Status and Near Future Progress and Assessment

March 3rd 2009

The Energy*Solutions* Industry Team Perspective

Introducing the Industry team

TOSHIBA

Booz | Allen | Hamilton

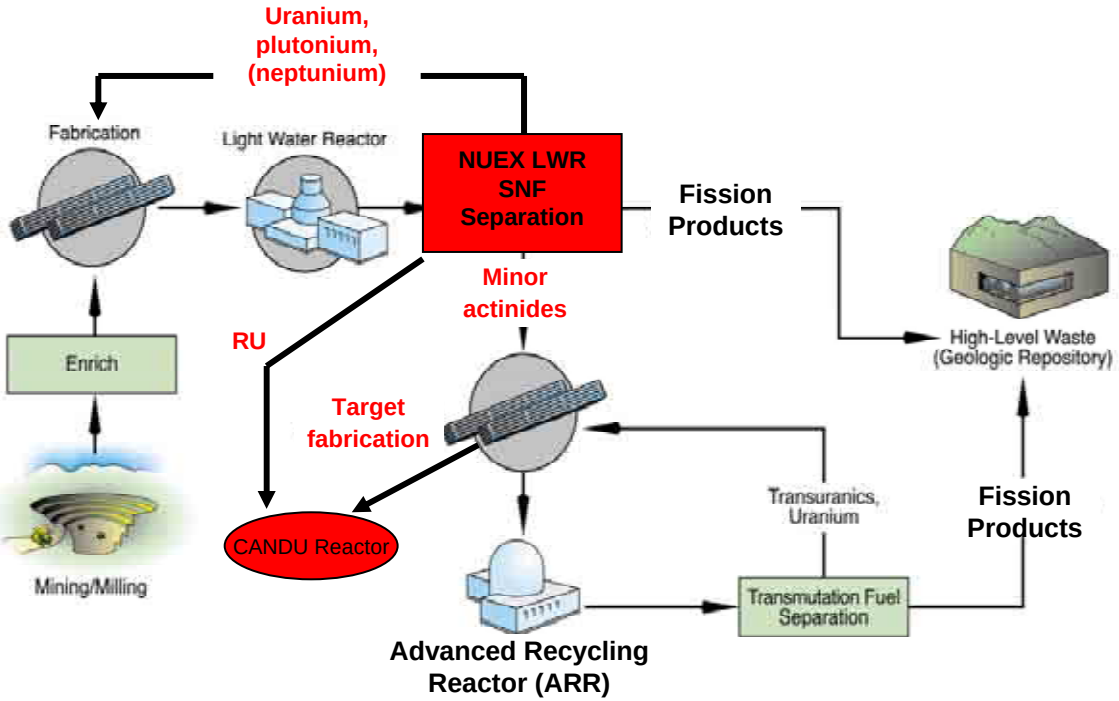
Our Approach for Recycling

- Incremental approach to deployment of fuel cycle facilities
  - Aqueous LWR Recycling first
  - Fast Reactors and non-aqueous Recycling later
- Minimizes risk and costs by using advanced processes on proven equipment
- Buys time on disposal of high level waste

Need to start now in order to close the fuel cycle in the future

Our Approach

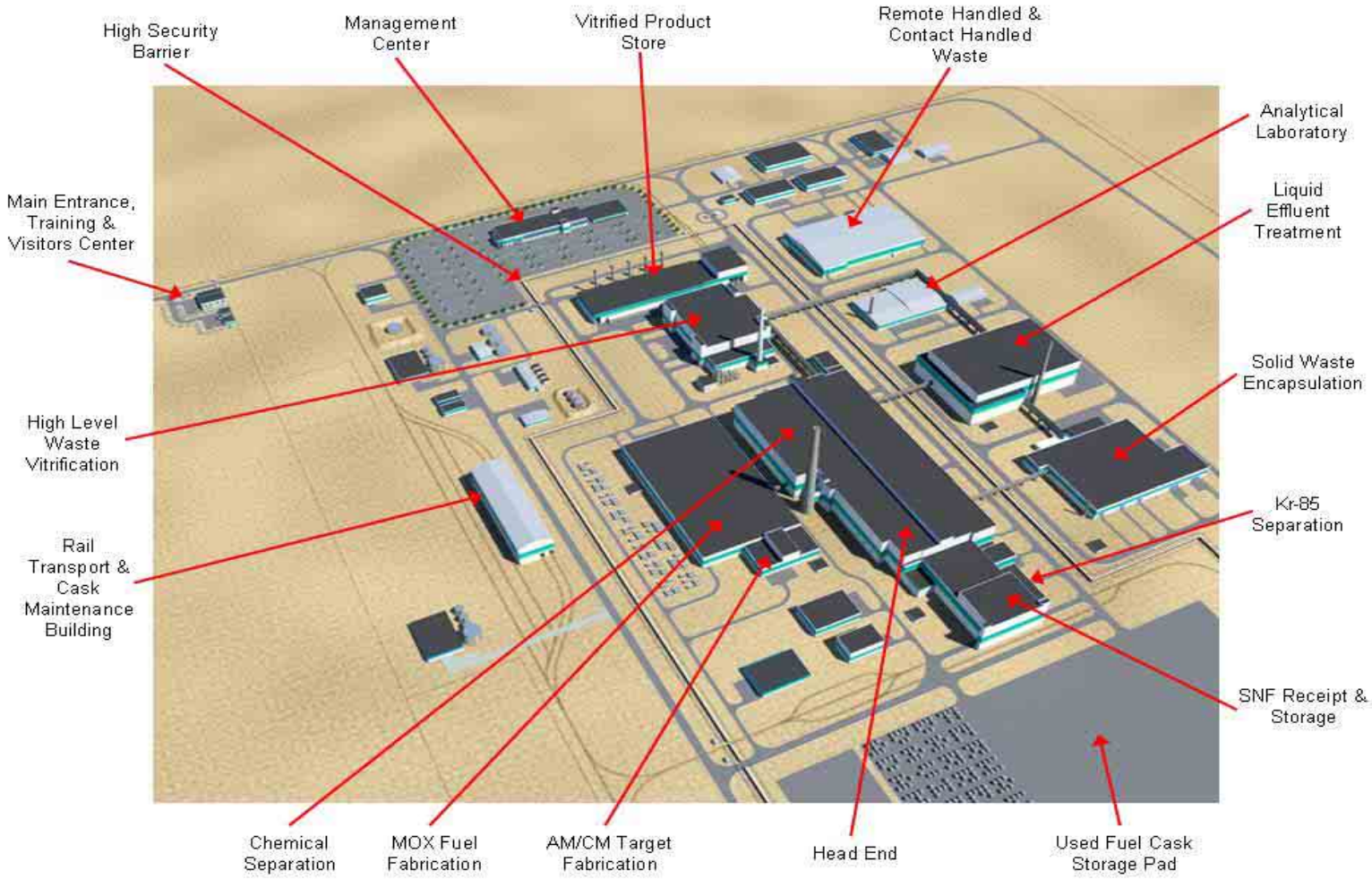
- Ability to re-use Recycled Uranium in CANDU reactors or existing/new build LWRs
- Ability to re-use U/Pu/Np as MOX fuel in existing or new-build LWRs
- Ability, if required, to burn Am/Cm (as targets) in existing thermal (CANDU) reactors
- This approach “fills the gap” before Advanced Recycle Reactors enter commercial operation



Our Approach

- Advances in Waste Management
  - High level waste incorporation rates into Glass reduces HLW waste volumes
  - Volume reduction of all Low level waste (GTCC and Class A/B/C)
  - Tritium treatment/Solidification of Liquid Effluents resulting in zero discharge facility
  - Gaseous effluent treatment/capture (Kr, I, C-14) resulting in near-zero aerial discharge facility
- Advances in proliferation resistance
  - No pure plutonium is separated anywhere in the recycle facility
  - Mixed uranium/plutonium/neptunium product is low attractiveness and is immediately recycled
  - Chemical 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 Accountancy
- Advances in Business Management
  - New Government Entity to manage used fuel, nuclear waste fund and a new fund
  - 100% private funding of recycling
  - Minimal increase in waste fee charged to utilities (~1-3 mil/kWh)
  - Maximize revenues for recovered U products, MOX

LWR Recycle Center



Urgency of Recycling

- Current proposals advocate need to research, develop and demonstrate advanced fuel cycle systems
- Industry thinks that aqueous recycle technology is developed and mature – enhancements can be made to advance the technology, wastes and proliferation resistance but not radically change the processes (evolution not revolution)
- Realization of advanced aqueous recycling will still require a long lead time before facilities become operational
  - Requires legislative, regulatory and financial enablers
  - Requires design and licensing
  - In the meantime, used nuclear fuel continues to accumulate at reactor sites (60,000 tons now and 2,500 tons every year)
- Demonstrable end-point of Government liability under Standard Contracts

Role of Industry in advanced recycling

- Recycle technology advancements requires a collaborative effort from Labs/Industry
- Industry can provide focus for Lab Development programs (Design Data Needs etc)
- Industry can provide reachback to massive, non-US development programs for advanced recycling
- Industry provides the recycling design, operation and maintenance experience and expertise (Lessons Learned)
- Industry provides the business, commercial, financial, contractual experience and expertise

Closing the Fuel Cycle- Conclusions

- Closing the fuel cycle can:
  - Solve the nuclear waste problem
  - Significantly reduce amount, heat load and toxicity of high level nuclear waste
  - Minimize risk of proliferation, plutonium is consumed and pure plutonium never produced
  - Improve US energy security, reduce dependence on foreign energy supplies
- Recycling will be paid for by the nuclear industry not the government
- Allows carbon emissions to be reduced by supporting the nuclear renaissance
- Create thousands of much needed US jobs – many in manufacturing and construction

Back-up Slides

Issues and perceptions to be dealt with

- Recycling generates massive quantities of nuclear wastes
- Recycling costs are too high and make recycling uneconomic
- Recycling results in serious proliferation concerns with both weapons material and separations technologies
- No need to rush into building and operating recycling facilities –research and develop more advanced methods

Wastes from Recycling

- If all the electricity consumed by an average US household **over their lifetime** was generated by nuclear fuel, then the resulting wastes from recycling would be:

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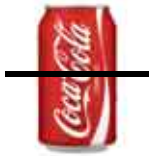


Radioactivity content 99%

Half a Soda Can of Vitrified HLW Waste
7 fl oz

+

Radioactivity content 0.9%

Milk container of GTCC low level waste
0.25 gals

+

Radioactivity content 0.1%

Paint can of low level waste
5 gals

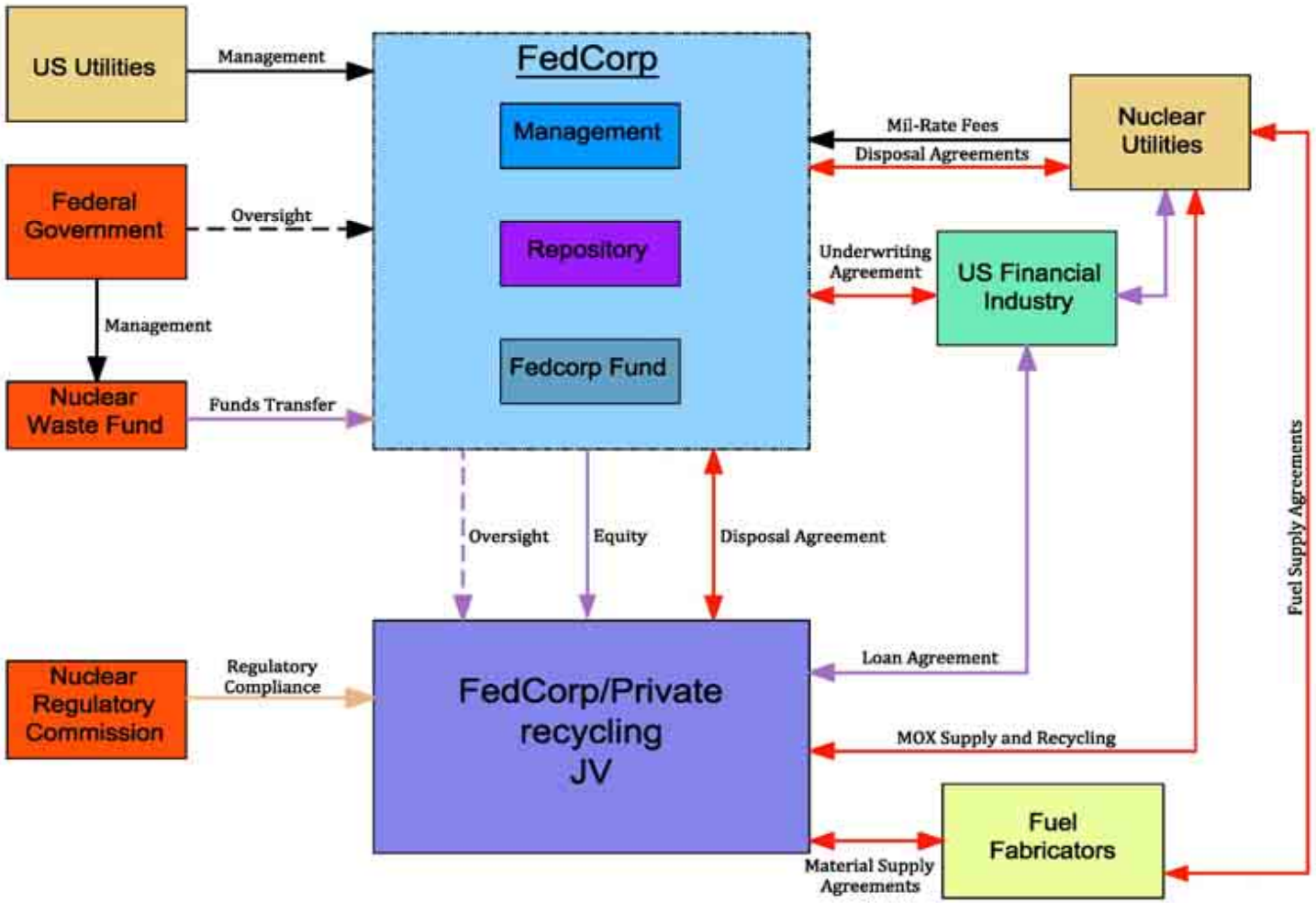
Business Approach

- Create a new Federal Corporation to manage used fuel
- Create a new Waste Fund to finance capital and operating expenses
- Maximize revenues for recovered U products
- Maximize MOX revenues

Costs of Recycling

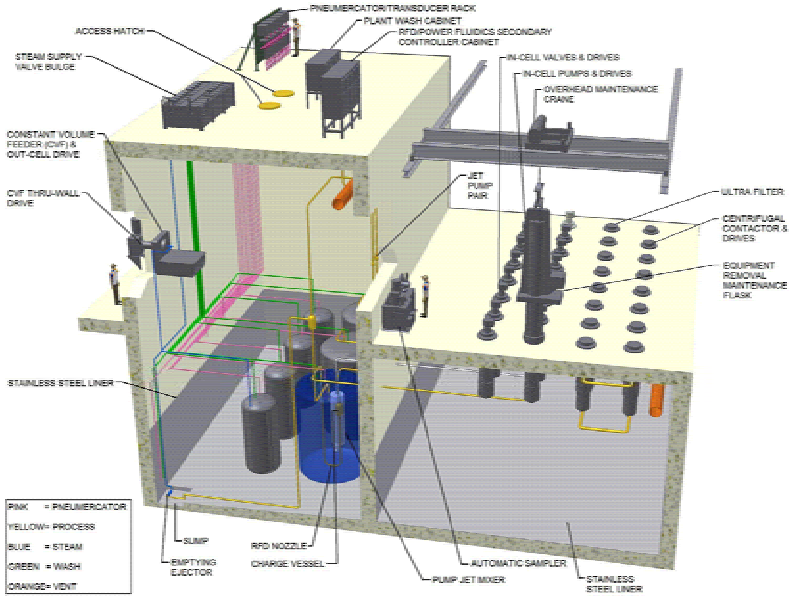
- Based on our proposed Business Model, costs of recycling used nuclear fuel would add between **18 and 61 cents per month** to an average family home electricity bill
  - Range of costs are state-to-state dependant
- No Government funding necessary to implement near term LWR nuclear fuel recycling

Self-Performing FedCorp



Proliferation Resistance - Intrinsic Features

- Process chemistry
  - No pure plutonium is separated anywhere in the recycle facility
- State-of-the-art in-situ fissile material measurement systems
  - Near Real Time Accountancy
- Chemical separations carried out in Passive Secure Cells
  - No personnel access routes to separations equipment
  - High radiation fields inside cells prevent deliberate intruder access



Proliferation Resistance - Extrinsic Features

- Independent IAEA monitoring Systems
  - Regulator owned systems
  - Branched operator systems
  - Joint Laboratory analysis
  - Seals, locks and cameras
  - On-site Inspectors
- Layered physical security features
  - Owner Controlled Area, Protected Area, Material Access Areas
- Access Authorizations
  - Security clearances, biometric access controls, metal detection, explosives detection
- Protective Force
  - Armed Response personnel, Central and Secondary Alarm Stations