Fuel Cycle Information Exchange 2009

Closing the Nuclear Fuel Cycle

The EnergySolutions Perspective

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ENERGYSOLUTIONS

We're part of the solution

Introducing the Industry team

ENERGYSOLUTIONS

ENERGYSOLUTIONS

Shaw® Shaw Environmental, Inc.

Westinghouse

TOSHIBA

Booz | Allen | Hamilton

National Nuclear Laboratory

NFS

AECL

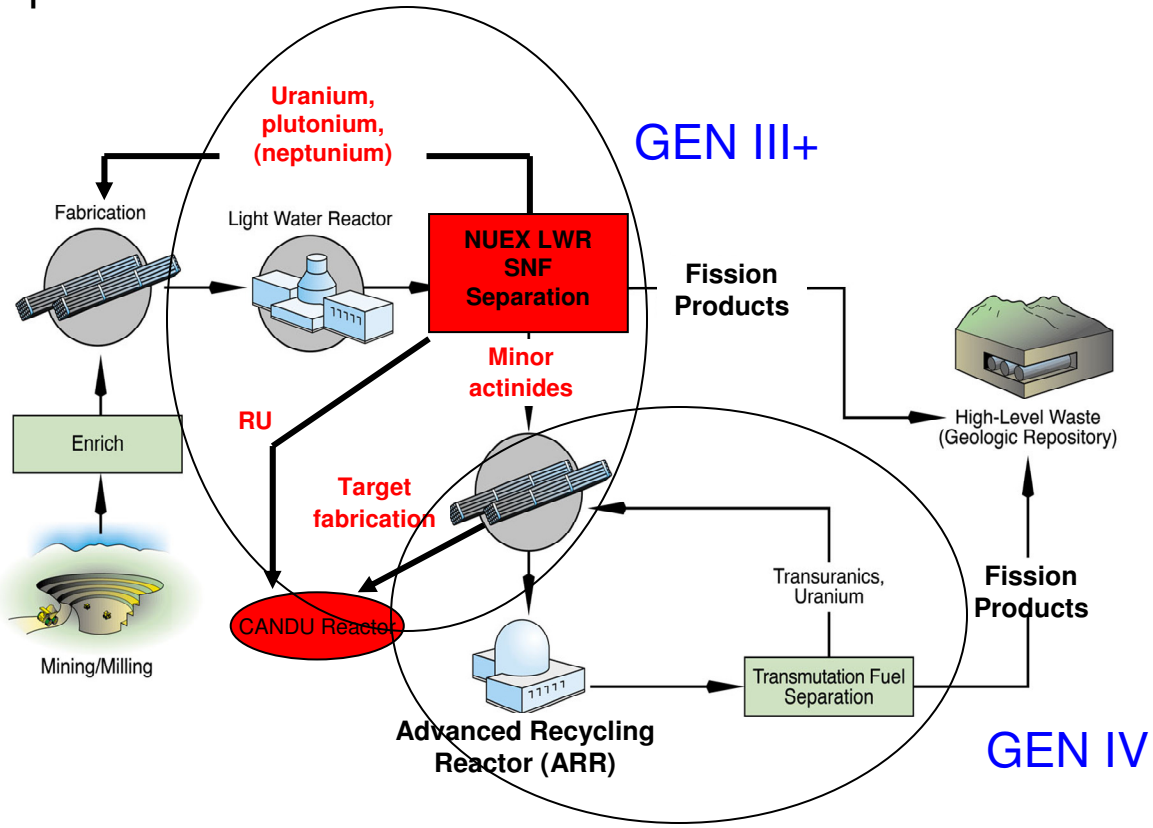
Why close the fuel cycle?

ENERGYSOLUTIONS

- Solves the nuclear waste disposal problem
  - Reduces amount, toxicity and heat of high level waste
  - Opens alternative repository options
  - Reduces need for multiple HLW repositories
  - Will lower future HLW disposal costs
- Provides additional waste confidence for nuclear new build to proceed
- Improves the security of US energy supplies
  - Recovers and recycles valuable nuclear materials

Our Approach

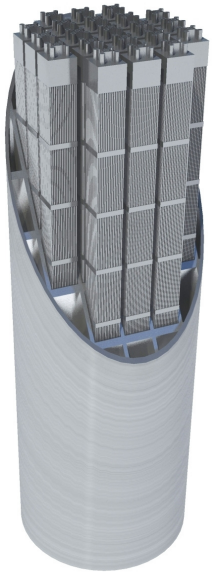
- Incremental approach to deployment of fuel cycle facilities
  - Gen III+ aqueous LWR Recycling first
  - Gen IV non-aqueous and Recycling Fast Reactors later
- Minimizes commercial risk and costs by using advanced processes on proven equipment



Our Approach

- Our near-term approach is **not** to use current processes but to advance them to Gen III+
- Advances in Business Management
  - New Government Entity to manage used fuel, nuclear waste fund and a new fund
  - Commercial funding of recycling – not taxpayer dollars
- Advances in Waste Management
  - Vitrified high level waste suitable for disposal in different repository options
  - Volume reduction of all Low level waste (GTCC and Class A/B/C)
  - Tritium treatment/Solidification of Liquid Effluents targets zero discharge facility
  - Gaseous effluent treatment/capture (Kr, I, C-14) targets near-zero aerial discharge facility
- Advances in proliferation resistance
  - No pure plutonium is separated anywhere in the recycle facility
  - Mixed uranium/plutonium product is low attractiveness and is immediately recycled into new fuel
- But is this advanced enough?
- How will we know?

Wastes from Recycling



RECYCLING

+

+

Radioactivity content 100%

10.9m³
Cost to dispose
$6 million
Yucca

Radioactivity content 99%

0.8m³
Cost to dispose
$0.1m
WIPP like Repository

Radioactivity content 0.9%

3.9m³
Cost to dispose
$0.5 million
WIPP like Repository

Radioactivity content 0.1%

71m³
Cost to dispose
$0.1 million
Clive

The wastes produced from recycling the nuclear fuel that has provided the **annual electricity needs for over 250,000 family homes**

Key non-proliferation requirements

- Prevent theft of nuclear material and technology
- Early detection of attempted diversion & theft
- Material should be low attractiveness
- Implement by incorporating “Safeguards by Design” early in project

Our Challenge

- Understand the full spectrum of proliferation concerns
  - Mixed Uranium/Plutonium product
  - Separations Technology availability to others
  - Security/terrorism challenge
  - Safeguardability and nuclear accountancy

- Develop proliferation resistant system accordingly, for example
  - Separations carried out in Passive Secure Cells; No personnel access routes to separations equipment; High radiation fields inside cells prevent deliberate intruder access
  - State-of-the-art in-situ fissile material measurement systems - Near Real Time Nuclear Accountancy
  - Gates, Guns and Guards to prevent and detect insider and outsider threats