

**U.S. Nuclear Regulatory Commission Staff Observations on Terrestrial Energy’s  
Integral Molten Salt Reactor Core-Unit Definition White Paper**

Note: [[ ]] denotes proprietary information.

**Observations for Terrestrial Energy’s consideration for revising the Integral Molten Salt  
Reactor (IMSR) – core unit white paper:**

1. The configuration of the guard vessel in the top area needs to be clarified. Does the guard vessel extend above the reactor vessel? Is there one reactor closure plate that is both the barrier for the primary fuel system and the guard vessel?
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3. The white paper does not provide details regarding the core-unit internals. Additional details would allow the staff to understand what internal components are also part of the core-unit. For example, does the core-unit include things such as [[  
]] the core-unit closure head, [[  
]] reactivity control devices, the [[  
]], isolation valves, the shutdown mechanism, and other instrumentation?
4. The Primary Heat Exchanger needs to be further clarified: Is the secondary coolant piping within the Core-Unit part of this definition?
5. Is the chemistry continuous monitoring and adjustment system part of the core-unit?

**Feedback that should be considered for future submittals, including Standard Design  
Approval (SDA) application:**

1. The white paper describes the structures, systems and components that interface with the core unit, but it doesn’t describe how the core unit would be analyzed. In order to maximize the value of a future application, the staff would expect to see an analysis that would cover the equivalent information in the Standard Review Plan Chapters 3, 4, 5 and 15, although clearly defined input assumptions could replace calculated inputs.
2. In future submittals, clearly identify what you are requesting the U.S. Nuclear Regulatory Commission (NRC) staff to review and what will remain for later licensing actions. For example, will the core unit SDA cover seismic evaluations, missiles, beyond design basis accident analyses, etc.? This will help the staff focus the review and not generate unnecessary questions.
3. The codes and methods used for analyzing the core for normal operation, anticipated operational occurrences, and design-basis accidents need to be reviewed and approved by the NRC staff. This is typically accomplished by separate topical reports but could be part of the core unit application. [[  
  
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4. In general, future licensing documents should identify areas where future experimentation or research is required, or where information is not yet developed or submitted to the NRC. In the “Introduction” section Terrestrial noted that its design builds

off work done at Oak Ridge National Laboratory (ORNL) for the Molten Salt Reactor Experiment (MSRE). In future submittals, it would be helpful to indicate where ORNL work was considered. In addition, any differences between the MSRE and the IMSR design should be identified

5. The white paper mentions using the Canadian definition of a guaranteed shutdown state. Future submittals should clearly define how the NRC rules/regulations are met.
6. Typically, the NRC wants to understand what components are important to safety and which are designed to seismic Category I criteria. Once this is determined, the staff wants to understand what design and fabrication code will be used for the construction and installation of the component.
  - For components important to safety, appropriate in-service inspection requirements should be identified to ensure the component will be able to meet the design requirements for the life of the component.
  - For active components which are important to safety, specifically, pumps and valves, appropriate in-service testing requirements should be established, along with initial qualification testing requirements. Typically, the American Society of Mechanical Engineers QME-1, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," as endorsed by NRC's Regulatory Guide 1.100, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants," is the standard for initial qualification testing for pumps and valves.