



A

AREVA

---

# ***A NEW WASTE STRATEGY***

***Alan S. Hanson***

*Executive Vice President*

*AREVA NC Inc.*

***Global Energy and Environment Initiative  
Johns Hopkins School of Advanced International Studies***

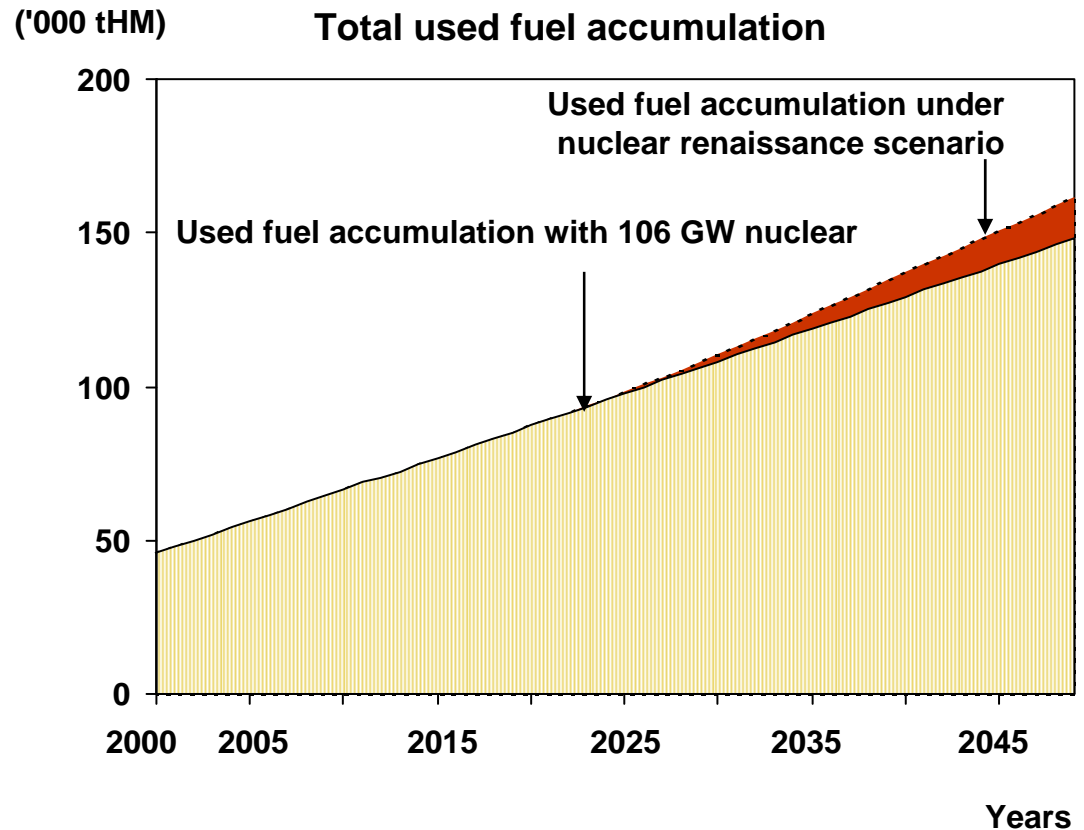
***Washington, DC***

***April 8, 2009***

- ▶ **All discussion of nuclear waste should start from one simple fact:**
  - ◆ **A nuclear waste repository is needed**
    - ...independent of nuclear power growth.
    - ...independent of fuel cycle chosen.
    - ...independent of who is the President.
  - ◆ **But we do not need it now,**
  - ◆ **What is needed is progress toward the implementation of waste disposal to assure the public that the Government will eventually meet its legislated and contractual obligations**

# Accumulation of Used Nuclear Fuel (UNF)

- ▶ **Current inventory approx 59,000 MTU**
- ▶ **Used fuel strategies are critical to the Nuclear Industry**
- ▶ **Ultimate Disposal of commercial and defense waste is a Must**



*A sustainable long term solution to managing UNF is needed in the face of a worldwide expansion of CO<sub>2</sub> free nuclear power*

- ▶ **Atomic Energy Act of 1954, as amended**
- ▶ **Nuclear Waste Policy Act of 1982**
  - ◆ **Standard contracts between DOE and utilities**
- ▶ **Nuclear Waste Policy Act of 1987**
  - ◆ **Names Yucca Mountain as sole site to be characterized for repository**

- ▶ **10 CFR Part 50: reactor pool storage of used fuel**
- ▶ **10 CFR Part 72: interim used fuel storage**
- ▶ **10 CFR Part 71: used fuel transportation**
- ▶ **10 CFR Part 63: used fuel disposal in a repository**

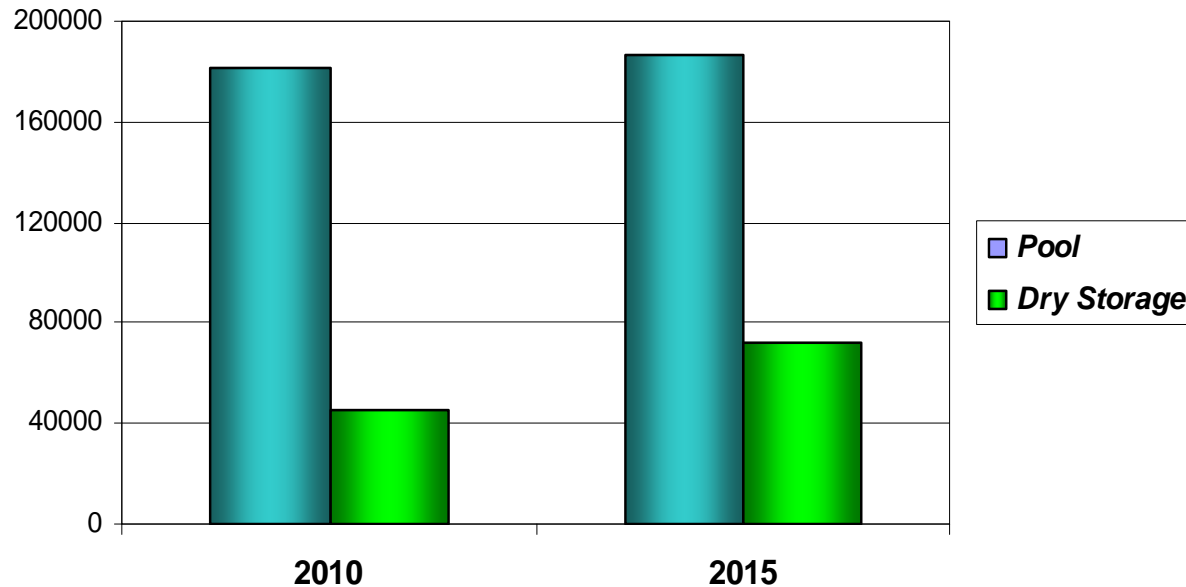
- ▶ **Rerack wet pool storage to densify**
- ▶ **Expand wet pool storage**
- ▶ **Trans-ship used fuel to other pool**
- ▶ **Add dry storage casks**

# Projections for Dry Storage Use

- ◆ 2010
- ◆ 20,000 MTU
- ◆ 45,000 Assemblies
- ◆ 1,200 Casks

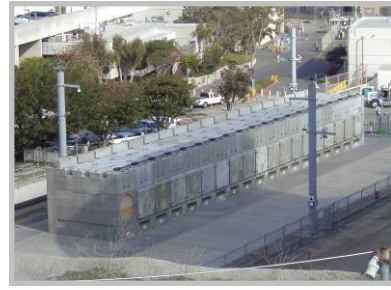
- 2015
- 27,000 MTU
- 72,000 Assemblies
- 1,600 Casks

Used Fuel Inventory in Assemblies



*By 2015 over 40% of the fuel inventory could be in Dry Storage*

# Increased Reliance on Dry Storage



- ▶ **2008** – More than 1000 dry storage systems in use at reactor sites today
- ▶ **2012** – 93 reactors will likely be contracted for dry storage
- ▶ **2015** – 2000 MTU/year added to dry storage



*Secure and reliable cask supply is critical to the industry as nearly 90% of US reactors will rely on dry storage for continued operation*

- ▶ **NWPA of 1982 committed the Department of Energy to begin disposing of spent fuel no later than February 28, 1998.**
- ▶ **By this date, not only was no fuel disposed, there was no repository, no license application for one, and DOE had not even removed any spent fuel from a reactor site.**
- ▶ **Today, ten years after the contractual date, the DOE has finally submitted a license application for Yucca Mountain to the NRC. The earliest projected opening date for the repository is now unofficially 2020.**
- ▶ **Lack of demonstrated fuel removal from commercial reactors threatens the future of nuclear power.**
- ▶ **A geologic repository will be required no matter what configuration is finally adopted for the fuel cycle.**

- ▶ **DOE must defend the recently submitted license application for a repository at YM.**
- ▶ **DOE must demonstrate convincingly that a YM repository can meet the final EPA standard just promulgated.**
- ▶ **This must be accomplished in a fiscally challenging environment**
- ▶ **It is unlikely that Congress will allocate enough funding to allow the NRC to meet its legislated timetable**
  - ◆ **Question: Is it time to remove the 3 (or 4) year deadline for NRC review of DOE's application?**

- ▶ **It is extremely unlikely that Congress will appropriate funds for repository construction in the amounts needed at peak of construction (more than \$1 billion per year)**
  - ◆ **Question: Is it time to reform the Nuclear Waste Fund to take it off budget and free from annual appropriations?**
- ▶ **It is doubtful that the DOE can properly manage and oversee the large and complex task of building the repository and transport system to feed it.**
  - ◆ **Question: Is it time to create a new Federally chartered organization to manage the back end of the nuclear fuel cycle?**
- ▶ **The Obama Administration has expressed extreme skepticism about the viability of Yucca Mountain as a nuclear waste repository**

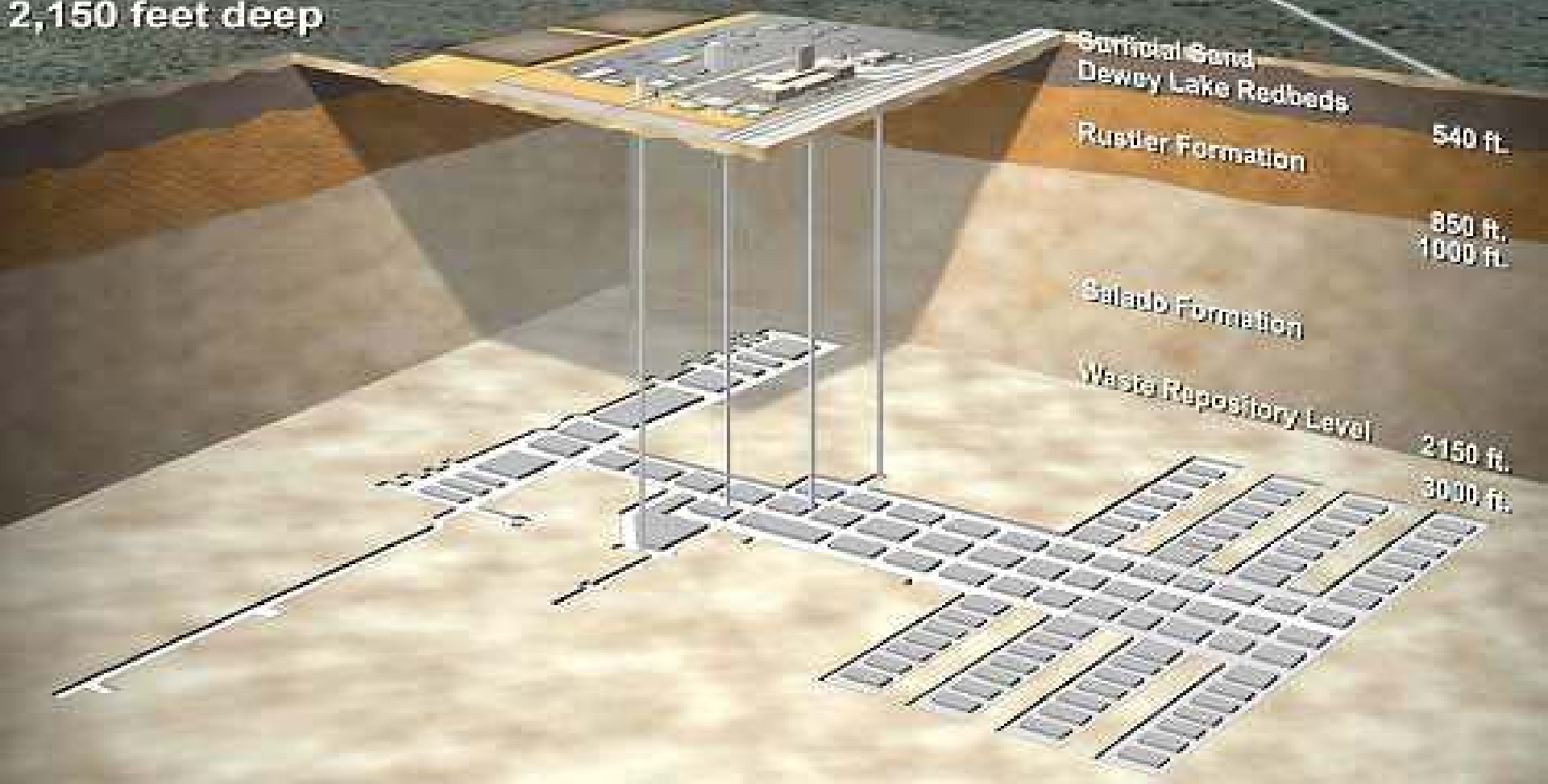
- ▶ **It would be a mistake to abandon Yucca Mountain as a potential repository at this time.**
- ▶ **However, since YM may be found by the NRC to be unsuitable or politics may conspire to block its implementation, alternative repository sites should be sought.**
- ▶ **A process to seek a voluntary site should be put in place in parallel with YM review.**
  - ◆ **Such a process has worked in Finland & is working in Sweden.**
  - ◆ **In the U.S. it worked in New Mexico for the WIPP facility**
  - ◆ **Considerations of fairness and equity strongly suggest that nuclear facilities of all types should be located where they are wanted.**
- ▶ **We have lots of time and many communities are warming up to advantages of hosting nuclear facilities.**

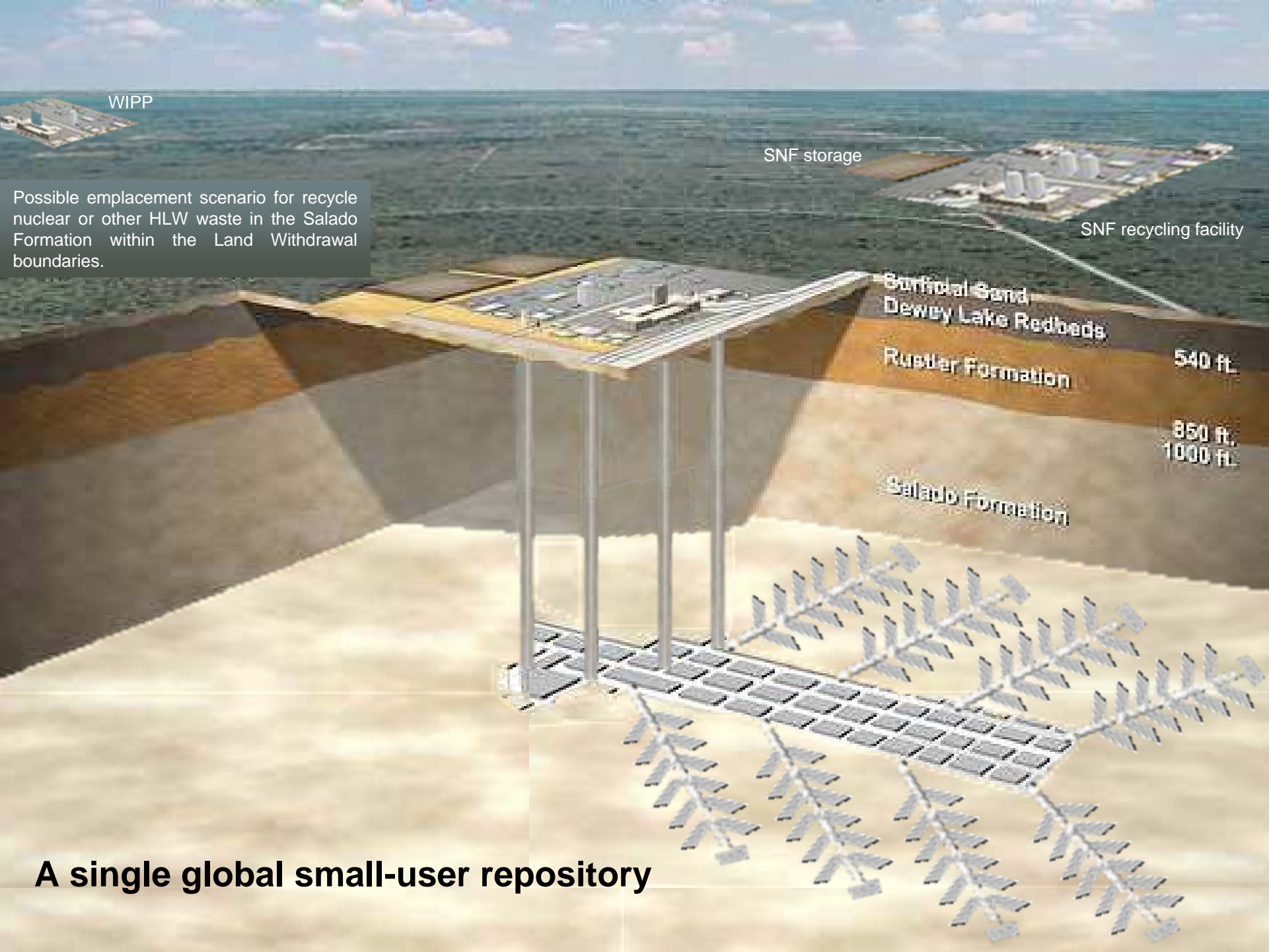
# Waste Isolation Pilot Plant

U.S. Department of Energy facility

Designed for permanent disposal  
of transuranic radioactive waste

2,150 feet deep





WIPP

SNF storage

SNF recycling facility

Possible emplacement scenario for recycle nuclear or other HLW waste in the Salado Formation within the Land Withdrawal boundaries.

Surficial Sand  
Dewey Lake Redbeds 540 ft.  
Rustler Formation 850 ft.  
Salado Formation 1000 ft.

**A single global small-user repository**

# *Is There A Role For Centralized Interim Storage?*

---

- ▶ **Here, answer is simple. Maybe, but only if local jurisdiction wants it.**
- ▶ **Must recognize that this is NOT an alternative to disposal but a stopgap measure to buy time for the repository.**
- ▶ **If centralized interim storage is pursued, there are only two realistic locations—at the head end of the repository or at the site of a treatment facility if a closed fuel cycle is chosen. Problem today is interim storage at YM is legislatively forbidden and there is no treatment facility in existence or on the immediate horizon.**
  - ◆ **Question: Isn't this a decision which could be assigned to the new Government entity?**

# *Should the U.S. Pursue Recycling Like France and Japan?*

- ▶ **Recycling will not eliminate need for a repository, but...**
- ▶ **Recycling will change the waste form to be put in the repository**
  - ◆ **In France LWR recycling reduces HLW volume by factor of five**
  - ◆ **And reduces radio toxicity of waste by a factor of ten,**
  - ◆ **While adding about 5% to the cost of nuclear electricity.**
    - **Question: Would a similar trade off be good for the U.S.?**
- ▶ **If recycling in the U.S. were to add 1mil/kwh to the cost of waste management, this would represent a 1-2% increase in cost of nuclear electricity at retail level.**
  - ◆ **Question: Could the decision regarding if, when, where and how to do recycling be assigned to the new Government entity?**

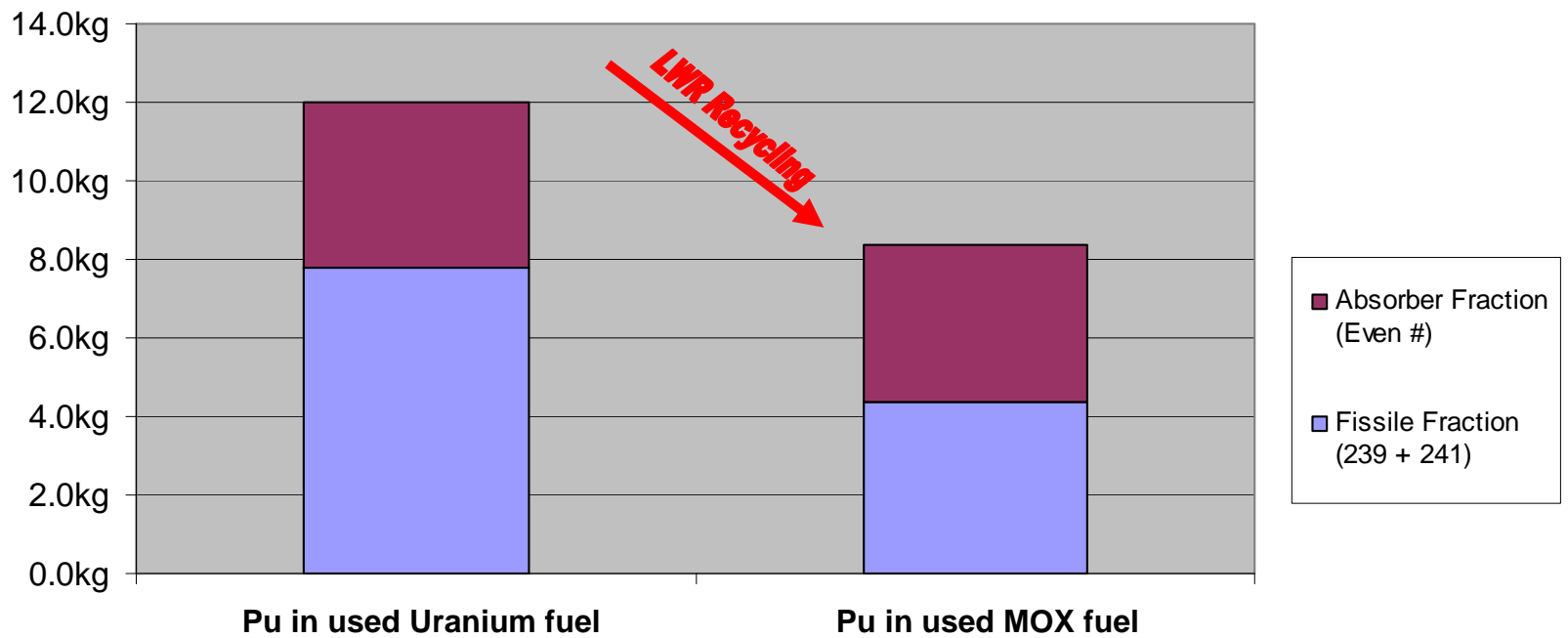
▶ **But wouldn't recycling contribute to proliferation??**

- **Not necessarily!**

- ▶ **Conventional PUREX processing produces a pure Pu stream**
- ▶ **For high-burning LWR fuel the isotopic composition of the Pu stream is not very good for explosive purposes but such uses cannot be completely excluded**
- ▶ **Therefore, recycling plants need safeguards to verify no diversions and physical protection to prevent theft**
- ▶ **Large quantities of fissile material in recycling plants presents a challenge for safeguards, but it can be, and is being, done**
- ▶ **Transport of unirradiated MOX fuel also requires physical protection measures that go far beyond those for conventional UO<sub>2</sub> fuel**

# Which composition is preferable from a non-proliferation perspective?

**Pu content in used fuel: after irradiation of 1000kg of Uranium fuel and a second pass in MOX fuel (both 50GWd/t burnup)**



- ▶ **About 30% of the initial fissile Pu atoms have been destroyed**
- ▶ **Pu isotopic composition of used MOX is not amenable for weapons use**
  - ◆ **High content of even-numbered Pu isotopes (Pu-238, -240, -242)**
  - ◆ **High spontaneous neutron emission**
  - ◆ **High heat generation rate**
- ▶ **Used MOX fuel is more self-protecting than used UOX fuel**
- ▶ **Every atom of Pu fissioned reduces the number of atoms of U-235 which would otherwise need to be enriched**

- ▶ **Allow the NRC to complete its job of reviewing the YM license application taking as much time as it needs.**
- ▶ **Establish a new Government cooperation charged with responsibility for used fuel management including the repository(ies), transportation and possibly recycling**
- ▶ **Take nuclear waste fund off budget and out of the annual appropriations process.**
- ▶ **Implement a process to seek volunteer sites for a second (or a first) repository.**
- ▶ **Continue to evaluate the options to close the fuel cycle to gain benefits in resource management, waste form optimization and non-proliferation.**