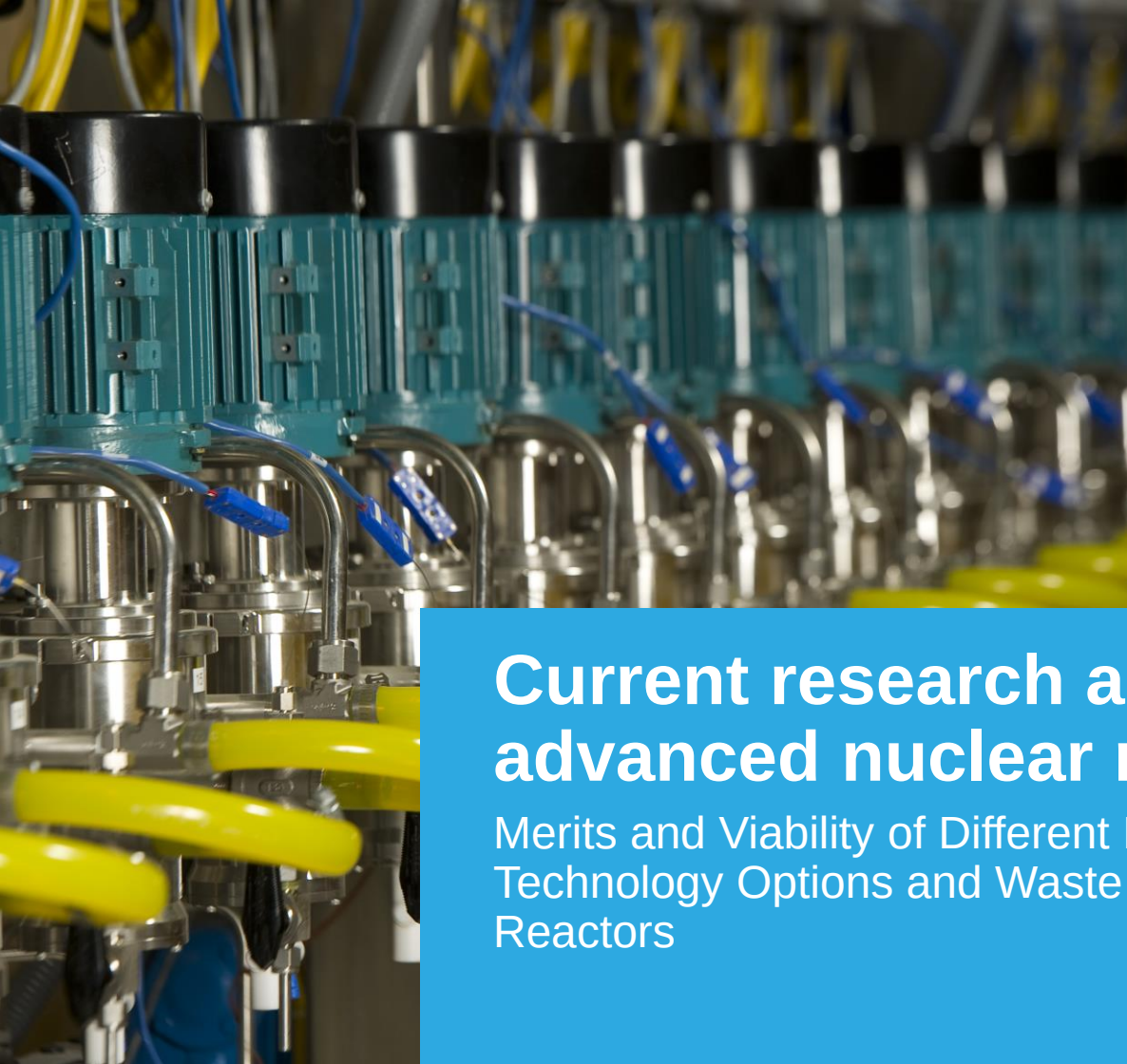




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Current research activities for advanced nuclear reactor fuel cycles

Merits and Viability of Different Nuclear Fuel Cycles and
Technology Options and Waste Aspects of Advanced Nuclear
Reactors

US R&D for advanced fuel cycles

- 1990s-mid 2000s R&D programs were focused on partitioning and transmutation of wastes from nuclear reactors
 - ATW, AAA, AFCI DOE-NE programs
 - Fast Reactor/accelerator, Fuels development and Recycle
- 2006-2009 GNEP program
 - Fast Reactor, Fuels development, Recycle, Waste Forms
- 2009- 2017 FCR&D, NTR&D programs
 - Broader view of nuclear enterprise, still work on reactors and recycle, waste forms, domestic safeguards
 - After 2011, Accident Tolerant Fuel (ATF) became the primary program driver
- 2017- present NFS&SC program
 - Continued priority for ATF, broader view of R&D for advanced reactors and fuel cycles

DOE- NE Material Recovery and Waste Form Development Campaign

- Advanced aqueous processing R&D
 - Simplified solvent extraction process development
 - Radiation chemistry effects
 - Coordination and complexation chemistry
 - Advanced headend processes
- Advanced electrochemical processing R&D
 - Pyroprocessing of oxide and metal fuel
- Advanced waste forms
 - Aqueous, pyrochemical/molten salt, off-gas
- Off-gas capture and immobilization
 - Kr-85 (Xe), I-129, H-3, C-14
- Fundamental molten salt characterization
 - F⁻ and Cl⁻ salts
- Interim HALEU supply from Gov. owned Zr and Al clad fuels

DOE- NE Material Recovery and Waste Form Development Campaign

- Closely coordinated with other DOE-NE programs
 - Systems Analysis and Integration
 - MPACT
 - Advanced Fuels
 - Molten Salt Reactor
- International Collaborations to leverage capabilities
 - France
 - UK
 - Japan
 - South Korea

Summary

- The MRWFD campaign has been working to be more closely aligned with advanced reactors, and in particular, those selected by DOE Advanced Reactor Demonstration and Risk Reduction Programs
 - Fuel supply for advanced reactors (HALEU)
 - Advanced fuel cycles (e.g. recycle of HALEU)
- Funding for fuel cycle research has been in steady decline and is significantly less than for the reactor development and demonstration programs
 - Fuel cycle R&D FY-21 funding ~ 4 M
 - Fuel supply R&D FY-21 funding ~ 3 M
- Development of advanced reactors without the development of their associated fuel cycles creates additional programmatic risk