ATF Solutions to Light Water-Cooled SMRs

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ABSTRACT:

Fuel is the heart of all the nuclear reactor systems where the defense-in-depth principles and safety systems are designed around it. While traditionally treated as a low-cost item as part of the nuclear power plant total cost, nuclear fuel dictates the reactor power density and the nuclear island construction requirements (e.g. containment size to prevent radioactivity release from fuel). The increasing of the power density of SMRs could be critical to its economic viability to overcome the lack of economy of scale. Indeed, a logical area of economic opportunity for ATFs is increase in core power density (e.g. power uprates) given their high temperature capability.

The objective of the proposed work is to: (1) Provide scoping analysis of promising longer-term advanced fuel forms to improve the safety and economics of SMRs. (2) Explore benefits of ATF in improving safety and economics of GEH's BWRX-300. We will then identify key gaps and recommend future R&D on the promising fuel technologies.

We will meet the outlined objectives by addressing each critical research question in a dedicated task, and leveraging the expertise of our multi-disciplinary team. The team is made up of nuclear fuels, design and safety engineers. Particularly, the PI has led various activities on the techno-economic and value assessment of advanced fuels for large and small water-cooled reactors including the Accident Tolerant Fuels (ATF) for >12 years. We will work closely with industry advisory board and Idaho National Lab to increase synergy with other DOE activities and also facilitate hosting student internship.