



U.S. DEPARTMENT OF
ENERGY

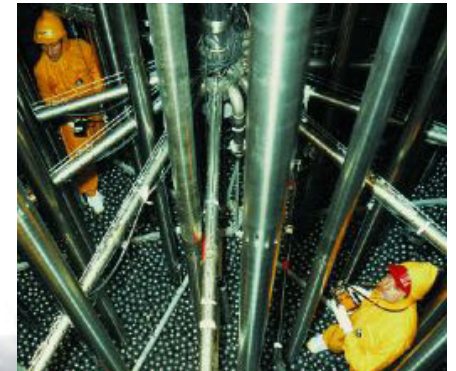
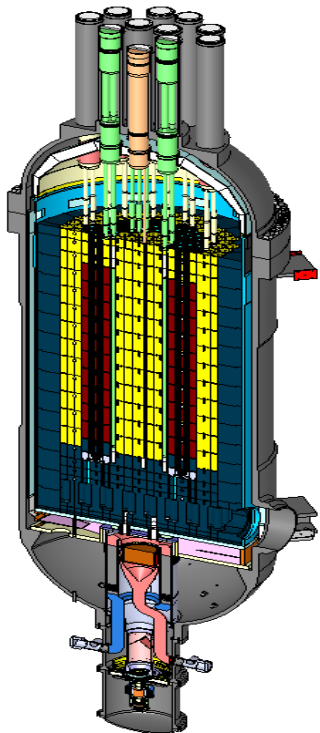
Nuclear Energy

Radioisotope Retention in Graphite and Graphitic Materials

NEUP FY17 RC-2

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Office of Nuclear Energy
U.S. Department of Energy





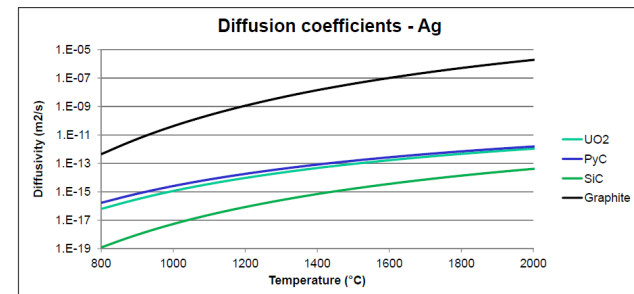
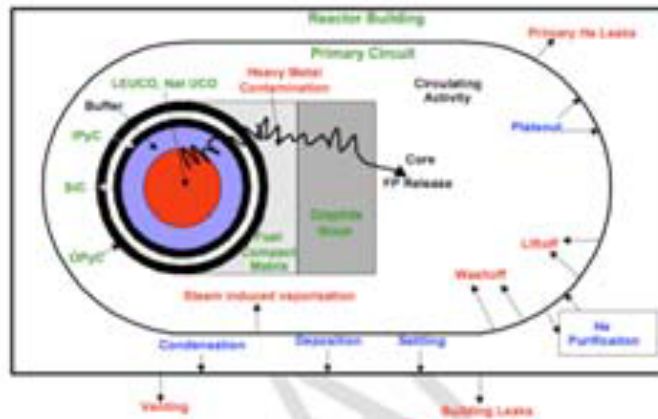
Radioisotope Retention in Graphite and Graphitic Materials (RC-2)

Motivation for getting fission product retention, release data:

- High quality fission product retention data is needed to data is needed for deterministic source term evaluations.
- Radioisotope transport and retention behavior information is needed for predicting fission product phenomena in **TRISO** particle fuel, matrix, and graphite for HTGR, FHR, MSR designs during normal irradiation and accident conditions.

Diffusion Coefficients (IAEA Tec. Doc. 978)

D_0 (m ² /s)	Kernel	Buffer	IPyC / OPyC	SiC	Graphite
Q_0 (kJ/mol)	6.7e-9	1.0e-8	5.3e-9	3.6e-9	1.6
Q_0	165	0	154	215	258





Radioisotope Retention in Graphite and Graphitic Materials (RC-2)

- **Focused on TRISO-fueled Helium Gas-Cooled Reactors and/or Molten Salt-Cooled Reactors:**
 - **Gas-cooled TRISO fuel reactors:** Fission product retention and release test data is needed for the microstructural, physical properties of irradiated TRISO fuel particles, graphitic fuel matrix and structural graphite materials, during reactor irradiation conditions and during accident conditions simulated by PIE transient safety heat up tests.
 - **FHR and MSR concepts:** Fission product retention data (transport, diffusion, sorption) is needed for TRISO fuel, graphite structures and salt coolant system temperature and time-dependent conditions.



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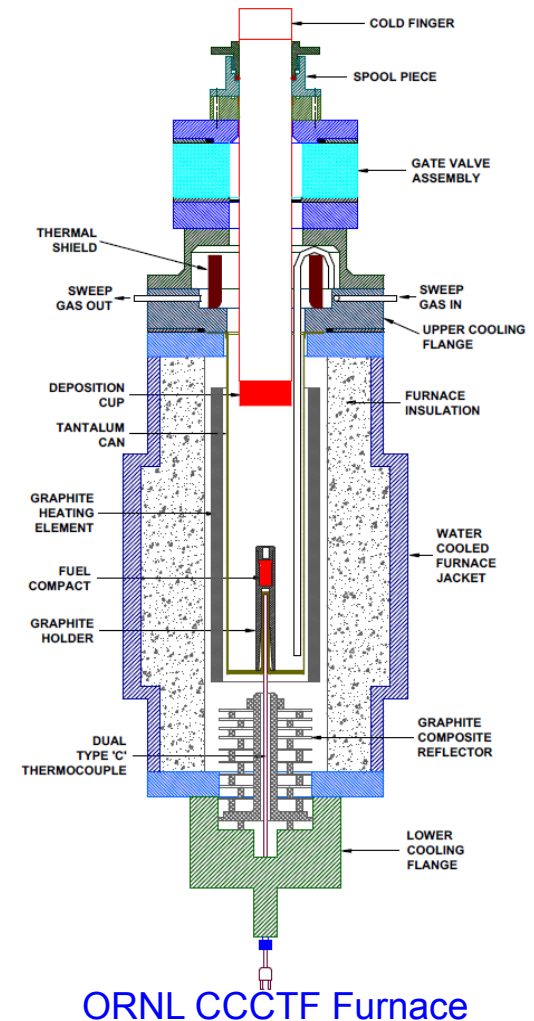
INL FACCS
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RC-2 Proposal Scope and Requirements

■ Proposals should include fission product retention/release experiments:

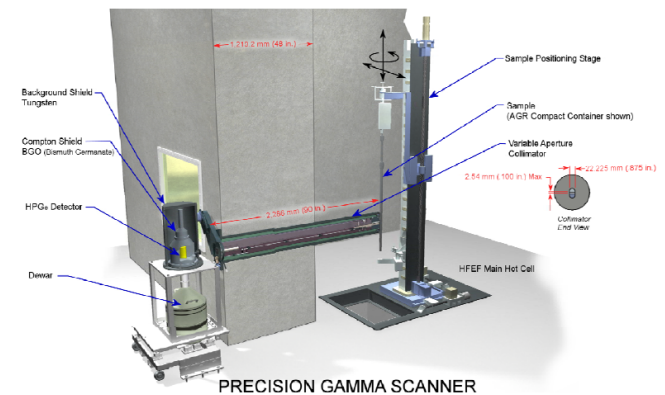
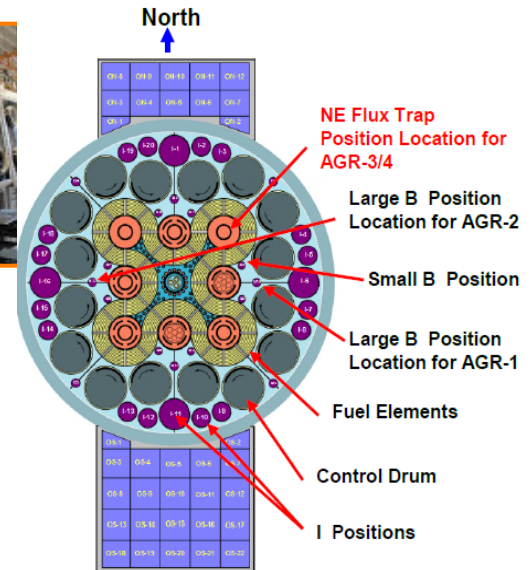
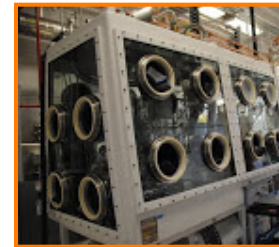
- Separate effects tests focused on fission product release, transport mechanisms, chemisorption, diffusion, sorption/desorption and retention characteristics.
- Individual chemical species of interest (I, Cs, Sr, Eu, Ru, Ag) using non-radioactive surrogates and/or radioactive isotopes
- Determine time- and temperature-dependent fission product behavior (diffusion, sorption, retention, transport mechanisms)
- Be performed at nominal reactor operating temperature ranges as well as high temperature transient accident conditions (1000-1800 C).





Proposals are sought that:

- Provide sufficient separate effects fission product data needed for gas-cooled reactor TRISO fuel matrix and graphite using typical reactor operating conditions and accident temperatures.
- May use surrogate non-radioactive species or radioactive isotopes (Kr, I, Cs, Sr, Ru, Ag)
- Tests should be performed on both un-irradiated and irradiated materials, e.g., VHTR TRISO fuel or surrogates, fuel matrix and graphite and/or salt-cooled reactor TRISO fuel and graphitic materials.
- May use irradiated specimens from AGR TRISO fuel and AGC graphite experiments at NSUF facilities (e.g., INL hot cells, and CAES microscopy SEM/TEM/FIB)

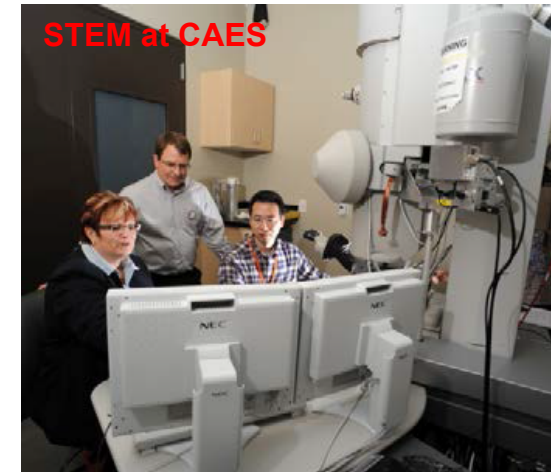




RC-2 Proposal Scope and Requirements

■ Proposals may:

- Use in-situ university R&D laboratory facilities for non-radioactive specimen and material experiments.
- Demonstrate experiments and/or test rig configurations that may be feasible for using radioactive isotopes and materials in hot cells.
- Use existing specimens from Advanced Graphite Creep (AGC) tests and/or Advanced Gas Reactor (AGR) TRISO fuel experiments at NSUF locations for hot-cell PIE, SEM, TEM, FIB microscopy, etc.
- Use specimens in liquid salt loop test rigs with non-radioactive isotopes to develop fission product (radioactive) source term experiments.

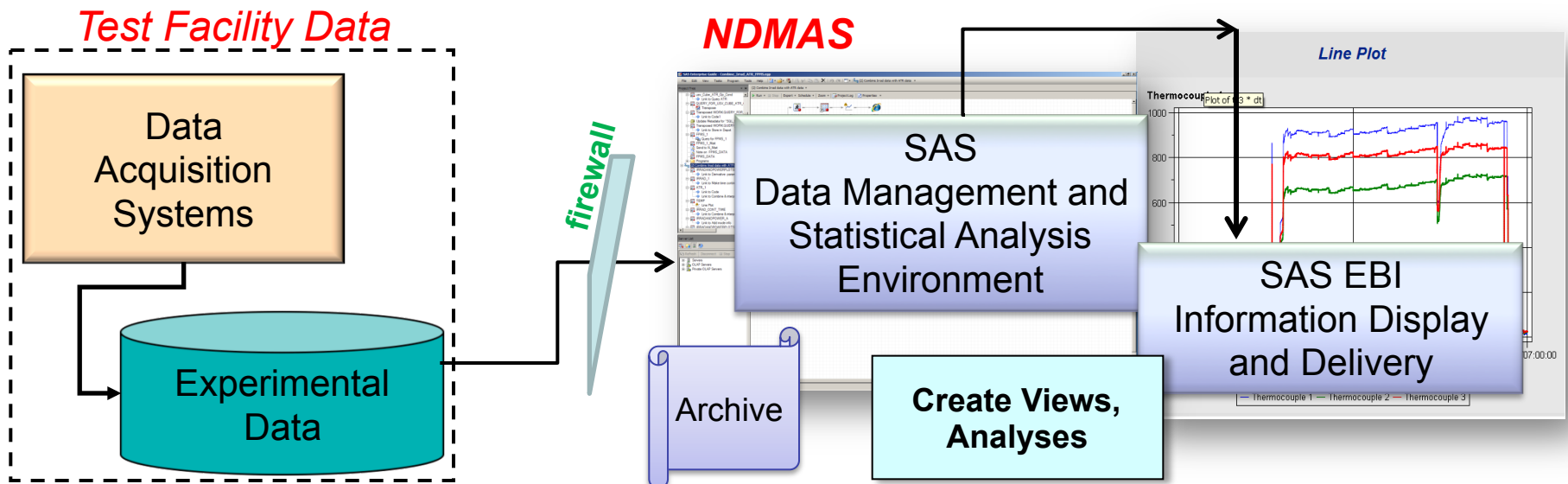




Quality Assurance Compliance

■ Quality Assurance and Data Retention:

- Data collection, experiments, data validation, and verification may require compliance with NQA-1 2009 and 2009 NRC accepted paragraphs.
- Archiving data and simulation results in the INL Nuclear Data Management and Analysis System (NDMAS) may be required.





Contact Information

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and/or

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