

RFA-18-15368, Advancement of Instrumentation to Monitor IMSR® Core Temperature and Power Level

Terrestrial Energy USA (TEUSA) is developing an advanced small modular reactor using Integral Molten Salt Reactor (IMSR®) technology, for first commercial deployment in the 2020s, and to provide cost-competitive electricity and process heat to the United States industry. The IMSR® design is a graphite moderated, low enriched uranium once-through fueled, fluoride molten salt reactor (MSR) that uses a replaceable reactor core architecture.

All nuclear power plant control systems are designed to constrain reactor power levels to within operational limits for safe and efficient power generation. To achieve this, a power plant control system must be able to define the power profile across the reactor core. There are many measurement approaches and methods used by Conventional Reactors for the measurement of reactor-core power. However, due to fundamental differences in the core operating environments of MSRs compared to Conventional Reactors, existing reactor core power measurement devices are not readily employable nor suitable for use in MSR systems such as the IMSR®. A high temperature gamma thermometer (HTGT) has the potential to be adapted for accurate measurements of IMSR® reactor-core power.

TEUSA has requested assistance from Oak Ridge National Laboratory as they develop their HTGT that will accurately determine IMSR® power levels under all normal and off-normal reactor operating conditions. The instrument overcomes the unique challenges of a MSR reactor-core operating environment. The HTGT will ensure safe and effective control of IMSR® reactor-core power and will be applicable to other MSR designs.