RAIO-1217-57861

December 21, 2017

Docket No. 52-048

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

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 276 (eRAI No. 9182) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 276 (eRAI No. 9182)," dated November 03, 2017

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's response to the following RAI Question from NRC eRAI No. 9182:

- 02.03.05-1

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9182

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9182

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Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 9182
Date of RAI Issue: 11/03/2017

NRC Question No.: 02.03.05-1

Regulatory Background

10 CFR Part 20, "Standards for Protection against Radiation," Subpart D, "Radiation Dose Limits for Individual Members of the Public," Section 20.1301, "Dose limits for individual members of the public," establishes dose limits to members of the public and Appendix B to Part 20, “Annual Limits on Intake and Derived Air Concentrations of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage,” establishes limits on concentrations of radioactive material in effluents to unrestricted areas. Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light Water-Cooled Nuclear Power Reactor Effluents," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," provides numerical guides for design objectives to meet the requirements that radioactive material in effluents released to unrestricted areas be kept as low as is reasonably achievable.

Pursuant to 10 CFR 52.47(a)(1), a Design Certification (DC) applicant is required to provide site parameters postulated for its design and an evaluation of its design in terms of those site parameters. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Section 2.3.5, “Long-Term Atmospheric Dispersion Estimates for Routine Releases,” Subsection III (Review Procedures), Item 5(b), in part, calls for the NRC staff to reach a conclusion that “[t]he applicant has provided a basis for each of the site parameters” and that “[t]he postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application.”

RG 1.111, “Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors,” Revision 1, provides guidance for performing atmospheric dispersion and deposition estimates of radioactive materials in gaseous effluents from routine releases. NUREG/CR-2919, “XOQDOQ Computer Program for the Meteorological Evaluation of Routine Releases at Nuclear Power Stations” describes the NRC-sponsored computer code XOQDOQ, which is used to implement the constant mean wind direction methodology outlined in RG 1.111.
Regulatory Position C.2 of RG 1.111 also provides guidance on source configuration evaluations.

Information Request 1:

In FSAR Tier 2, Table 2.0-1, "Site Design Parameters," the applicant lists routine release atmospheric dispersion f actors (χ/Q valu es) and a tm ospheric dep osition f actors (D/Q va lu es) at the site b oun dar y an d locations of interest. FSAR Tier 2, Section 2.3.5, "Long-Term Atmospheric Dispersion Estimates for Rout ine Releases, " states t hat t hese χ/Q a nd D/Q va lu es are used to ca lculate the site b oun dar y release concentrations for comparison to the activity release limits in 10 CFR 20 as discussed in Section 11.3. These are the sam e χ/Q an d D/Q v alues listed in FSAR Tier 2, Table 11.3-6, "GASPAR Code Input Parameter Values." However, the applicant has neither provided in Section 11.3 nor 2.3.5, any assumptions used in generating these values.

a. Please describe (or provide) the assumptions used to derive each of the χ/Q and D/Q values presented as site parameters in FSAR Tier 2, Table 2.0-1 (i.e., the annual average routine release χ/Q value of 3.64E-04 s/m3 at the security owner controlled area fence, and the routine release χ/Q and D/Q values of 5.43E-05 s/m3 and 5.43E-07 m2, respectively, at the site boundary and locations of interest). If applicable, please also identify the meteorological data set used to generate these χ/Q and D/Q site parameter values. Please revise the FSAR as necessary.

b. Please explain where the annual average routine releases χ/Q site parameter value of 3.64E-04 s/m3 for the security owner controlled area fence is used in any of the dispersion analyses presented in the FSAR.

c. If an atmospheric dispersion model, such as XOQDOQ, was executed to derive these χ/Q and D/Q site parameter values, please identify all the input parameters used, including:
    1. The meteorological data set used to generate the χ/Q and D/Q values
    2. All release points
    3. For each release point, the distances to the security owner controlled fence, site boundary, and locations of interest
    4. For each release point, the assumed vent velocity, vent inside diameter, vent height, adjacent building height, adjacent building minimum cross-sectional area, and vent heat emission rate

Information Request 2:

a. FSAR Tier 2, Section 11.3.3 states the input parameters for the calculation of the maximum individual dose at the exclusion area boundary are tabulated in FSAR Tier 2, Table 11.3-6, “GASPAR Code Input Parameter Values.” This table shows the distance to the bounding offsite dose location as 820 meters, whereas, FSAR Tier 2, Table 2.0-1 lists the minimum exclusion area boundary as the security owner controlled area fence, which is a distance of 400 feet (122 meters) according to FSAR Tier 2, Section 2.3.4. Please explain this apparent discrepancy in distances.
b. Please correct the units shown in FSAR Tier 2, Table 2.0-1, for the routine release χ/Q values at the site boundary and locations of interest from m/s3 to s/m3.

Information Request 3:

FSAR Tier 2, Table 2.0-1 provides some routine airborne effluent release point characteristics (i.e., source configuration information) for evaluating atmospheric dispersion and deposition for offsite receptors.

a. Table 2.0-1 identifies the release location as “an y point o n Re actor B uild ing o r T urbine Building Wall.” The tallest structure is the reactor building roof at approximately 24.69 meters. However, Table 2.0-1 also lists:
   1. A release height of 37.0 meters
   2. An adjacent building height of 0.0 meters
   3. An adjacent building cross-sectional area of 0.01 square meters

   Please explain what “any point on Reactor Building or Turbine Building Wall” means in relation to release location and height, and clarify the apparent discrepancies in the values shown above.

b. Please revise the FSAR, as necessary,with the release point characteristics for each release point for use by COL applicants in developing their own site-specific routine release χ/Q and D/Q site characteristic values. The revised release point characteristics to be provided should include the following:
   1. The assumed vent velocity
   2. Vent inside diameter
   3. Vent height
   4. Adjacent building height
   5. Adjacent building minimum cross-sectional area
   6. Vent heat emission rate

Information Request 4:

FSAR Tier 2, Section 2.3.5, states that the site boundary annual average χ/Q and D/Q values provided in FSAR Tier 2, Table 2.0-1 are used to calculate the site boundary release concentrations for comparison to the activity concentration limits in 10 CFR Part 20, as discussed in FSAR Tier 2, Section 11.3. FSAR Tier 2, Table 11.3-5 lists normal gaseous effluent releases from both the plant exhaust stack and the condenser air removal system.

Please explain why the same set of χ/Q values is used to model the releases from these two pathways, given the difference in release characteristics for these two pathways.

NuScale Response:

Information Request 1:

a. For the NuScale power plant, there are three normal gaseous effluent release points: the

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plant exhaust stack, which is 420 feet from the site boundary, and the two turbine generator buildings, which are each 400 feet from the site boundary. Approximately 99% of the contribution to gaseous offsite concentrations from normal radioactive effluent discharges from the NuScale power plant are from releases from the plant exhaust stack.

The lower limit of the standard output range of the XOQDOQ code is 0.25 miles. XOQDOQ is outside of its standard output range at the 400 and 420 foot distances to the site boundary mentioned above and therefore NARCON was used to calculate the routine release X/Q value presented in FSAR Table 2.0-1. Meteorological data from the National Climatic Data Center associated with the national weather service weather station in Sacramento, California from 1984 to 1986 was used as input to NARCON.

Normal radioactive effluent discharges from the turbine generator buildings are modeled as ground level releases. Normal radioactive effluent discharges from the plant exhaust stack are modeled as an elevated release (37.0 meters).

X/Q values for the plant exhaust stack and both turbine generator buildings were calculated and the maximum dose derived from the sum of X/Qs multiplied by the percentage of effluent release from all release points was selected to identify the location with the highest offsite dose.

The most bounding X/Q for that highest dose location (5.43E-05 s/m^3) was selected for use in all normal radioactive effluent offsite concentration calculations, regardless of actual release point.

The D/Q value is assumed to be a factor of 1.0E-02 times that of the X/Q value calculated by NARCON. This assumption is necessary since NARCON can't calculate D/Q directly and XOQDOQ is outside of its standard output range at the 400 and 420 foot distances NuScale analyzes. The factor of 1.0E-02 is reasonable because the ratio of D/Q to X/Q reported by some other applicants is 1.0E-02. Additionally, XOQDOQ was used to calculate a D/Q value of 7.2E-09 $1/m^2$ at the highest dose location (820m) using the example meteorological data in XOQDOQ, which gives confidence that the 5.43E-07 $1/m^2$ value derived from NARCON is conservative.

The calculated offsite gaseous effluent doses from a NuScale plant are highly site specific due to distinct site features such as terrain, meteorology, and site receptors having an effect on results. These calculations must be performed by the COL applicant per COL Item 11.3-2. The results shown in FSAR Table 11.3-8 are example calculations using assumed inputs to show reasonable assurance that a COL applicant will be able to meet the design objectives of 10 CFR 50 Appendix I. There is no requirement or expectation that a COL applicant will use the same codes or methods which were used to determine the results presented in the FSAR Table 11.3-8.

b. The annual average routine release X/Q site parameter value of 3.64E-04 s/m^3 is not used in

any analysis presented in the FSAR and as such it has been deleted, per the markup of Table 2.0-1 included in the reply to eRAI 9179 Question 02.03.01-2.

c. See response to "Information Request 1: a." above. Additionally, input parameters were added to FSAR Table 11.3-12 as markups included in the reply to eRAI 9185 Question 02.03.04-1.

Information Request 2:

a. The largest X/Q (out of all three release points) at the location which produced the largest offsite dose (at 820 m) was selected, rather than using a X/Q from the site boundary (at 400 feet), as stated in the response to "Information Request 1: a." above. A footnote has been added to Table 11.3-6 to clarify this, per the attached markup.

b. The units have been corrected per the markups included in the reply to eRAI 9179 Question 02.03.01-2.

Information Request 3:

a. These parameters were used in the analysis and are not site parameters. As such, they have been moved from FSAR Table 2.0-1 to FSAR Tables 11.3-12 and 15.0-20 per the markups included in the replies to eRAI 9179 Question 02.03.01-2 and eRAI 9185 Question 02.03.04-1.

FSAR Table 15.0-20's entry of "Release location - Any point on Reactor Building or Turbine Generator Building wall" (as relocated from FSAR Table 2.0-1) is meant to describe the release point from the buildings, not from within the building. The release out of a building can occur from anywhere along the building wall. Therefore, to be conservative, the offsite X/Qs from the Reactor Building or Turbine Generator Buildings are calculated assuming the releases occur from the closest part of the building to the dose location.

b. The plant exhaust stack is not a part of the NuScale Standard Design. The plant exhaust stack has several design commitments that it must be built to per FSAR Section 9.4.2.2, however there is a range of plant exhaust stack designs that could be implemented by the COL applicant within those design commitments. Therefore, this information can not be provided by NuScale at this stage and the COL applicant is responsible for properly translating their final plant exhaust stack design into their site-specific analysis.

Information Request 4:

See response to "Information Request 1: a." above.

Impact on DCA:

FSAR Section 11.3 has been revised as described in the response above and as shown in the markup provided in this response.

RAI 02.03.05-1

Table 11.3-6: GASPAR Code Input Parameter Values

Parameter	Value
χ/Q associated with the bounding off site dose location	5.43E-05 s/m^3
D/Q associated with the bounding off site dose location	5.43E-07 m^{-2}
Distance from plant exhaust stack to bounding off site dose location[1]	820 meters
Milk animal	Goat
Midpoint of plant life	20 yrs
Fraction of year that leafy vegetables are grown	1.0
Fraction of year that milk cows are in pasture	1.0
Fraction of the maximum individual's vegetable intake that is from his own garden	0.76
Fraction of milk-cow feed intake that is from pasture while on pasture	1.0
Average absolute humidity over the growing season	8.0 $gram/m^3$
Fraction of year that beef cattle are in pasture	1.0
Fraction of beef cattle feed intake that is from pasture while the cattle are on pasture	1.0
Source term	Table 11.3-5

Note 1: The elevated release from the plant exhaust stack causes the bounding offsite dose location to occur further than the site owner controlled area fence.