by comparison to Groeneveld look up tables (in this case, conservative is an over-prediction of CHF, as that will signal an earlier re-wet and higher heat transfers from the SG).

Westinghouse proposed the following clarification to the eighth through eleven sentences of the sixth paragraph of Section 3.3.7.3:

> For mass fluxes, **[**
>
> **]**
> Therefore, Westinghouse proposed to use this conservative estimate of CHF. Westinghouse demonstrated that this results in a conservative estimate of the CHF by comparison to Groeneveld look up tables (in this case, conservative is an over-prediction of CHF, as that will signal an earlier re-wet and higher heat transfer from the SG).

NRC Resolution for Comment 27 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The eighth through eleventh sentences of the sixth paragraph of Section 3.3.7.3 are changed to read:

> For mass fluxes, **[**
>
> **]**
> Therefore, Westinghouse proposed to use this conservative estimate of CHF. Westinghouse demonstrated that this results in a conservative estimate of the CHF by comparison to Groeneveld look up tables (in this case, conservative is an over-prediction of CHF, as that will signal an earlier re-wet and higher heat transfer from the SG).

28. The second sentence of the third paragraph of Section 3.3.7.5 reads:

> Westinghouse has correlations to model single phase liquid natural convection, single phase liquid forced convection, nucleate boiling, critical heat flux, film boiling, and single phase vapor.

Westinghouse proposed the following clarification to the second sentence of the third paragraph of Section 3.3.7.5:

> Westinghouse has correlations to model single phase liquid natural convection, single phase liquid forced convection, nucleate boiling, critical heat flux, film boiling, and single phase vapor convection.

NRC Resolution for Comment 28 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The second sentence of the third paragraph of Section 3.3.7.5 is changed to read:

> Westinghouse has correlations to model single phase liquid natural convection, single phase liquid forced convection, nucleate boiling, critical heat flux, film boiling, and single phase vapor convection.

29. The first sentence of the first paragraph of Section 4.0 reads:

> Based on the forgoing considerations, the NRC staff concludes that the use of the methodology described in WCAP-17721 for calculating the M&E release from a large-break LOCA for a PWR provided that the following limitations and condition are met:

Westinghouse proposed the following clarification to the first sentence of the first paragraph of Section 4.0:

> Based on the forgoing considerations, the NRC staff concludes that the use of the methodology described in WCAP-17721-P/NP, Revision 0, for calculating the M&E release from a large-break LOCA for a PWR is acceptable provided that the following limitations and condition are met:

NRC Resolution for Comment 29 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The first sentence of the first paragraph of Section 4.0 is changed to read:

> Based on the forgoing considerations, the NRC staff concludes that the use of the methodology described in WCAP-17721-P/NP,

> Revision 0, for calculating the M&E release from a large-break LOCA for a PWR is acceptable provided that the following limitations and condition are met:

30. The Condition 1 contained within Section 4.0 states:

> The NRC staff is aware that the currently approved version of Westinghouse's fuel performance code, PAD4, does not account for thermal-conductivity degradation. As of the writing of this SE, Westinghouse has submitted a newer version of PAD, PAD5, which does account for thermal conductivity degradation. Additionally, Westinghouse has used an updated version of PAD4, PAD4TCD, in a number of licensing actions. Therefore, Westinghouse is required to use PAD4TCD for this analysis to ensure the initial stored energy is appropriate. Further, upon approval of a new fuel thermal mechanical code which does account for thermal conductivity degradation, Westinghouse shall confirm that the initial stored energy calculated using PAD4TCD remains accurate or conservative.

NRC Resolution for Comment 30 on Draft SE:

NRC and Westinghouse discussed the need and scope of the clarification needed for the Condition 1 during the phone conference on July 20, 2015, and agreed on the following clarification:

> The NRC staff is aware that the currently approved version of Westinghouse's fuel performance code (PAD4) does not account for thermal-conductivity degradation. As of the writing of this SE, Westinghouse has submitted a newer version of PAD (PAD5) for the NRC review and approval, which does account for the thermal conductivity degradation. Additionally, Westinghouse has used an updated version of PAD4 (PAD4TCD) in a number of licensing actions. Therefore, Westinghouse is required to use a fuel performance code which does account for fuel thermal conductivity degradation (such as PAD4TCD) for this analysis to ensure the initial stored energy is appropriate. If Westinghouse chooses to use PAD4TCD, then upon approval of a new fuel thermal mechanical code which does account for thermal conductivity degradation, Westinghouse shall confirm that the initial stored energy calculated using PAD4TCD remains accurate or conservative.

31. Westinghouse proposed the following proprietary markings for the RAI-SNPB-3 in Section A.2.3:

> In its responses, Westinghouse verified that the break flow model was consistent over its application domain and did not systematically under or over-predict the break flow, **[**
>
> **]** Westinghouse further detailed the method by which it makes the break flow prediction conservative for M&E cases by **[** **]** Westinghouse has provided this information; therefore, the NRC staff has concluded that this RAI has been resolved.

NRC Resolution for Comment 31 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

32. Westinghouse proposed the following proprietary markings for the RAI-SNPB-5 in Section A.2.5:

> In its responses, Westinghouse analyzed multiple reflood tests performed to support the reflood heat transfer modeling for WC/T. It demonstrated that WC/T consistently **[**
>
> **]** Westinghouse has provided this information; therefore, the NRC staff has concluded that this RAI has been resolved.

NRC Resolution for Comment 32 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

33. Westinghouse proposed the following proprietary markings for the RAI-SNPB-10 in Section A.2.10:

…In table 4-1 row 20 their initial submittal (Reference 1), Westinghouse stated that it would assume **[** **]** during the long-term containment pressure and temperature analysis for EQ and **[** **]** for minimum NPSHa analysis….

…The difference in each analysis is that EQ analysis will extended the long term cooling calculation past the time when pressures start to decrease (up to 30 days) and NSPHa analysis will **[**

]…

NRC Resolution for Comment 33 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

34. Westinghouse proposed the following proprietary markings for the RAI-SNPB-11 in Section A.2.11:

In its response, Westinghouse provided a discussion focusing on the large dry/sub-atmospheric and ice condenser. For the large dry/sub-atmospheric, the energy transfer rate from the SG secondary metal, SG secondary fluid, and RCS metal **[**

] Further, the safety injection which is not boiled is assumed to **[**

] This analysis is non-mechanistic as it does not credit **[** **]** and calculates a conservatively high energy transfer rate. For the ice condenser containment, Westinghouse **[**

] the ice condenser analysis is being performed in the same manner as the large dry/sub-atmospheric. **[**

] Westinghouse ensured that its **[** **]** was conservative by comparing it with a WC/T analysis. This comparison demonstrated that the **[** **]** was somewhat mechanistic, but ultimately conservative compared to the WC/T results over the same **[** **]** Westinghouse has provided this information; therefore, the NRC staff has concluded that this RAI has been resolved.

NRC Resolution for Comment 34 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

35. The last sentence in the comment to RAI-SNPB-13 in Section A.2.13 reads:

> Westinghouse stated that it did not need to consider this flow for their analysis as the additional energy was negligible, but did not any quantitative analysis.

Westinghouse proposed to insert “provide” between “not” and “any” in this sentence.

NRC Resolution for Comment 35 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff’s review findings and provides additional clarification.

The first paragraph of Section 3.2.2.3, is changed to read:

> Westinghouse stated that it did not need to consider this flow for their analysis as the additional energy was negligible, but did not provide any quantitative analysis.

36. Westinghouse proposed the following proprietary markings for the RAI-SNPB-15 in Section A.2.15:

> Further, during the audit (Reference 18), Westinghouse added that the power used during the steady state run corresponds to the **[** **]**
> Westinghouse has provided this information; therefore, the NRC staff has concluded that this RAI has been resolved.

NRC Resolution for Comment 36 on Draft SE:

The NRC staff reviewed the Westinghouse proprietary markings and finds them acceptable.

37. RAI-SNPB-31 in Section A.2.31 reads:

> Demonstrate that the Biasi critical heat flux correlation will provide a conservative estimate of the critical heat flux (which in this case is used to determine the when rewet occurs) for the range over which the correlation is being applied.

Westinghouse proposed to insert “time” between “the” and “when” in this sentence.

NRC Resolution for Comment 37 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff’s review findings and provides additional clarification.
RAI-SNPB-31 in Section A.2.31 is changed to read:

> Demonstrate that the Biasi critical heat flux correlation will provide a conservative estimate of the critical heat flux (which in this case is used to determine the time when rewet occurs) for the range over which the correlation is being applied.

38. The fourth and sixth sentences of the first paragraph of RAI-SNPB-36 in Section A.2.36 reads:

> However, there were two deviations. First, the specific heat of Inconel 600 and 690 used in WC/T was consistently than reported in BPVC by 3 percent. While any correction of this specific heat would be minimal, it would increase the energy stored in the metal. Therefore a condition has been placed such that the approved method must account for this additional energy.

Westinghouse proposed the following clarification to the fourth and sixth sentences of the first paragraph of RAI-SNPB-36 in Section A.2.36:

> However, there were two deviations. First, the specific heat of Inconel 600 and 690 used in WC/T was consistently lower than reported in BPVC by 3 percent. While any correction of this specific heat would be minimal, it would increase the energy stored in the metal. Therefore a limitation has been placed such that the approved method must account for this additional energy.

NRC Resolution for Comment 38 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The fourth and sixth sentences of the first paragraph of RAI-SNPB-36 in Section A.2.36 is changed to read:

> However, there were two deviations. First, the specific heat of Inconel 600 and 690 used in WC/T was consistently lower than reported in BPVC by 3 percent. While any correction of this specific heat would be minimal, it would increase the energy stored in the metal. Therefore a limitation has been placed such that the approved method must account for this additional energy.

39. The fourth sentence of the first paragraph of RAI-SCVB-9 in Section A.3.9 reads:

> Additionally, Westinghouse commented that the margin assessment was detailed the margin of input biasing described in the TR, but it is likely that other inputs not described in the TR (i.e., parameters obtained from licensees) would also be biased and result in additional margin.

Westinghouse proposed the following clarification to the fourth sentence of the first paragraph of RAI-SCVB-9 in Section A.3.9:

> Additionally, Westinghouse commented that the margin was due to input biasing described in the TR, but it is likely that other inputs not described in the TR (i.e., parameters obtained from licensees) would also be biased and result in additional margin.

NRC Resolution for Comment 39 on Draft SE:

The NRC staff reviewed the Westinghouse recommendation and finds it acceptable, because the suggested revision clarifies the staff scope and context of the staff review. The NRC staff agrees that such a revision is consistent with the staff's review findings and provides additional clarification.

The fourth sentence of the first paragraph of RAI-SCVB-9 in Section A.3.9 is changed to read:

Additionally, Westinghouse commented that the margin was due to input biasing described in the TR, but it is likely that other inputs not described in the TR (i.e., parameters obtained from licensees) would also be biased and result in additional margin.

40. Westinghouse provided eighty eight comments related to the typographical errors and stylistic changes.

    NRC Resolution for Comment 40 on Draft SE:

    The NRC staff reviewed the Westinghouse recommendations and finds them acceptable, because the changes are editorial in nature.