U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

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# Nuclear Energy University Programs (NEUP) Fiscal Year (FY) 2019

## RC-5 High Temperature Gas Reactors & RC-6: Fluoride Salt Cooled High Temperature Reactors

# RC-5 High Temperature Gas Reactor

- FY19: During a primary coolant boundary break leading to depressurization of primary loop, cavity air entering the pressure vessel is a complex function of:
  - » Primary helium inventory
  - » Break location
  - » Break size
  - » Break orientation
  - » Venting pathways
- Previous experiment sponsored by the Department of Energy and NGNP Alliance yielded preliminary results and insights but a full parametric study has yet to be performed
- All experiments MUST be performed to NQA-1 standards.

***Federal POC – Diana Li: Diana.LI@nuclear.energy.gov***

***National Technical Director – Hans Gougar: Hans.Gougar@inl.gov***

# RC-5 High Temperature Gas Reactor

- FY19 interested in spatial distribution of air and helium in each reactor building cavity during the blowdown.
- Proposed projects should investigate:
  - Concentration of oxygen in the vessel due to various small and medium-sized breaks
  - Orientation of breaks,
  - Alternate ventilation pathways.
- Principal Investigators are encouraged to:
  - Consider recommendations of NGNP Alliance.
  - Consult with US-based HTGR vendors (Framatome, X-Energy, USNC) to refine the experiment design and test matrix.
- General Atomics 350 MWt MHTGR should be used as basis for scaling experimental facility.

# RC-6: Fluoride Salt Cooled High Temperature Reactors

- The Fluoride Salt-cooled High Temperature Reactor (FHR) focus area seeks to address one of two areas identified by industry as gaps
- All results must be traceable via an NQA-1 process

***Federal POC – Diana Li: Diana.LI@nuclear.energy.gov***

***Technical POC – David Holcomb: holcombde@ornl.gov***

# RC-6: Fluoride Salt Cooled High Temperature Reactors

**1) Used FHR pebble fuel storage and handling**

- Seeking evaluation of technologies that support safe and effective used fuel pebble handling and passive cooling prior to dry storage
  - What type of system should be used to keep used FHR fuel pebbles cool until decay heat is low enough for dry storage?
  - How will the pebbles be transferred to this system?
  - What will the fissile material inventory be during the storage period?
  - What will be the necessary storage times to meet requirements for dry storage?
  - What will be the storage configuration of pebbles?
  - How can broken or cracked pebbles be safely stored?
  - Ensure sufficient capacity to store pebbles for the entire lifetime of the FHR.
  - Evaluations should also identify any necessary modifications to existing used fuel storage/transport casks for storage of FHR pebble bed fuel.

# RC-6: Fluoride Salt Cooled High Temperature Reactors

**2) Experimental validation of passive decay heat removal technology**

- Demonstrate a Direct Reactor Auxiliary Cooling System (DRACS) system
  - Reduced capacity, DRACS-type natural circulation decay heat rejection system
  - Use prototypic materials and temperatures
  - Include the ability to simulate initial loading and startup, normal reactor operations, transition to accident conditions, and extended duration operation
  - Confirm the system will sufficiently remove heat without salt freezing as cooling requirements reduce over time
  - Include tritium release mitigation mechanisms