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# Design of a Commercial-Scale, Fluoride-Salt-Cooled, High-Temperature Reactor with Novel Refueling and Decay Heat Removal Capabilities

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**ABSTRACT:**

The feasibility of an innovative commercial-scale, fluoride-salt-cooled reactor concept will be assessed. This new concept will combine recent developments in fluoride high- temperature reactors (FHR) with existing technology and capabilities from advanced gas- cooled reactors (AGR), which have operated for decades in the UK at temperatures near those proposed for FHRs. The FHR fuel is based on proven HTGR prismatic fuel block design modified for use with salt coolant. Using well-proven technology adapted from the AGR mitigates risk and lowers the overall design cost associated with this new reactor concept. This new FHR concept, once proven feasible, will therefore be well-positioned for commercialization.

First, a physics analysis of a high-power, FIRM-based FHR will be performed to determine realistic ranges of power density, decay heat, cycle length and reactivity margins within the proposed design space. These parameters will inform design trade-off decisions and refueling requirements.

The adaptation of AGR refueling technology and strategy to FHRs is the second thrust of this proposal and is integrally dependent on the core design. In particular, reactor decay heat can be used to provide margin to coolant freezing, but it must also be kept sufficiently low to accommodate spent fuel handling and prevent fuel failure in beyond-design-basis accident scenarios. The use of refueling standpipes will increase the heat transfer area between the core and the surrounding secondary salt thermal mass, and this feature becomes a critical design component for both spent fuel handling and accident scenarios.