



**PROPRIETARY INFORMATION – WITHHOLD UNDER 10 CFR 2.390
EXPORT CONTROLLED INFORMATION – WITHHOLD UNDER 10 CFR PART 810**

December 28, 2015

Docket: PROJ0769

U.S. Nuclear Regulatory Commission
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11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Submittal of Topical Report TR-0915-17565, "Accident Source Term Methodology," Revision 0 (NRC Project No. 0769)

REFERENCE: Letter from NuScale Power, LLC to U.S. Nuclear Regulatory Commission, "Key Issue Resolution Prior to Design Certification Application," LO-0715-16060, dated July 22, 2015 (ML15203B306).

In the referenced letter dated July 22, 2015, NuScale Power, LLC (NuScale) provided an updated schedule for topical report submittals. NuScale provided a schedule indicating the intent to submit this topical report by December 31, 2015. Consistent with that schedule, NuScale hereby submits Topical Report TR-0915-17565, "Accident Source Term Methodology," Revision 0.

The purpose of this submittal is to request NRC review and approval of the assumptions, codes, and methodologies presented in this report for assessing the source terms and radiological consequences of design basis accidents. In light of its early submittal and the holiday season, NuScale respectfully requests that the acceptance review be completed in about 60 days from the beginning of the new calendar year 2016.

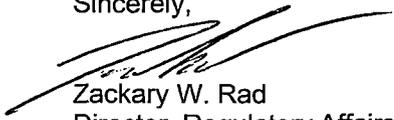
Enclosure 1 contains the proprietary version of the report entitled "Accident Source Term Methodology." NuScale requests this enclosure be withheld from public disclosure pursuant to 10 CFR § 2.390. The enclosed affidavit (Enclosure 3) supports this request. Enclosure 1 has also been determined to contain Export Controlled Information. This information must be protected from disclosure per the requirements of 10 CFR Part 810.

Enclosure 2 is the nonproprietary version of the report entitled "Accident Source Term Methodology."

This letter and its enclosures make no regulatory commitments and no revisions to any existing regulatory commitments.

Please contact Jennie Wike at 541-360-0539 or at jwike@nuscalepower.com if you have any questions.

Sincerely,


Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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NRD

The Enclosure contains Proprietary Information. Upon separation from the Enclosure, this letter is decontrolled.

ECI Will not be Added to ADAMS *



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Attachment: Responses to NRC Questions

Enclosure 1: "Accident Source Term Methodology," TR-0915-17565-P, Revision 0, proprietary version

Enclosure 2: "Accident Source Term Methodology," TR-0915-17565-NP, Revision 0, nonproprietary version

Enclosure 3: Affidavit; AF-1215-19805

In an email dated October 14, 2015, the NRC Staff provided NuScale Power, LLC questions to support the pre-submittal discussions for the Accident Source Term Topical Report. Responses to the NRC Staff's questions on NuScale's Accident Source Term Methodology Slide Presentation (ML15279A100) are provided below.

Question # 1: Slide 22 – The proposed Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) (EAB / LPZ) boundary distance is indicated to be 122 m (400 ft). ARCON96 incorporates three sets of vertical diffusion coefficients (Sigma-Z) depending on the downwind receptor distance (i.e., 0 to 100 m; 100 m to 1000 m; and greater than 1000 m). Given that the proposed EAB / LPZ boundary distance is so close to the first breakpoint at 100 m (and those breakpoints tend to have been set at “round numbers” (for lack of a better term), has NuScale investigated what the difference in X/Q estimates would be if the Sigma-Z values were constrained to the more conservative set of values (presumably to the 0 to 100 m range)? If not, then how does that decision reflect on the statement of conservatism on Slide 24 in using ARCON96 over PAVAN?

Response: *No, NuScale did not investigate what the differences in X/Q estimates would be if the Sigma-Z values were constrained to the more conservative set of values. A discussion and evidence to support the position of using ARCON96 over PAVAN is presented in Section 4.1.5 of the topical report, including justification for its conservatism.*

Slide 23 – Address the following:

Question # 2: Second / Sixth Bullet – Was the same distance assigned to all directions in the PAVAN and ARCON96 modeling runs (e.g., Site Map diagram of Slide 24 suggests that the distance from the “plant south” side of the Turbine building to the proposed EAB / LPZ was used such that a ground-level point source at this distance from the boundary would likely produce the “maximum of all directions”.

Response: *Yes, the same distance was assigned to all directions in the PAVAN and ARCON96 modeling runs. Refer to Sections 4.1.6 and 5.1.1 of the topical report for further details.*

Question # 3: Second Bullet – For the ARCON96 model runs, how was the default “wind direction window” defined? (If the same distance was assigned to each direction sector, then this should have no effect on the calculations.)

Response: *Refer to Section 4.1.6 of the topical report for further details regarding ARCON96 model runs.*

Question # 4: Third Bullet – Clarify what the “Selected 80th – 90th percentile site” is intended to mean (e.g., the 80th – 90th percentile X/Q value selected from among the set of 95% X/Qs for all of the meteorological (Met) data sets evaluated). See also Step 3 of the methodology listed on Slide 28.

Response: *Clarification regarding the 95/95 and 80th-90th percentile of sites is provided in Section 4.1.6 of the topical report.*

Question # 5: Fifth Bullet – Are there any energetic accident releases such that momentum-and/or buoyancy-induced plume rise dominates the initial vertical height and the maximum impact may occur beyond the proposed exclusion area / site boundary?

Response: *No credit has been taken for plume rise from buoyancy or mechanical jet effects as allowed by Regulatory Guide (RG) 1.194. Refer to Section 4.1.6 of the topical report for a summary of the methodology utilized for offsite dispersion calculations.*

Question # 6: Given the smaller size and areal extent of the proposed NuScale unit and facility, could the location of its deployment be closer to complex terrain such that elevations at the proposed EAB / LPZ boundary distance might be significantly different from the potential accident release elevations? To what extent, if any, would that affect the applicability of the dispersion parameters?

Response: *For design purposes and development of the generalized methodology presented in this topical report, it is assumed that all terrain in the vicinity of the site is flat. EAB and LPZ evaluations for complex terrain are outside the scope of this topical report. Refer to Section 5.1.1 of the topical report for further details.*

Question # 7: At what distance downwind does the structural wake effects on dispersion begin to decrease and eventually disappear using the ARCON96 model?

Response: *The distance at which the wake effects are apparent depends on the building area input. As part of the methodology described in the topical report, both minimum and maximum building areas were assumed for example calculations, and the conservative result was used. For limiting conditions, a conservative building area was assumed. Refer to Section 4.1.6 of the topical report for a discussion on the impact of wake effects at the EAB and LPZ distance assumed in this methodology.*

Slide 24 – Address the following:

Question # 8: Are there changes to the site layout configuration, building dimensions, and/or distance to the proposed EAB/LPZ boundary depending on the number of modules included in the design for a given facility?

Response: *No, the methodology presented in this topical report assumes only one module is impacted, as there is no credible design basis event or MHA that would involve multiple modules. A discussion of potential radiological consequences of a multi-module event is provided in the NuScale topical report TR-0915-17772, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites," which is independent of the discussions provided in this topical report.*

Question # 9: Are there accident release scenarios that include radionuclide emissions from more than one module since (from Slide 6) at least six module appear to be located adjacent to one another? If so, how does that affect the dispersion modeling assumptions and the proposed EAB / LPZ boundary distance?

Response: *No, the methodology presented in this topical report assumes only one module is impacted, as there is no credible design basis event or MHA that would involve multiple modules. A discussion of potential radiological consequences of a multi-module event is provided in the NuScale topical report TR-0915-17772, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites," which is independent of the discussions provided in this topical report.*

Question # 10: Is the Technical Support Center (TSC) located onsite or offsite? If offsite, which of the two dispersion models (PAVAN or ARCON96) is expected to be used to estimate dispersion conditions at that location? (Refer to Regulatory Guide 1.183 (Section 1.3.1-Design Basis Radiological Analyses) and NUREG-0737 (Supplement 1) for the need to evaluate habitability impacts at emergency response facilities.

Response: *The TSC is expected to be located onsite. ARCON96 dispersion model is used to estimate dispersion conditions. Refer to Sections 3.1.2 and 5.1.2 of the topical report for further details.*

Question # 11: Are cooling towers (CTs) of the wet mechanical-draft type? With the proposed CT arrangement directly adjacent to the security fence (e.g., shown at Plant North and Plant South), what design and/or administrative provisions are anticipated to avoid potential offsite impacts including fogging and icing, and potential operation effects due to entrainment into CR, TSC, and other air intakes? Further, has the potential need to extend the proposed EAB / LPZ boundary been evaluated with respect to these effects?

Response: *Cooling tower design and associated potential offsite impacts, and the EAB and LPZ boundary analysis is beyond the scope of this topical report. This analysis and cooling tower design is expected to be provided by a combined operating license applicant that utilizes the methodology presented in this topical report.*

Question # 12: Slide 25 – The "X/Q vs. Frequency" plot is used to compare the relationship shown by Ramsdell and Fosmire between PAVAN and ARCON96 model results. Confirm that the label "Revised Model" in the Ramsdell and Fosmire plot is referring to Rev. 1 of ARCON96.

Response: *Yes, the label "Revised Model" in the Ramsdell and Fosmire plot refers to Revision 1 of the ARCON96 model. Refer to Section 4.1.4 and Figure 4-1 of the topical report for further details.*

Question # 13: At what downwind distance(s) do the X/Q values in the respective plots correspond to?

Response: *Refer to section 4.1.4 of the topical report for further details regarding downwind distances.*

Question # 14: Explain what the “X” (Cumulative Frequency) axis of the plots represents (e.g., the entire distribution of all modeled X/Qs in the respective studies) and for the NuScale test case what number of Met data sites and periods of record those PAVAN and ARCON96 results are based on. More importantly, confirm whether the area at the right side of the plot represents the X/Qs that would be used as input to the dose compliance demonstration (i.e., the 95% value as opposed to the 5% value at the left side of the plot). Be aware that there is potential confusion from a difference in terminology – that is, ARCON96 refers to a 95% X/Q (i.e., the designated value in the distribution that exceeds 95 percent of the modeled values for a given averaging interval) whereas the regulatory guidance refers to a 5% X/Q (i.e., the designated value in the distribution that is exceeded by only 5 percent of the modeled values for a given averaging interval).

Response: *The discussion regarding the data presented in the respective studies and the NuScale test case graph is presented in Section 4.1.5.1 of the topical report.*

Question # 15: Confirm whether the “X/Q vs. Frequency” plot represents results for one averaging interval (e.g., the 0- to 2-hour X/Q). How do the PAVAN results compare for the other short-term averaging intervals?

Response: *The “X/Q vs. Frequency” plots in Section 4.1.5 of the topical report represent calculations that are performed on individual points. The 0 to 2 hour, 2 to 8 hour, etc., X/Qs are 95th percentile values using averages of several points. Further discussion pertaining to these plots is presented in Section 4.1.5 of the topical report.*

Slide 26 – Address the following:

Question # 16: First Bullet – If the results are looked at by order-of-magnitude ranges or bands (i.e., 1E-03 to 1E-02, 1E-04 to 1E-03, 1E-05 to 1E-04, and 1E-06 to 1E-05), under-predictions appear to exceed over-predictions in the highest X/Q band (1E-03 to 1E-02), still a tendency for under-prediction in the second-highest X/Q band (1E-04 to 1E-03), about the same occurrence of over- and under-predictions in the third-highest X/Q band (1E-05 to 1E-04), and a clear tendency for over-prediction in the fourth-highest (or lowest) X/Q band (1E-06 to 1E-05).

Response: *The discussion of NuScale’s application of ARCON96 is presented in Section 4.1.4 of the topical report.*

Question # 17: How do these characteristics affect the statement of “conservatism” on Slide 26 with respect to the magnitude of X/Q estimates expected at the proposed EAB / LPZ boundary (e.g., see the example for Columbus, GA, on Slide 30 at about 5.7 E-04) for the “80-90th percentile U.S. site” consistent with the cited EPRI Advanced LWR Utility Requirements document on Slide 28? Given the Columbus, GA, example, does NuScale have an idea of what the controlling 80-90th percentile X/Q might be from among all of the Met monitoring sites to be (or already) modeled?

Response: *These characteristics do not impact the statement of conservatism. The under-predictions and over-predictions of X/Q estimates, and the impact on conservatism, are discussed in Section 4.1.4 of the topical report. The database utilized to determine the 80-90th percentile meteorological data is provided in Section 5.1.*

Question # 18: Second Bullet – Clarify, further, the statement “Linear Interpolation feature of ARCON96 prevents a single under-predicted point from being used in the evaluation of consequences of accidental releases.” (See Section 4.6.15 of the NUREG/CR-6331 (Rev. 1)).

Response: *A discussion of the linear interpolation feature of ARCON96 is provided in Section 4.1.4 of the topical report.*

Question # 19: How has atmospheric stability class been determined and if different from the delta-T method called for in Regulatory Guide 1.23 what differences might be expected in the resulting X/Q values using the two different methods?

Response: *A discussion of how the atmospheric stability class is determined, and differences from the delta-T methodology provided in RG 1.23 is provided in Section 5.1 of the topical report.*

Question # 20: EPA categorizes atmospheric stability using six classes (designated A thru F) compared to the NRC approach (based on delta-T) in Regulatory Guide 1.23 and its dispersion models which designates seven stability classes (A thru G). What consideration for adjustment of the results of the dispersion analyses based on different diffusion coefficients and wind speed adjustments has been made and, if no adjustments have been made, explain why not and how might that affect the size of the proposed Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) boundary?

Response: *A discussion of the comparison between the delta-T method and the Pasquill-Gifford Turner method, and its impact to the proposed methodology, is provided in Section 5.1 of the topical report.*

Question # 20: There are seventeen (17) Met monitoring stations in the current EPA SCRAM database for Alaska. Does their inclusion in the NuScale Met database imply the possible deployment of this design in that environment? Further, more limiting or extreme dispersion conditions are likely characteristic of this environment including the persistence of very restrictive atmospheric stability conditions (Class F and G stabilities) and limited mixing depths (very shallow but intense ground-based temperature inversions) for periods of many consecutive days. Accident releases under very cold ambient air temperature conditions may also experience greatly enhanced plume rise such that the assumption of a ground-level release may not be realistic for certain times of the year. If deployment could occur in extreme cold environments, has NuScale given any consideration to these different dispersion characteristics and how that could affect the reasonableness of the assumptions on conservatism and proposed use of ARCON96 in such locations?

Response: *No, site specific evaluations are beyond the scope of this topical report. This analysis is expected to be provided by a combined operating license applicant that utilizes the methodology presented in this topical report, if needed.*

While not the focus of this meeting, other dispersion modeling-related questions include:

Question # 21: Slide 20 - Are there any accident release scenarios internal to the plant structures such that dispersion is not subject to conditions in the outdoor ambient air but rather are internal to the HVAC system that would impact either the Control Room (CR) and/or the TSC?

Response: No, this methodology assumed there were no direct release paths that could transport releases from the reactor building to the Control Room or TSC. A discussion of the direct release paths is provided in Section 3.3.4.11 of the topical report.

Question # 22: Slide 29 (Second Bullet, Item 1) – How many Met data sets will be used to assess onsite dispersion parameters?

Response: Onsite dispersion parameters are assessed with the same database used for the offsite calculations. Refer to Sections 5.1.1 and 5.1.2 of this topical report for further details.

Question # 23: How will long-term routine releases be evaluated (e.g., XOQDOQ) and does that present any potential issues between the two modeling methodologies?

Response: Long-term routine releases and associated evaluations are beyond the scope of this topical report. This information is expected to be presented in the NuScale design certification application.