U.S. DEPARTMENT OF ENERGY | Nuclear Energy

Advanced Reactors

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Advanced Reactor Technologies

- **Research and Development that supports safe, economical and proliferation resistant advanced reactor technologies (Generation IV)**
- **Major Thrusts:**
  - Advanced reactor technologies and components
  - Development of a regulatory framework
  - Development of industry codes and standards
  - Development and maintenance of critical expertise and facilities
  - International collaboration
- **Programs:**
  - Advanced Small Modular Reactor R&D (AdvSMR)
  - Advanced Reactor Concepts (ARC)
  - Next Generation Nuclear Plant (NGNP)*

* Consolidated under ARC beginning in FY 2014

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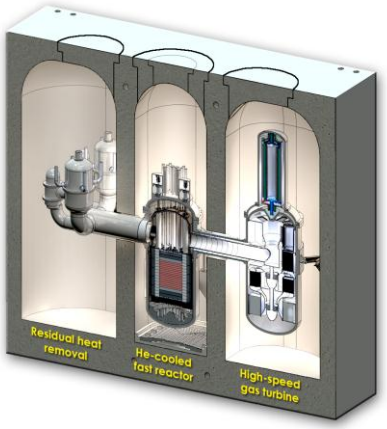
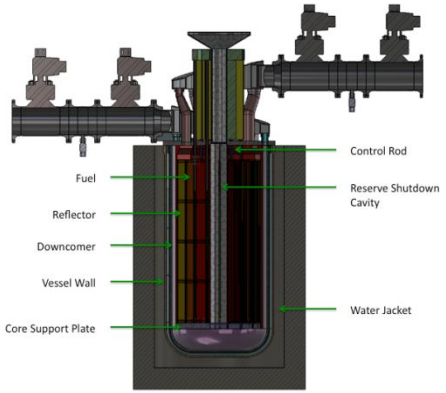
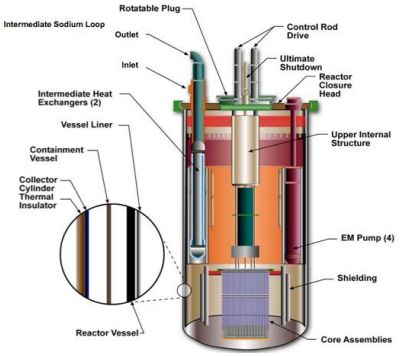
Advanced SMR Program

- **Performs research that supports licensing and deployment of advanced non-light water SMR designs**
- **Focus Areas:**
  - Instrumentation, Controls and Human-Machine Interface
  - Materials, Components and Technology Development
  - Safety, Regulatory Framework, and Safeguards
  - SMR Assessments (Performance and Economic Analysis and Evaluation)







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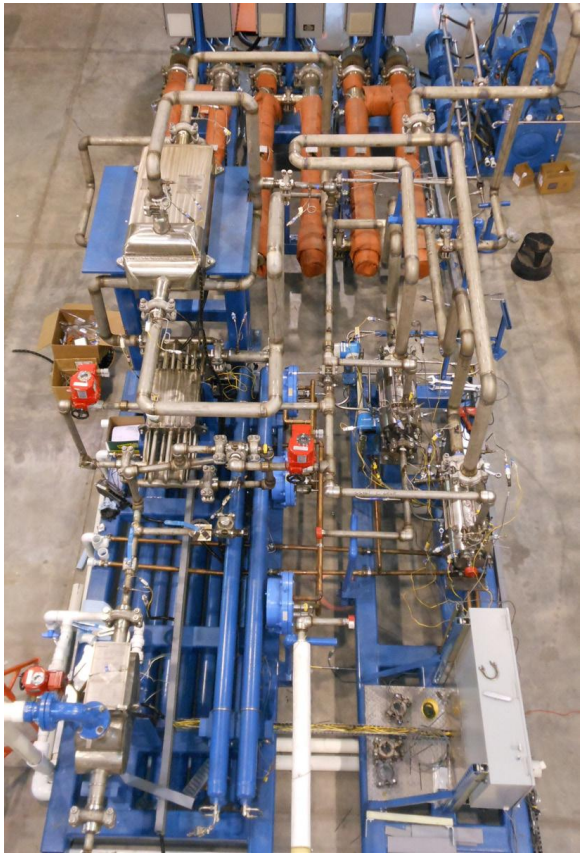
Advanced Reactor Concepts

- **Research to develop advanced reactor technologies and subsystems to improve nuclear power performance including sustainability, economics, safety and proliferation resistance**
- **Focus Areas:**
  - Fast Reactor Research and Development
  - Advanced Energy Conversion
  - Fluoride Salt High-Temperature Reactor (FHR) Concept
  - International Collaboration
    - Bilateral and tri-lateral agreements
    - Generation IV International Forum (GIF)
  - Industry Engagement (Technical Review Panel Process, multiple application of technologies)



Supercritical CO_2 Brayton Cycle

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Next Generation Nuclear Plant

- **Demonstrate high-temperature gas-cooled reactor (HTGR) technology to produce electricity and high temperature process heat**
- **Focus Areas:**
  - Provide non-electric applications
  - Fuels Development R&D
  - Materials Development R&D
  - Design and Safety Methods Development
  - NGNP Licensing Framework Development

Kernel Forming and Drying

Industrial Scale 6 inch CVD Coating (2 kg charge)

Dry Mix and Jet Mill Matrix

Granurex Overcoat and Dry

Hot Press Compact

Carbonize + Heat Treat in a Sequential Process

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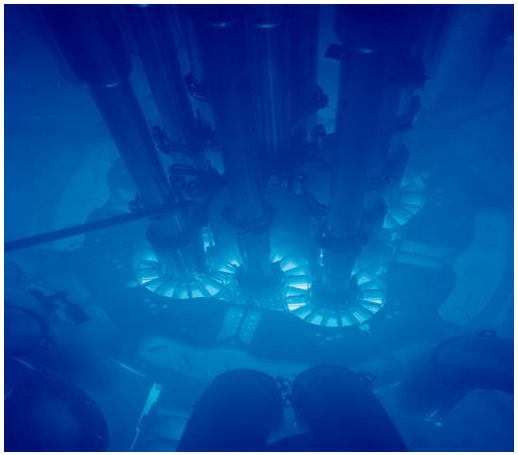
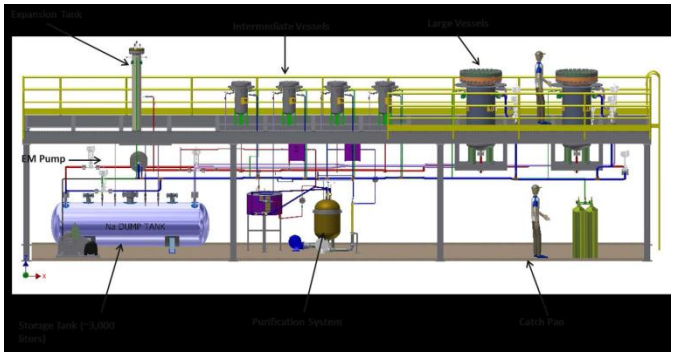
Advanced Reactor Experimental Facilities

- **Facilities that support testing of multiple advanced reactor concepts**
  - Mechanisms Engineering Test Laboratory (METL) (Sodium) – ANL
  - Delta Loop (Lead Bismuth) – LANL
  - Advanced Test Reactor (ATR) - INL



ATR



METL

Delta Loop

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DOE & NRC Areas of Coordination

- **NGNP Licensing Framework**
  - NRC/DOE cooperation supported by 2005 EPACT
  - NRC/DOE MOU to support licensing and R&D
- **NRC approved applicable portions of NGNP Quality Assurance Program Description**
- **High Temperature Test Facility**
  - Co-Funding Cooperative Agreement (CA) university consortium (9/08).
  - Completion scheduled for summer of 2013 and followed by experiments

HTTF at OSU

HTGR Reactor Vessel Concept

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International Collaboration via Generation IV Program

Generation IV Systems	Argentina	Brazil	Canada	China	France	Japan	Korea	Russia	South Africa	Switzer - land	U.K.	U.S.A.	EU
Sodium-cooled Fast Reactor (SFR)				○	○	●	○	○				○	○
Very-high Temperature Gas-cooled Reactor (VHTR)				●	○	○	○			○		○	○
Gas-cooled Fast Reactor (GFR)					●	○				○			○
Supercritical-water cooled Reactor (SCWR)			○			○		○					●
Lead-cooled Fast Reactor (LFR)						○		○				👀	○
Molten Salt Reactor (MSR)					○			👀				👀	○

● Chairing country ○ Participating Country 👀 Observer Country