SUMMARY OF THE SEPTEMBER 15, 2025, PARTIALLY CLOSED MEETING WITH TERRA INNOVATUM TO DISCUSS FEEDBACK ON THE WHITE PAPER LTR-TINN-25-012, "DESIGN CONSIDERATIONS ON REACTOR CORE (FUEL) AT NOMINAL CONDITIONS," REVISION 0 (EPID NO. L-2025-LRO-0037)

The presentation slides outlining the U.S. Nuclear Regulatory Commission (NRC) staff's feedback on the white paper (WP) are available at Agencywide Documents Access and Management System (ADAMS) accession no. ML26026A150. The discussions between the NRC staff and Terra Innovatum during the meeting are outlined below.

The feedback and observations provided by the NRC staff during this meeting are preliminary and subject to change. The feedback and observations are not regulatory findings on any specific licensing matter and are not official agency positions.

Slide 5

- Terra Innovatum asked for an explanation of the feedback on potentially higher fast neutron fluence noted on slide 5, referring to section 4.2 of the WP which touches on fast flux boundary conditions.
    - The NRC staff noted that in future applications, a comparison of the fast flux range to that typical for a pressurized water reactor (PWR) would be beneficial.

Slide 6

- Terra Innovatum stated that validation of models will be addressed separately in a future submittal.
- Terra Innovatum asked for clarification on what is meant by "Potential for gap closure."
    - The NRC staff explained that it would expect Terra Innovatum to address the potential effects of closure of both sets of gaps (fuel to cladding, cladding to graphite) given that gaps are notably small.
    - Terra Innovatum stated that gaps were assumed to be open as it is the worst case from a temperature perspective, and that the appendix to the WP was provided to justify ruling out a material compatibility issue if the gaps were to close.
    - The NRC staff stated that it would also expect potential mechanical interactions between pellets-cladding and cladding-graphite to be addressed in a future submittal (e.g., bowing, buckling, shearing).
    - Terra Innovatum stated that each rod will have a spring at the top to allow for axial expansion, and that it will consider graphite expansion in mechanical evaluations. Terra Innovatum stated that its goal in future submittals is to justify that local gap closures are mechanically and chemically acceptable and provide a more favorable thermal case.
    - The NRC staff noted that springs may introduce instability or buckling. The NRC staff also noted that graphite densification may widen gaps initially, which should be considered in thermal modeling.
    - The NRC staff also noted that, although outside the scope of this WP, it would expect an evaluation of effects of transportation on the fuel positioning in the core in a future submittal.

Slide 7

- The NRC provided additional context by explaining that temperatures appeared to be outside of the MatLib qualification validation range in the FAST fuel performance code supporting documentation.

Slide 8

- Terra Innovatum stated that fuel performance under transient and accident conditions will be addressed separately in a future submittal.
- Terra Innovatum asked why development of specified acceptable fuel design limits (SAFDLs) specific to SOLO may be required given that the environment is less challenging.
    - The NRC staff provided an example, stated that there may need to be specific limits for SOLO related to contact with graphite at high cladding temperatures. The NRC staff also noted that it's possible an evaluation of transients and accidents may show that SOLO-specific limits are warranted to account for those scenarios and that Terra Innovatum would ultimately be expected to justify the limits it selects for both normal and off-normal conditions, whether aligned with typical light water reactor (LWR) fuel limits or not.
- The NRC staff asked Terra Innovatum whether there will be any kind of in-reactor measurements to provide a warning if values derived from modeling and simulation are exceeded.
    - Terra Innovatum stated that this will be part of a future instrumentation and control plan.

Slide 9

- The NRC staff stated that it may be beneficial for Terra Innovatum to review chapter 4.2 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," and evaluate applicability to the SOLO design to inform table 5-1.
    - Terra Innovatum confirmed that is the intent of table 5-1, however they understood that the justification for the values needs to be provided.

Slide 10

- Terra Innovatum noted that the combination of a relatively low fuel temperature and relatively high cladding temperature has been studied in the 1970s and 1980s and asked the NRC staff if data dating back that far is appropriate to use in justifications for the use of LWR fuel in the SOLO operating environment.
    - The NRC staff stated that this is generally acceptable with appropriate justification and stated that acceptability may be influenced based on whether data is being completely relied upon or only used to "fill gaps."

Slide 11

- The NRC staff reiterated that justification for acceptability of the cladding in the SOLO operational conditions will be necessary in a future licensing submittal. Particularly, the NRC staff noted that SOLO conditions appear to be closer to the **[[ ]]**, which may affect mechanical behavior.
- The NRC staff stated that although SOLO may not see oxidation from aqueous corrosion, it would be beneficial for Terra Innovatum to provide further justification in a future licensing submittal on potential oxidation in the SOLO operating environment if the fuel to cladding gap were to close.