Accident Source Term Topical Report, Rev 3
Discussion Topics for 5/14/2019 Teleconference

1. During discussions associated with the accident source term (AST) white paper, NuScale indicated that the new design basis source term (DBST) which would be used for equipment environmental qualification in and around containment would be based on release of primary coolant with iodine spiking, which does not consider the potential spiking of other radionuclides. The applicant indicated that their proposed approach of increasing the iodine introduction rate by a factor of 500 and using unadjusted design basis reactor coolant concentrations for other radionuclides is consistent with RG 1.183. However, the staff noted that RG 1.183, Appendix I, assumes that a core melt accident is being considered for the radiation environment for equipment qualification, which typically bounds the dose to most equipment, especially equipment inside containment. Therefore, since a core melt source term was not being considered for NuScale, the staff informed the applicant that if they were only considering the spiking of iodine without considering the potential spiking of other radionuclides that could occur during design basis events or transients, then they would need to provide justification for why only spiking iodine is sufficient.

   In TR-0915-17565, "Licensing Topical Report Accident Source Term Methodology," Revision 3, Section 3.2.6, the applicant indicates that, "Spiking effects may occur for radionuclides besides iodines. However, any potential spiking of radionuclides besides iodine is implicitly accounted for by conservative treatments of the iodine spike DBST. For example, the assumed instantaneous event time-zero release of the entire primary coolant inventory results in doses expected to be several times larger than a more realistic graduated release of a primary coolant mass less than the entire primary coolant mass."

   The applicant does not provide any additional information or justification of the implicit conservatism to support their position except that the treatment of primary coolant activity, including iodine spiking, is consistent with RG 1.183, which the staff already informed the applicant was inadequate, as discussed above. The staff understands that assuming an instantaneous release may be conservative, but TR-0915-17565 does not provide information justifying NuScale's statement that the conservatisms bound the consideration of spiking of other radionuclides.

   10 CFR 50.49(e)(4) requires that the radiation environment associated with the most severe design basis accident be considered. Without adequate information to demonstrate that the conservatisms in developing the iodine spike DBST using the methodology described in the topical report bound the need to consider the potential spiking of other radionuclides, the staff is unable to make a determination that the radiation environment associated with the most severe design basis accident is being appropriately considered.

2. The iodine spike DBST and gamma dose rates provided by NuScale in the FSAR are significantly different than what the staff calculates using the revised NuScale methodology. Specifically, the staff notes the following:
   a. The RCS peak iodine activity concentrations provided in FSAR Table 12.2-34 (in FSAR Rev. 2) are significantly different than iodine values calculated by staff using the methodology described by NuScale in TR-0915-17565, Rev. 3

b. Although NuScale indicates that there is no spiking of any radionuclides besides iodine, the concentrations of other radionuclides in FSAR Table 12.2-34 are significantly different than the design basis RCS concentrations provided in FSAR Table 11.1-4.
c. Using the source term provided in FSAR Table 12.2-34, staff estimates significantly different maximum gamma dose rates than those provided in FSAR Table 3C-8.

As a result, the staff does not understand NuScale's source term provided in FSAR Table 12.2-34 and dose rates provided in FSAR Table 3C-8. Please clarify how the values in these tables were determined.

Providing a similar level of detail to describe the source term assumptions in Section 3.2.6 of the topical report as in other sections of the report (e.g., Section 3.2.3 regarding main steam line break outside containment) would help clarify the iodine spike DBST methodology.

Providing more detailed information on the iodine spike DBST analysis inputs and assumptions in FSAR Section 15.0.3.8.6, rather than just referencing the methodology topical report, would also help clarify how the values in FSAR Tables 12.2-34 and 3C-8 were calculated.

3. One of the primary purposes for revising TR-0915-17565 was to address issues NuScale was experiencing with Environmental Qualification of certain equipment.

   10 CFR 50.49(e)(4) requires identification of the type and quantities of radiation expected during operation and design basis events. RG 1.183, Appendix I, "Assumptions for Evaluating Radiation Doses for Equipment Qualification," states that gamma and beta doses and dose rates should be determined for three types of radioactive source distributions: (1) activity suspended in the containment atmosphere, (2) activity plated out on containment surfaces, and (3) activity mixed in the containment sump water. RG 1.183 includes guidance for consideration of the chemical form of Iodine species.

   The proposed revisions to the FSAR Page 12.2-7 Section 12.2.1.13 states: "Three volumes associated with the NPM are evaluated for EQ dose consequences: the reactor pressure vessel and containment vessel combined liquid sump volume, the containment vapor volume, and the bioshield envelope volume." And "Plateout of activity onto containment surfaces is neglected due to the small containment volume and the lack of surface coatings inside containment."

   The staff does not believe that the NuScale application provides sufficient information regarding their assumptions and may utilize a methodology that underestimates the radiation environment of Environmentally Qualified equipment, specifically:

- Based on the review of TR-0915-17565 and the associated FSAR change markups, the staff is unable to identify where and how NuScale identifies the kinds and quantities of radioactive material in the "combined liquid sump volume."

- Based on direct statements by the applicant, NuScale is neglecting the effects of plate out of radioactive materials on plant components that may impact the radiation dose to equipment, such as the Electrical Penetration Assemblies (EPA). The staff notes that the top of the reactor vessel has a relative large available surface area, that is also very close, with respect to radiation transport, to the EPAs.
- Based on direct statements by the applicant, NuScale may not be including some large volumes, such as the upper reactor vessel, that will contain sources of radiation that can expose the Environmentally Qualified equipment.

4. Appendix A, Table A-1, with respect to GDC 19, the methodology compliance column information states that GDC 19 is not directly applicable to beyond design basis events. Although proposed in the January 31, 2019 white paper, this concept does not appear to be discussed anywhere else in the topical report (or FSAR changes).
    a. What is the basis for the statement that GDC 19 is not directly applicable to beyond design basis events?
    b. Clarify where in the methodology this difference is described and modeled.