



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

**IEA/NEA Nuclear Technology Roadmap
Update
Stakeholder Engagement Workshop**

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**Paris, France
January 23, 2014**



Role of U.S. Department of Energy for Sustainable and Innovative Nuclear Energy

Conduct Research, Development, and Demonstration to:

- Reduce regulatory risk
- Reduce technical risk
- Reduce financial risk and improve economics
- Manage nuclear waste
- Minimize the risks of nuclear proliferation and terrorism
- Foster international and industry collaboration



Vogtle – October 2013

Source: Southern Co.



NE R&D Portfolio

■ Reactor R&D

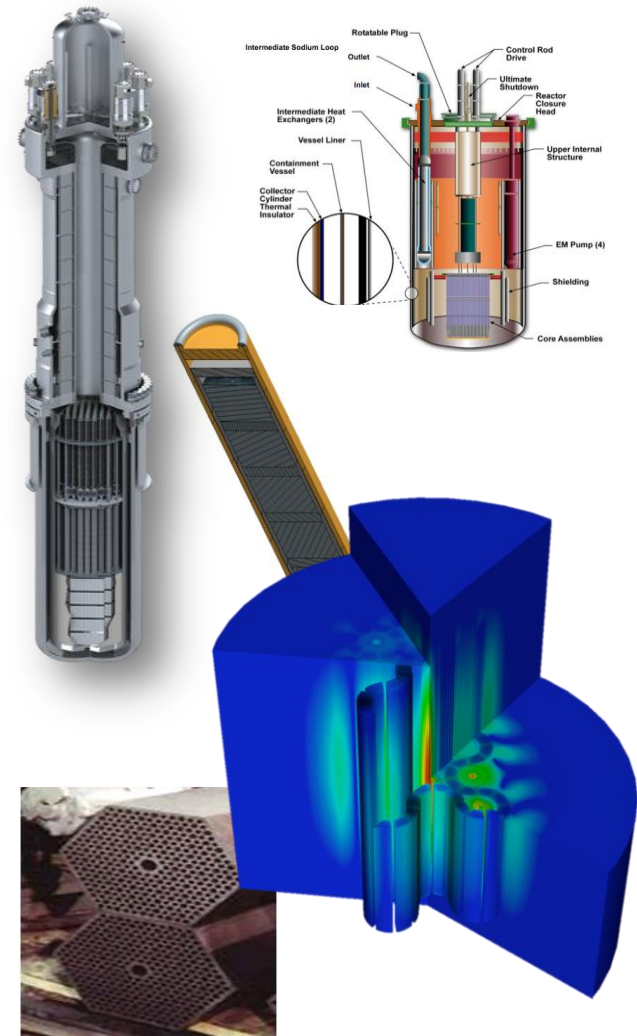
- Advanced Reactors
- Small Modular Reactors

■ Fuels R&D

- Advanced Fuels
- Used Fuel Disposition

■ Crosscutting R&D

- Nuclear Energy University Programs (NEUP)





Behaviors of Accident Tolerant Fuels & Fuel and Cladding at High Temperatures

Improved Reaction Kinetics with Steam

- Heat of oxidation
- Oxidation rate

Slower Hydrogen Generation Rate

- Hydrogen bubble
- Hydrogen explosion
- Hydrogen embrittlement of the clad

Improved Fuel Properties

- Lower operating temps
- Clad internal oxidation
- Fuel relocation/dispersion
- Fuel melting

High temperature
during loss of active
cooling

Improved Cladding Properties

- Clad fracture
- Geometric stability
- Thermal shock resistance
- Melting of the cladding

Enhanced Retention of Fission Products

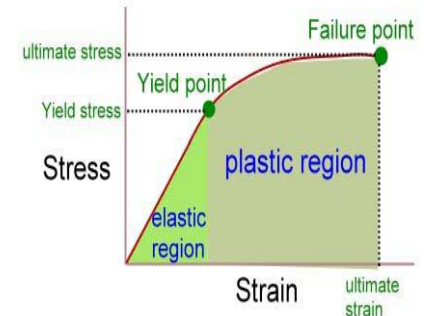
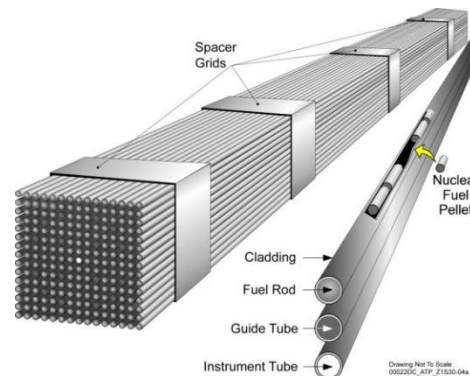
- Gaseous fission products
- Solid/liquid fission products

Storage and Transportation R&D

Objective: Prepare for the eventual large-scale transport of spent nuclear fuel and high-level waste

Develop the technical basis for:

- Extended storage of used nuclear fuel
- Fuel retrievability and transportation after extended storage



Storage and Transportation

Extended Storage R&D

Better understand potential degradation mechanisms in long-term dry cask storage including:

- **Complete the identification of data gaps to support extended dry storage**
- **Continue material testing to support modeling and simulation of used fuel aging**
- **Participate with industry and others on full-scale cask storage demonstration of high burnup used fuel**

