NE-18-16098, Quantify Sodium Fluoride/Beryllium Fluoride Salt Properties for Liquid Fueled Fluoride Molten Salt Reactors

ThorCon is developing a thermal thorium/uranium molten salt fueled reactor. Meeting near term deployment goals requires avoiding new technology wherever possible. The ThorCon reactor is not a breeder but requires regular additions of fissile material in the form of uranium fluoride. On-site fuel-salt chemistry control is accomplished by the addition of makeup fuel-salt to achieve the desired neutronics and the addition of beryllium metal to maintain redox control.

ThorCon's emphasis is on a fission reactor that produces low cost electricity and can be deployed rapidly, adding nuclear power capacity at a pace of many tens of GWe per year. ThorCon will employ shipyard production methods to build a complete 500 MWe power plant in a shipyard that will then be towed to a site where it is ballasted to the sea bottom. The target capital cost for a ThorCon power plant is $1B/GWe with a target cost of electricity below $30/MWhr including cost of capital, waste disposal, decommissioning, etc. Achieving these costs would dramatically increase nuclear power's share of the world's total electricity generation.

Specifically, this project will determine the NaBe salt thermal properties to advance the design of the system. Knowledge of the fuel-salt properties is required to enable detailed design of the ThorCon system. This investigation will benefit all thermal liquid fueled MSR companies should lithium-7 not become available in volume at an economical price. Argonne National Laboratory's capability to conduct tests with beryllium and plutonium, and measure these salt properties are capabilities not available in the private sector. The thermodynamic and thermal conductivity data are required to assess thermal properties of the system under normal and transient conditions, and will positively impact the design of an efficient heat transfer system.

A technical report containing methods, calibrations, error analysis and results for all of the tasks completed in this work scope will be prepared and can be made available to all US MSR companies through GAIN.