

ATTACHMENT 1

Responses to the “University of Illinois at Urbana-Champaign – Request for Additional Information – University of Illinois Urbana-Champaign High Temperature Gas-cooled Research Reactor: Event Sequence Identification and SSC Safety Classification Methodology,” Topical Report, dated December 19, 2023

RAI-1: *The topical report (TR) “University of Illinois Urbana-Champaign High Temperature Gas-cooled Research Reactor: Event Sequence Identification and SSC Safety Classification Methodology,” Revision 0 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML23250A318), in Section 3.1, discusses how the proposed definition of safety-related (SR) the University of Illinois at Urbana-Champaign (UIUC) has proposed for its reactor will “meet the intent” of the 10 CFR 50.2 definition of SR structures, systems, and components (SSCs). However, the staff notes that the proposed definition of SR in TR Section 3.2.2 specifies SSCs that “are relied upon ... during and following all event sequences...” and that “event sequences” are defined in TR Sections 2.2.2 and 2.3.3 as conditions based on limiting postulated initiating events (PIEs), which based on the examples provided in TR Appendix A, all appear to be off-normal events. The 10 CFR 50.2 definition of SR SSCs includes, in part, SSCs that “are relied upon ... during and following design basis events to assure ... 2) the capability to shut down the reactor and maintain it in a safe shutdown condition...”. The staff notes that, per 10 CFR 50.49 (which the staff notes is not applicable to research reactors, but which does apply to nuclear power plants that use the 10 CFR 50.2 definition of SR SSCs), design basis events are considered “conditions of normal operation, including anticipated operational occurrences...”. As such, the staff considers the intent of the 10 CFR 50.2 definition of SR SSC to include SSCs required to achieve safe shutdown from normal operations.*

Is UIUC’s definition of SR in TR Section 3.2.2 intended to include SSCs required for safe shutdown from normal operations, as well as those that are relied upon during and following event sequences? If so, clarify the definition or explain how it meets this intent.

Yes, UIUC’s definition of safety-related is intended to include SSCs required for safe shutdown from normal operation, as well as those that are relied upon during and following event sequences. A safety-related SSC will be available during normal operation to assure reactor shutdown capability.

Reactor shutdown is encompassed by the fundamental safety function ‘control of reactivity’ outlined in Section 3.2.1 of the TR.

UIUC will add the following language to Section 3.2.1: “Control of reactivity encompasses reactor shutdown.”

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RAI-2: TR Section 3.3.1 states “[t]he limiting PIEs will be identified and serve as an input in the safety classification methodology.” However, the application of this statement in the context of the TR is not fully clear. Please clarify the statement in TR Section 3.3.1. Specifically:

- a. Describe what a "limiting PIE" is and how a PIE is determined to be limiting (i.e., what figure(s) of merit would be used).

A Limiting PIE is meant to be equivalent to Limiting Event (sequence) discussed in NUREG-1537. UIUC will update Limiting PIEs to Limiting Event Sequences in the TR.

Radiological consequence or other surrogate characteristics (i.e. fuel temperature, helium pressure, etc.) will be the figure of merit when determining Limiting Event Sequences.

- b. Describe how "limiting PIEs" align with the event sequence categories described in TR Section 2.3.4. Does each category have a single limiting PIE (e.g., as described in NUREG-1537, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors” (ML042430055 and ML04243055)) or multiple limiting PIEs, and how is that decided?

A limiting event sequence will represent events using the same set of responding SSCs to perform safety functions within the category. Therefore, more than one limiting event sequence may exist for each category.

UIUC will update the TR to include explanatory language in Section 2.3.4.

- c. When classifying SSCs based on limiting PIEs alone, how will consideration be given to PIEs that were not considered limiting, but rely on different SSCs than the limiting case? For example, if SSC A is relied upon to mitigate PIE X, and SSC B is relied upon to mitigate PIE Y, how does the methodology classify SSC A, if PIE Y is identified as the "limiting PIE" of the two (particularly for potential cases when the failure of SSC A following PIE X could result in measurable consequences)?

Event sequences bound by a limiting event sequence will rely on the same set of SSCs to perform safety functions. Therefore, all SSCs performing safety functions will be captured by safety classification methodology.