Operated at Oak Ridge National Laboratory from 1965 to 1969, is the Primary Reactor-Based Experience with Molten Salts
Molten Salt Reactor Experiment (MSRE)

- Fuel ($^{235}\text{U}$, $^{233}\text{U}$ and $^{239}\text{Pu}$) dissolved in a fluoride salt
  - Liquid-fuel reactor
  - Thermal-spectrum limited breeder reactor
  - 7.34 MW
  - 1225°F (662°C) outlet temperature
  - Fuel salt was 65% Li7F - 29.1% BeF2 - 5% ZrF4 - 0.9% UF4
  - Program cancelled when the liquid metal fast breeder reactor chosen

- New interest in MSR
  - Fast spectrum or thermal spectrum
  - Liquid fuel or solid fuel
  - Target diverse markets – base load electricity generation, process heat applications, desalination, water purification, remote locations
Proposals are requested to develop and enhance domestic university capabilities to generate high-quality data, in coordination with the DOE MSR Campaign and MSR developers.

- Emphasis should include the establishment of new or enhanced research infrastructure at universities to broaden the base capability, to provide high-quality data for model validation or material property performance and prepare students to enter the emerging advanced reactor technical field.
- The development and/or expansion of university, industry and national laboratories irradiation facilities is strongly encouraged.
- Infrastructure support could include but are not limited to salt production, characterization and property measurement, and isotope production and isolation.
• To ensure proposed infrastructure efforts complement existing research, specific examples are provided below. In addition to these examples, other proposals enhancing the domestic MSR research infrastructure are welcome

  – Experimental Validation of Thermal Hydraulic Simulations
    • *MSR code validation with appropriately scaled fundamental, SET, or MET experiments that complement those that have been, or can be, conducted at suitable, existing integral facilities.*

  – Advanced Heat Exchangers

  – Experimental Data for Fission Product Retention, Diffusion and Transport Properties
    • *Study the release and transport behavior of radionuclides (gaseous, mists, foams) in liquid-fueled molten salt reactors under representative irradiation conditions.*

  – Targeted Irradiations of Core Internal and Boundary Materials
    • *understand radiation damage effects (swelling, embrittlement, segregation, etc.) on advanced structural materials for representative molten salt reactors and also for candidate non-metal reactor core structural material, such as graphite or silicon carbide.*
Points of Contact for IRP-RC-1 Molten Salt Reactor

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