# Response to NuScale Topical Report Audit Question

**Question Number**: A-XPC.LTR-2

**Receipt Date**: 03/27/2023

**Question**:

Information is needed relative to the methodology assumptions for RCS and ESB mixing in the following areas:

a) The methodology does not provide adequate basis for model validation vs test data {{

}}[2(a),(c)] Riser holes impact initial conditions, natural circulation and RCS response.

b) Validation basis information/evaluations for the condensate flow rate assumption into the boron dissolver basket and containment mixing tubes is missing. There is no justification provided for the assumed fraction of the available containment wall area above each condensate rail that is used in determining the condensate collector flow rate, considering the non-uniformity of the containment wall shell as well as the other structures in the containment that influence condensation and condensate flow.

c) The methodology is missing the basis information/evaluations that validates the {{

}}[2(a),(c)] Additionally, the methodology is missing the basis information that validates the transport assumptions of fluid from one mixing volume to the next {{

}}[2(a),(c)] (The gradients and flow patterns/behavior in the volumes have not been validated).

**Response**:

The original response was posted on April 21, 2023. NuScale voluntarily supplemented the original response and posted the supplemented response on March 14, 2024. The original and supplemented responses below are unchanged. On April 19, 2024, NuScale received written feedback from the NRC on NuScale's original and supplemental responses. NuScale's response to NRC feedback is added after the original and supplemented responses, starting with the section labeled "NuScale Response to NRC Feedback." On July 22, 2024, NuScale received additional written feedback from the NRC on NuScale's response to NRC feedback. NuScale's response to the additional NRC feedback is added to the end of the response, starting with the section labeled "NuScale Response to Additional NRC Feedback."

a) Please refer to the response to A-NonLOCA.LTR-1 for discussion of the riser hole effect on the steady-state initial conditions, and short-term LOCA and nonLOCA response. This response focuses on the riser hole behavior during extended passive cooling.

Extended passive cooling and reactivity control topical report TR-124587 Section 5.1.2 discusses extended DHRS cooling behavior. During extended DHRS operation, effective heat transfer can result in sufficient coolant volume shrinkage to uncover the riser. If the primary level is below the top of the riser prior to ECCS actuation, it is because decay heat removal is sustained. After riser uncovery, the decay heat removal through the steam generator is sustained by the cross-flow through the upper riser flow paths, with increased core temperature rise. Flow to sustain decay heat removal is well above flow necessary to mitigate boron redistribution in the downcomer region before ECCS operation. The extended passive cooling PIRT update considered the upper riser flow paths and extended DHRS cooling before and after riser uncovery. {{

}}2(a),(c)

During ECCS operation, flow through the lower riser holes is required to mitigate boron redistribution in the downcomer, but small bypass flows are not expected to substantially impact the energy balance of the RCS. EC-103483 Revision 1 documents the NRELAP5 assessment against the NIST-2 long-term cooling test suite. Section 4.3.2.3 of EC-103483 discusses {{

}}2(a),(c)

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}}2(a),(c)

Section 5.2.3 of TR-124587 provides an approach for evaluation of riser hole flow rates used in boron transport analyses during ECCS cooling, or for justification of rates determined from a different source such as NRELAP5 calculation results. Sensitivity calculations in EC-128030, Revision 0 (provided in electronic reading room (eRR)), demonstrate that at high pressure conditions where NRELAAP5 predicts reasonably stable liquid flows, NRELAP5 predicts reasonable lower riser hole flows compared to the alternate method. At lower pressure conditions, NRELAP5 predicts oscillatory core flows and under-predicts the riser hole flows. The biased NRELAP5 results were used to evaluate ECCS boron transport, consistent with TR-124587.

Table 1. {{

}}2(a),(c)

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}}2(a),(c)

b) TR-124587 Sections 4.4.3.33 and 4.4.3.36 discuss the treatment of containment vessel wall heat transfer and condensate collection in the extended passive cooling and reactivity control methodology.

The methods used to determine condensate flow rates into the boron dissolver basket and containment mixing tubes are described in EC-132087 Rev. 1, Section 3.2, which is provided in the eRR.

The credited fraction of the available containment wall area above each condensate rail that is used in determining the condensate collector flow rate is determined based on containment vessel geometry, including influences on condensation and condensate flow.

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}}2(a),(c)

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}}2(a),(c)

Figure 1. ESB Dissolver CNV Wall Condensate Area (Note: this figure is a screenshot of an NPM 3D model for illustrative purposes only to aid in visualizing the general arrangement of wall area and major obstructions)

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}}2(a),(c)

Figure 2. ESB Lower Mixing Tube 2 CNV Wall Condensate Area (Note: this figure is a screenshot of an NPM 3D model for illustrative purposes only to aid in visualizing the general arrangement of wall area and major obstructions)

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}}2(a),(c)

Figure 3. ESB Lower Mixing Tube 1 CNV Wall Condensate Area (Note: this figure is a screenshot of an NPM 3D model for illustrative purposes only to aid in visualizing the general arrangement of wall area and major obstructions)

c) {{

}}2(a),(c)

*Response Supplement for Item (c)*

Mixing in the RPV Volume

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}}2(a),(c)

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}}2(a),(c)

Core and riser boron distribution in these types of long-term ECCS cooling scenarios (boiling-dominated or convection-dominated cooling) was quantitatively evaluated as part of the US600 design certification as documented in Section 2.1.4 of the second supplemental response to RAI 8930 (question 15-27). As described above, the principles evaluated for the US600 design continue to be applicable to NPM designs with lower riser holes that are analyzed with the XPC evaluation method. Mixing in the core and riser is evaluated in Section 15.0.6.4.4 of the US600 NRC safety evaluation. The conclusion of the safety evaluation is consistent with ER-103121:

*For high core exit flow qualities, significant riser/core mixing is expected due to two-phase mixing. For low core exit qualities (e.g., zero), internal flow recirculation rates would have to be high, indicating sufficiently high riser/core mixing. In either case, the applicant argues, and the staff agrees, significant mixing would occur to reduce or eliminate an adverse core boron concentration gradient.*

During XPC audit discussions in the NuScale Rockville office on June 20, 2023, reviewers inquired about whether there is enough flow to prevent boron concentration gradients in the core region, specifically in boron precipitation analysis scenarios. In addition to the information summarized above, in the XPC evaluation method, representative boron precipitation results in TR-124587 Section 7.5 demonstrate significant margin to the boron precipitation limit. Similarly, the XPC evaluation method was applied to the US460 design and the results in FSAR Table 15.0-19 of the SDAA show that there is significant margin between the precipitation limit and the core and riser region boron concentration for different transients analyzed.

[1] J. Tuunanen, H. Tuomisto, and P. Raussi, “Experimental and Analytical Studies of Boric Acid Concentrations in a VVER-440 Reactor during the Long-Term Cooling Period of Loss-of-Coolant Accidents,” Nuclear Engineering and Design, Vol. 148, pp. 217-231, 1994.

Mixing in the CNV Volumes

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}}2(a),(c)

{{ }}2(a),(c)

Figure A – CFD simulation result at ~5 minutes

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}}2(a),(c)

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}}2(a),(c)

Figure B – CFD simulation results at ~10.5 minutes (left) and ~30 minutes (right)

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}}2(a),(c)

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}}2(a),(c) Therefore, comparing the CFD simulation results to the boron transport analysis results demonstrates conservatism in the CNV mixing assumptions used in the boron transport analysis.

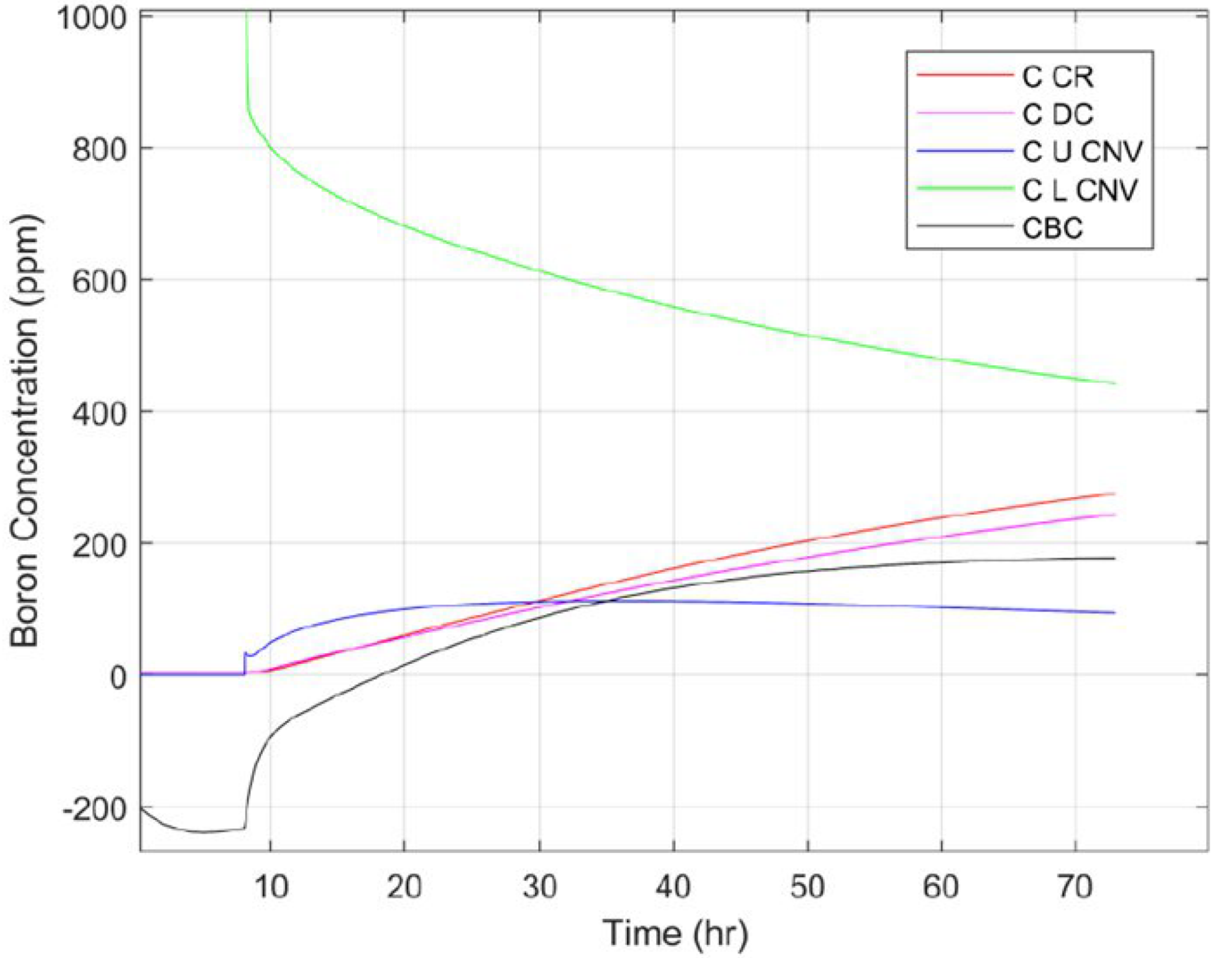


Figure C – Boron transport (dilution) analysis results (RCCW pipe break)

NuScale Response to NRC Feedback

On April 19, 2024, NuScale received written feedback from the NRC. The following provides NuScale's response to the feedback.

NRC Feedback on Item (a)

*a) The response did not provide the requested information. The audit question requested that justification be provided that* {{

}}2(a),(c)

*Topical report markups are missing that contain this information. Provide LTR markups as originally requested.*

<u>NuScale Response to Feedback on Item (a)</u>

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}}2(a),(c)

## Table 2: NRELAP5 Transient Sensitivity Cases

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}}2(a),(c)

## Figure 4: Reactor Coolant System Flow

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### Figure 5: Reactor Coolant System Flow (Zoomed In)

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}}2(a),(c)

**Figure 6: Total Riser Hole Flow (All Holes Combined)**

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**Figure 7: Total Riser Hole Flow (All Holes Combined, Zoomed In)**

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}}2(a),(c)

## Figure 8: Average Reactor Coolant System Temperature

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**Figure 9: Pressurizer Pressure**

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**Figure 10: Flow Over Riser**

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## Figure 11: Riser Upper Plenum Void Fraction

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**Figure 12: Upper Riser Void Fraction**

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**Figure 13: Steam Plenum 1 Pressure**

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**Figure 14: Decay Heat Removal System 1 Flow**

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}}2(a),(c)

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}}2(a),(c)

**Figure 15: Low Pressure Results, MATLAB vs NRELAP5 Riser Hole Flow**

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}}2(a),(c)

**Figure 16: High Pressure Results, MATLAB vs NRELAP5 Riser Hole Flow**

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}}2(a),(c)

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}}2(a),(c)

Table 3 and Figure 17 show the case matrix definition and range of parameters evaluated.

Figures 18 through 20 show results of the parametric sensitivities.

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}}2(a),(c)

**Table 3: Case Matrix Definition and Range**

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**Figure 17: Statepoints of Reactor Coolant System Vapor Pressure and Core Decay Heat**

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}}2(a),(c)

**Figure 18: Riser Hole Mass Flow Rate and Vapor Condensation vs. Power, All Cases with Clark Void Fraction Model and 15,000 kg Reactor Coolant System Mass**

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**Figure 19: Ratio of Riser Hole Flow to Condensate, vs. Power, Case 2**

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}}2(a),(c)

**Figure 20: Ratio of Riser Hole Flow to Condensate, vs Power, Case 4 Reactor Recirculation Valve Temperature 65°F, Range of Reflector Flow Rates**

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}}2(a),(c)

NRC Feedback on Item (b)

*b) The response did not provide the requested information. The audit question requested the validation basis information/evaluations for the condensate flow rate assumption into the boron dissolver basket and containment mixing tubes and justification for the assumed fraction of the available containment wall area above each condensate rail that is used in determining the condensate collector flow rate in the topical report.*

*The response provided some description about the approach for the condensate flow rate assumptions and a reference to document EC-132087 Rev 1. The following items have not been addressed and are requested to be included in the methodology to address the audit question:*

*i. The response did not provide the methodology description which specifically states how the credited fraction of the available containment wall area is determined; it does not state specifically how the geometry is used and how influences on condensation and condensate flow rate are considered.*

*ii. The response did not provide the methodology description for how the credited minimum CNV surface area interacts with the channels that are directed toward the boron dissolver baskets. One of the channels enters the basket but is not used for diluting the boron. How the minimum CNV surface area is distributed to the channels is not described. Additionally, EC-132087 Rev 1 ODI-132835, states* {{

}}2(a),(c) *This open design item has not been adequately addressed by the methodology. The methodology would need to be explicitly limited to these conditions, or a condition/limitation will be placed on the methodology by the staff.*

*iii. The response did not provide the methodology description for how the dissolver condensate collection capacity is determined or a description of how the dissolver condensate collection capacity is used.*

*iv. The response did not provide the methodology description which specifically states how the ESB mixing tube containment wall area is determined and specifically how the methodology accounts for major obstructions. Additionally,* {{

}}2(a),(c) *This open design item has not been adequately addressed by the methodology. The methodology would* *need to be explicitly limited to a design with this feature which has been demonstrated to have appropriate justification, or a condition/limitation will be placed on the methodology by the staff.*

*v. The response did not provide the methodology description for how the mixing tube condensate collection capacity is determined or a description of how the dissolver condensate collection capacity is used.*

*Please provide the information from the audit response as well as the information that has not been addressed in order to provide justification that the methodology can adequately characterize the NPM response with respect to condensate flow rate assumptions in the methodology markups. The potential impact on the NPM response due to the uncertainty added by the condensate flow rate assumptions on the figures of merit should be quantified to support justifications. Topical markups are missing that contains this information. Provide LTR markups as originally requested.*

<u>NuScale Response to Feedback on Item (b)</u>

(NRC feedback is in indented, italic text; NuScale's response to the feedback is in normal text)

> *i. The response did not provide the methodology description which specifically states how the credited fraction of the available containment wall area is determined; it does not state specifically how the geometry is used and how influences on condensation and condensate flow rate are considered.*

The available CNV wall area is a design value {{

}}2(a),(c) Determination of the minimum available CNV wall area is outside the scope of the extended passive cooling (XPC) and reactivity control evaluation model (EM) documented in TR-124587, Revision 0. The EM calculations use the design value for the available CNV wall area as an input, as described in Table 4-17 of TR-124587. Final safety analysis report (FSAR) Table 15.0-22 provides the modeling choices used for containment wall area inputs in the limiting boron transport and precipitation cases.

The CNV wall area for the US460 design ESB dissolver baskets is calculated in ER-121191, Revision 0, "ECCS Supplemental Boron Dissolver Sizing Report," which was previously provided in the eRR. The CNV wall area for the US460 design ESB mixing tubes is addressed in item iv. below.

The response to audit item A-6.3.2.2.1-1 addresses design parameters of the ESB system in the FSAR, including CNV wall area.

> *ii. The response did not provide the methodology description for how the credited minimum CNV surface area interacts with the channels that are directed toward the boron dissolver baskets. One of the channels enters the basket but is not used for diluting the boron. How the minimum CNV surface area is distributed to the channels is not described. Additionally, EC-132087 Rev 1 ODI-132835, states* {{
>
> }}2(a),(c) *This open design item has not been adequately addressed by the methodology. The methodology would need to be explicitly limited to these conditions, or a condition/limitation will be placed on the methodology by the staff.*

Regarding the boron dissolvers, the boron transport and precipitation analyses are concerned with condensate generation and collection (including CNV wall area and collector rail) that feeds into the ESB basket containing boron oxide. The condensate collected by the auxiliary collector rail is not used in the XPC analysis because, although it enters the dissolver housing, it does not feed into the ESB dissolver basket containing boron oxide. The CNV wall area above the auxiliary collector rail (orange striping in Figure 1 in this response) is not credited in the XPC analysis and is separate from the credited CNV wall area above the collector rail that feeds into the ESB dissolver basket containing boron oxide (yellow striping in Figure 1 in this response). Therefore, the XPC evaluation model does not address condensate collection by the auxiliary collector rail or the CNV wall area above the auxiliary collector rail because they are not used in the XPC analysis.

As described in TR-124587 Section 4.4.3.36, {{

}}2(a),(c)

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}}2(a),(c) [emphasis added]

Consistent with this description, information in TR-124587 and FSAR Section 15.0.5 about condensate collection for the ESB dissolvers is specific to condensate collection entering into the ESB dissolver baskets containing boron oxide and excludes the auxiliary collection channel and associated CNV wall area.

Table 3-3 of TR-124587 summarizes key features of the plant design or plant design requirements that must be met in order to apply the XPC evaluation model. Table 3-3 of TR-124587 includes an entry specifying, “ECCS supplemental boron systems, structures, and components (SSC) distribute condensate over top of the packed bed.” The table entry further explains that this design feature is required for analytical evaluation of boron dissolution, and for the US460 design the feature is defined in detailed design work. Section 4.3.3 and Section 6.2.5 of TR-124587 also discuss the applicability limitation for distribution of condensate over top of the packed bed.

> *iii. The response did not provide the methodology description for how the dissolver condensate collection capacity is determined or a description of how the dissolver condensate collection capacity is used.*

The condensate collector rail size determines condensate collection capacity. Condensate collector rail size is a design value determined as part of the design of the ESB feature of ECCS. The determination of this design value is outside the scope of the XPC evaluation model. The EM calculations use the design value for the collector rail size as an input. The EM uses the collector rail sizing as described in Section 4.4.3.36 of TR-124587:

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}}2(a),(c)

Collector rail sizing for the US460 SDAA design ESB dissolver baskets is documented in ER-121191. Collector rail sizing for the ESB mixing tubes is documented in ER-122608, Revision 1, “ECCS Supplemental Boron Mixing Tube Sizing Report,” which was previously provided in the eRR.

The response to audit item A-6.3.2.2.1-1 addresses design parameters of the ESB system in the FSAR, including condensate collection flow capacity.

*iv. The response did not provide the methodology description which specifically states how the ESB mixing tube containment wall area is determined and specifically how the methodology accounts for major obstructions. Additionally, EC-132087 Rev 1 ODI-132953, states* {{

}}$^{2(a),(c)}$ *This open design item has not been adequately addressed by the methodology. The methodology would need to be explicitly limited to a design with this feature which has been demonstrated to have appropriate justification, or a condition/limitation will be placed on the methodology by the staff.*

As described in item i above, the available containment wall area is a design value determined by calculating the flat wall area above the condensate rails for the ESB dissolver basket and mixing tubes, where condensate from the wall is expected to flow into the collection rails (i.e., free of major interferences such as support structures and penetrations). The determination of this design value is outside the scope of the Extended Passive Cooling and Reactivity Control EM. The EM calculations use the design value for the available containment wall area as an input. The containment wall area inputs used in the limiting boron transport and precipitation cases are provided in FSAR Table 15.0-22.

Table 3-3 of TR-124587 summarizes key features of the plant design or plant design requirements that must be met in order to apply the XPC evaluation model. Table 3-3 includes an entry specifying the methodology is limited to a design with mixing tubes in containment. The condensate collection area, collector rail size, and mixing tube size are design values that are determined as part of the design of the ESB feature of ECCS. The determination of these design values is outside the scope of the Extended Passive Cooling and Reactivity Control EM.

The containment wall area inputs used in the limiting boron transport and precipitation cases are provided in FSAR Table 15.0-22. Section 15.0.5.3.2 describes conservatisms applied to the modeling of the mixing tubes in the boron transport calculations.

The minimum CNV wall area for the US460 design ESB mixing tubes is specified in the ESB design. The response to audit item A-6.3.2.2.1-1 addresses design parameters of the ESB system in the FSAR, including CNV wall area.

*v. The response did not provide the methodology description for how the mixing tube condensate collection capacity is determined or a description of how the dissolver condensate collection capacity is used.*

As described in item iii above, the condensate collector rail size determines condensate collection capacity. Condensate collector rail size is a design value determined as part of the design of the ESB feature of ECCS. The determination of this design value is outside the scope of the Extended Passive Cooling and Reactivity Control EM. The EM calculations use the design value for the collector rail size as an input. The XPC EM uses the collector rail sizing as described in TR-124587 Section 4.4.3.36:

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}}2(a),(c)

Additional description of how the mixing tube collection capacity and resulting condensate flow into the mixing tubes is used in the XPC evaluation model is described in Section 4.4.3.38 of TR-124587:

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}}2(a),(c)

Section 15.0.5.3.2 of the FSAR describes that the condensate flow into the ESB dissolvers and containment mixing tubes, generated by the effective minimum CNV wall condensation area, is modeled in the boron transport and precipitation analyses as described in TR-124587.

The response to audit item A-6.3.2.2.1-1 addresses design parameters of the ESB system in the FSAR, including condensate collection flow capacity.

> *Please provide the information from the audit response as well as the information that has not been addressed in order to provide justification that the methodology can adequately characterize the NPM response with respect to condensate flow rate assumptions in the methodology markups. The potential impact on the NPM response due to the uncertainty added by the condensate flow rate assumptions on the figures of merit should be*

*quantified to support justifications. Topical markups are missing that contains this information. Provide LTR markups as originally requested.*

Existing information in TR-124587 describes the EM used for condensate generation and collection in the boron transport analyses. In response to audit items A-15.0.5-1 and A-15.0.5-2, NuScale provided input parameters and modeling decisions used in implementing the boron transport analyses for the US460 SDAA as described in markups to FSAR Section 15.0.5.3.1. Other design information for the ESB feature of the ECCS system is provided in Section 6.3.2.2.1 of the FSAR or other related sections. The response to audit item A-6.3.2.2.1-1 addresses design parameters of the ESB system in the FSAR.

Conservative biasing of condensate flow rates applied to the boron transport method are described in Section 4.4.3.36 of TR-124587. As described in this section, the effects of slow-biased and fast-biased boron dissolution are evaluated in the XPC evaluation model. Section 4.3.3 presents quantitative dissolution testing results showing that applying a slow-bias reliably under-predicts the boron dissolution rate and applying a fast-biased reliably over-predicts the dissolution rate.

In addition to boron dissolution biasing, the different types of transients and boundary conditions contribute to whether the boron oxide is dissolved into liquid below or above the reactor flange. For example, the limiting boron dilution event (reactor component cooling water line break) in Section 15.0.5 of the FSAR shows that boron is dissolved into liquid in the lower CNV volume hours before ECCS actuates. This timing is driven primarily by the sequence of events of the transient rather than condensate flow rate assumptions. Therefore, the conservative biasing of condensate flow and boron dissolution combined with the transient and boundary condition modeling described in TR-124587 are addressed.

<u>NRC Feedback on Item (c)</u>

*c) The response did not provide the requested information. The audit question requested validation for* {{

}}2(a),(c)

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}}2(a),(c) *The potential impact on the NPM response due to the uncertainty added by the assumptions on the figures of merit should be quantified to support justifications.*

*Topical markups are missing this information. Provide LTR markups as originally requested.*

<u>NuScale Response to Feedback on Item (c)</u>

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}}2(a),(c)

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}}2(a),(c)

TR-124587 describes mixing in the RPV and CNV volumes in Section 4.4.3.12, Section 4.4.3.34, and Table 4-17. These sections describe the associated conservatisms used in the boron transport methodology and refer to supporting Raleigh number analysis and CFD analyses.

NuScale Response to Additional NRC Feedback

On July 22, 2024, NuScale received additional written feedback from the NRC. The following provides NuScale's response to the feedback.

NRC Additional Feedback on Item (a)

*a) The response did not provide the requested information. The audit question requested that justification be provided that NRELAP5 can correctly calculate actual expected NPM response in the topical report for model validation,* {{

}}2(a),(c) *This information was requested for the following audit items: A-XPC.LTR-2, A-LOCA.LTR-2 and A-NonLOCA.LTR-1.*

*Provide the following information to address the audit items:*

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}}2(a),(c)

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}}2(a),(c)

*These audit items (A-XPC.LTR-2, A-LOCA.LTR-2 and A-NonLOCA.LTR-1) are FISDs and the requested information is needed to be included in the topical reports. Provide the information requested in the audit response in the TRs and provide the requested TR markups.*

*For the XPC TR, with respect to lower riser hole flow rates that are evaluated independent of NRELAP5 "to provide confidence in the lower riser hole function to maintain adequately mixed boron concentration" and described in EC-128030 to independently calculate riser hole flows and compare the results to NRELAP5, the requested information was provided. This item is an FISD and is needed to be included in the XPC LTR. Provide the requested information presented in the audit response in the XPC TR and provide the requested XPC TR markups.*

<u>NuScale Response to Additional Feedback on Item (a)</u>

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}}2(a),(c)

**Table 4: Riser Hole Effects and Associated Audit Item Information**

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}}2(a),(c)

<u>NuScale Response to Additional Feedback on Item (b)</u>

(NRC feedback is in indented, italic text; NuScale's response to the feedback is in normal text)

> *b) The response did not provide all the requested information.*
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> *i. The response states that the determination of the minimum available CNV wall area is outside the scope of the XPC topical report. However, where this is addressed in the application has not been provided. If the information is outside the scope of the XPC TR then point to where in the SDAA the specific information is provided or provide a markup to SDAA that contains the requested information.*

As stated in the response to NRC feedback above, the response to audit item A-6.3.2.2.1-1 addresses design parameters of the ESB system in the FSAR, including CNV wall area.

> *ii. The description of the auxiliary collector rail is not located in the XPC topical report or the SDAA. Update the topical report to include the information provided in response to this item.*

A description of the main and auxiliary condensate channels in the ESB feature is added to the FSAR by audit item A-6.3-8.

> *iii. This information has been provided.*

No response is necessary.

> *iv. The response states that the determination of the minimum CNV wall area for the ESB mixing tubes is outside the scope of the XPC topical report. However, where this is addressed in the application has not been provided. If the information is outside the*

*scope of the XPC TR then point to where in the SDAA the specific information is provided or provide a markup to SDAA that contains the requested information.*

As stated in the response to NRC feedback above, the response to audit item A-6.3.2.2.1-1 addresses design parameters of the ESB system in the FSAR, including CNV wall area.

*v. This information has been provided.*

No response is necessary.

*These items are an FISDs and are needed to be included in the XPC LTR or SDAA. Provide the requested information in the audit response items (all revisions) in the XPC TR or SDAA and provide the requested XPC TR or SDAA markups.*

The requested information is provided as described in the individual items above.

NRC Additional Feedback on Item (c)

*c) The response did not provide the requested information.*

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}}2(a),(c)

*This information is needed to adequately justify the transport and mixing assumptions in the XPC topical report and is identified as missing information (FISD). The topical report does not discuss CFD analysis except to state "and supporting CFD analyses" with no additional information. This item is an FISD and is needed to be included in the XPC LTR. Provide the requested information presented in the audit response in the XPC TR and provide the requested XPC TR markups.*

NuScale Response to Additional Feedback on Item (c)

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}}2(a),(c)

The CFD analysis is not used to evaluate the response of the NPM against figures of merit or to perform a detailed uncertainty assessment. The CFD analysis demonstrates adequate conservatism in the CNV mixing assumptions used in the boron transport analysis. A markup to the XPC topical report is included with this revised response to refer to the CFD analysis.

This response references a proprietary version of a topical report that is marked as containing export controlled information (ECI). However, the extracted page of the topical report that is attached to this response does not contain ECI as submitted herein. Notwithstanding, any proprietary information included in the response and the attachment hereto shall be withheld per 10 CFR 2.390.

Markups of the affected changes, as described in the response, are provided below:

#### 4.4.3.34 3D Flow, Boron Distribution and Mixing in the CNV

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Audit Question A-XPC.LTR-2

}}2(a),(c) Therefore, it is concluded that the boron transport method conservatively accounts for effects of 3D flow, boron distribution and mixing in the CNV, with appropriate methods specified for boron dilution analyses and boron precipitation analyses.

#### 4.4.3.35 Containment Isolation Valve Leakage Rate

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}}2(a),(c)