Response to SDAA Audit Question

Question Number: A-15.0.3.7-1

Receipt Date: 04/17/2023

Question:

Section 15.0.3.7.1 and Section 15.0.3.7.2 assume the containment and secondary systems are isolated at 30 minutes. Provide the basis for this assumption.

Response:

The dose consequence analyses in Sections 15.0.3.7.1 and 15.0.3.7.2 are for the failure of small lines carrying primary coolant outside containment and steam generator tube failure events, respectively. Both of these events assume a bounding mass release of primary coolant from the RPV directly to the environment. Isolation of the release is assumed at 30 minutes. Beyond 30 minutes, further releases are limited to the design-basis limit for containment leak rate. Regarding the assumption of the isolation timing, there are two considerations: the total mass release and treatment of iodine spiking.

For both events, a bounding mass of 23,000 lbm of primary coolant is assumed to be released. This mass is calculated based on the maximum possible decrease in pressurizer level before the containment isolation setpoint is reached as described in Sections 15.0.3.7.1 and 15.0.3.7.2. Because the mass release amount is associated with reaching the low pressurizer level MPS setpoint in Table 15.0-7, automatic containment isolation and secondary system isolation are assured. The total mass release is therefore calculated independently of the time of isolation. Using an alternate isolation time, either slower or faster than 30 minutes, would not alter the total mass release.

The iodine spiking assumptions associated with these two events are consistent with the NuScale accident source term methodology topical report (Reference 15.0-6 in the FSAR). The failure of small lines event assumes a coincident iodine spike. The steam generator tube failure event assumes both a pre-incident and coincident iodine spike. For pre-incident iodine spiking,

the isolation time is not relevant. For coincident iodine spiking, the iodine transport from the fuel to the coolant increases over time after the change in power caused by reactor trip. The earlier that isolation happens following reactor trip, the less impact of the iodine spiking. In the NuScale US460 design, many of the MPS signals that cause reactor trip for these events also cause isolation. As a result, the time period for iodine spiking prior to isolation is expected to be minimal. The assumption of 30 minutes for isolation is therefore conservative for iodine spiking for the break release as it effectively models a 30 minute delay between reactor trip and isolation. For containment leakage releases beyond the break release, an eight hour period of coincident iodine spiking is also evaluated.

The dose calculations in Sections 15.0.3.7.1 and 15.0.3.7.2 were performed in a bounding manner independent of event-specific transient inputs. The assumptions, including the isolation time of 30 minutes, are conservative for the reasons described above. The bounding nature of the calculations in Sections 15.0.3.7.1 and 15.0.3.7.2 can further be verified by comparing the assumptions to the event-specific values. Table 1 shows the comparison for the failure of small lines carrying primary coolant outside containment. Table 2 shows the comparison for the steam generator tube failure event. Note that for the event-specific analysis results in both tables, the values represent the limiting value for that parameter from the analyzed cases and may not be from the same case. As demonstrated in the tables, the assumptions in Sections 15.0.3.7.1 and 15.0.3.7.2 are clearly bounding.

Table 1:
Failure of Small Lines Carrying Primary Coolant Outside Containment

	Bounding Assumption in 15.0.3.7.1	Event-Specific Analysis (15.6.2) Result
Isolation Time (from event initiation)	30 min	{{ }}2(a),(c)
Break Release Mass (event initiation to isolation)	23,000 lbm	{{ }}2(a),(c)
Break Release Iodine Spiking Time (reactor trip to isolation)	30 min	{{ }}2(a),(c)

Table 2:
Steam Generator Tube Failure

	Bounding Assumption in 15.0.3.7.2	Event-Specific Analysis (15.6.3) Result
Isolation Time (from event initiation)	30 min	{{ }}2(a),(c)
Break Release Mass (event initiation to isolation)	23,000 lbm	{{ }}2(a),(c)
Break Release Iodine Spiking Time (reactor trip to isolation)	30 min	{{ }}2(a),(c)

No changes to the SDAA are necessary.