

## Off-Gas Modeling and Uncertainty Propagation to Support Molten Salt Reactor Licensing

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**Pathway:**

Advanced Reactor Development Project

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**Abstract**

Terrestrial Energy USA, Inc. (TEUSA), a Delaware C-Corp founded in August 2014, is a U.S. majority-owned company with corporate offices in Charlotte, NC and Greenwich, CT. TEUSA's business objective is to develop, license, construct, commission and demonstrate the commercial operation of the Integral Molten Salt Reactor (IMSR<sup>®</sup>) nuclear power plant in the United States in the late 2020s. TEUSA is actively engaged with the U.S. Nuclear Regulatory Commission (NRC) on a broad spectrum of IMSR<sup>®</sup> pre-licensing technical and regulatory topics. In addition, TEUSA is engaged in a number of active projects with US industry, government, and academia to support IMSR<sup>®</sup> licensing and future deployment.

The principal objective of the Project is to develop a broadly applicable, modeling and simulation (M&S) capability and methodology for the propagation of uncertainties in parameters of importance for off-gas systems of molten salt reactors (MSRs). This will be accomplished using available Nuclear Energy Advanced Modeling and Simulation (NEAMS) program tools. This methodology will then be applied by the project team to determine the uncertainty propagation of the Off-gas System for IMSR<sup>®</sup> design.

TEUSA will use the M&S work performed to complete two Topical Reports that will be submitted to the NRC with a request for a formal Safety Evaluation. The feedback received from the NRC during the Project will be incorporated into the M&S work to develop the aforementioned methodology and its application to the IMSR<sup>®</sup> Off-gas System. This will ensure that the methodology developed, and its application to the IMSR<sup>®</sup> design, are acceptable to the NRC for licensing purposes.

Behavior of the off-gas system is a central topic for the licensing of any MSR design. In the risk-informed environment of the NRC, the bandwidth of uncertainties plays a critical role in the NRC's designation of Design Basis Events (DBE) and Beyond Design Basis Events (BDBEs). As such, the NRC will analyze the process that is used by the project team to determine uncertainties or probabilities for the IMSR<sup>®</sup> design. The methodology developed as part of the Project can also be utilized by any MSR vendor that is engaged with the NRC to license their design in the United States.

