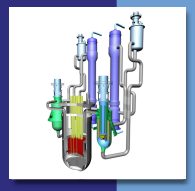

INRA Perspective on a Closed Fuel Cycle

FCIX Conference
June 25, 2009

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VP Strategic Programs, AFS

Sustaining the Nuclear Renaissance

- **The world is looking at a nuclear renaissance**
  - **By 2030, domestic electricity demand is projected to grow by ~30%**
  - **During the same time, global demand is expected to nearly double – many countries will build new nuclear plants**
- **Major Questions for a U.S. Used Fuel Strategy**
  - **Does the "throw away" fuel cycle strategy provide a strong enough foundation for a rebirth of nuclear? to sustain a renaissance in the U.S.?**
  - **If not, what are the other options?**
  - **Can we find a long-term solution that will be politically viable (bi-partisan)?**

International Nuclear Recycling Alliance (INRA)

- **Utility Advisory Panel (UAP) – end user input**
  - **13 U.S. utilities, EdF, FEPC and 11 Japanese utilities**
- **Financial Advisory Group – what is bankable?**
  - **Citi & JP Morgan**

Conclusion – integrated UNF management strategy with closed fuel cycle option

Why Consider A Closed Fuel Cycle? (1/2)

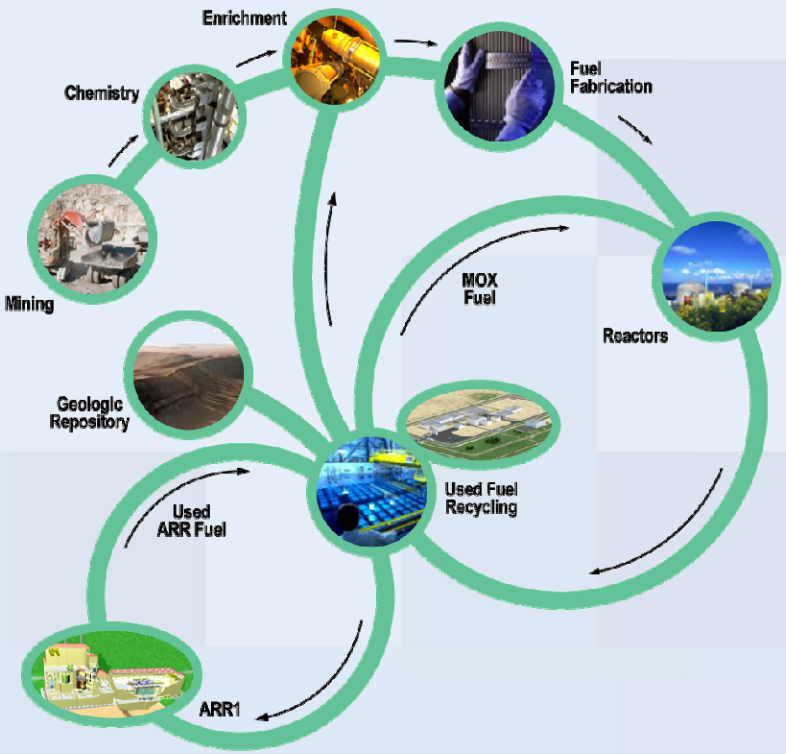
- **Recycling makes waste management easier**
  - **Only 4% of UNF is waste - when vitrified, total volume for disposal in deep geological repository is 75% less than volume if UNF disposed of directly**
  - **Projected increase in LLW disposed in near-surface facilities only 2.5% of the volume of such waste that is disposed annually in the U.S.**
  - **Extracting plutonium and uranium from the waste significantly reduces the waste's toxicity by 90%**
  - **Provides a highly safe, resistant and well-characterized waste form - strong as volcanic rock**
  - **No IAEA safeguards required – HLW safely interim-stored in simple, compact and low-cost facilities**
  - **Provides a credible and reliable option consisting of storing the vitrified waste for an extended period of time waiting for a geological repository to be ready and approved**

Why Consider A Closed Fuel Cycle? (2/2)

- **Recycling is a path to burning plutonium, thereby reducing proliferation concerns**
  - **Recycling plutonium in MOX fuel consumes roughly one-third of the plutonium through single recycling**
  - **Recycling significantly alters the isotopic composition of the remaining plutonium, thus degrading its attractiveness for weapons uses**
  - **Recycling is the path chosen by U.S. for disposition of excess weapons-grade plutonium**
- **Recycling saves natural resources**
  - **Recycling RepU and MOX leads to total savings of 25% of natural uranium resources**
  - **UNF inventory (60,000 MT in 2010), if recycled represents the energy equivalent of 8 years of nuclear fuel supply for today's entire U.S. nuclear reactor fleet – enhances energy security**

Path Forward For A Closed Fuel Cycle: Technology

- **Technology exists - commercial process using mature and available technology with no separated pure plutonium**
- **Pursue a fuel cycle technology RD&D program parallel with a commercial recycling program**
  - **Technology to further extract radionuclides from UNF that can be burned in fast reactors**
    - **Advanced processes (aqueous and pyro)**
    - **Transmutation fuel**
    - **GenIV reactors**
  - **Advanced safeguards**



Technology evolution is realistic based on lessons learned from existing recycling facilities

Path Forward For A Closed Fuel Cycle: Regulatory

- **Regulatory**
  - **Rulemaking**
    - **INRA performed gap analysis**
    - **NEI Task Force on Recycling – white paper to NRC and public meeting in 2008**
    - **NRC gap analysis – Secy-09-0082**
  - **Effluents (40CFR 190.1a) - Kr-85**
  - **Waste - disposal path for GTCC and captured / conditioned I-129**
  - **Transportation of fresh MOX fuel**

"Rulemaking critical before private financing can be considered - anything short of one-step licensing is very difficult from financing stand-point"

(Financial Advisory Group)

Much Has Happened In Last 2.5 Years But …

- **Legislation needed**
  - **Authorize new fedcorp for integrated UNF strategy**
  - **Amend NWPA …**
- **Human resources / supply chain**
- **Public acceptance / bipartisan support**
  - **Growing interest by the utilities – calling for communication plan on recycling (USRAP)**
  - **What about the communities – what matters?**
    - **Safety/Environment**
    - **Jobs/Economic development**

Make decisions as appropriate – do not have to decide everything up front

Summary

- **Nuclear must be part of the energy mix to meet growing energy demands while addressing climate change**
- **While we debate, the rest of the world is advancing regarding nuclear energy → some are already recycling, others are considering starting**
- **There is short-term solution: interim storage**
- **Ultimate disposal of commercial and defense waste is a must**
- **Recycling is a complementary option… and should be considered**
- **At same time, we must invest in R&D at the National Labs and universities with support from industry for a "commercial" perspective**

Need for transparency – keep the dialogue going

Closing the Fuel Cycle in the U.S. – Global Perspective

Thank You