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# 'Plan D' for Spent Nuclear Fuel

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Paul Wilson  
UW-Madison



<http://tinyurl.com/plan-D-spent-fuel>

# Report Background

- Consensus reached at March 2009 workshop of Midwestern nuclear engineering faculty
  - Hosted by the U. Illinois Program on Arms Control, Disarmament, and International Security
  - Supported by John D. and Catherine T. MacArthur Foundation through its Science, Technology and Security Initiative
- Rapporteurs
  - Cliff Singer, UIUC
  - Rod Ewing, U. Michigan
  - Paul Wilson, U. Wisconsin-Madison
- Editors
  - Matt Rosenstein, UIUC
  - William Roy, UIUC
- Other Participants
  - Dan Bullen, Exponent
  - Carlos Castano, Missouri U. of Science & Technology
  - Audeen Fentiman, Purdue
  - Colin Flint, UIUC
  - Carolyn Heising, Iowa State U.
  - William Martin, U. Michigan
  - James Stubbins, UIUC
  - Rusi Taleyarkhan, Purdue
  - Robert Thompson, U. Missouri



# Motivation

- Interviews with staff of members of Congress from both major parties revealed essentially universal support for an escrow arrangement for funds set aside for spent nuclear fuel management
- March 2009 workshop discussed this and other related mechanics of revising the Nuclear Waste Policy Act (NWPA)

# Statement of the Problem

- New administration in Jan 2009
  - Limited funds budgeted for pursuing licensing of Yucca Mountain
  - Absence of near-term steps towards extensive actinide burning
  - Absence of proposal for centralized surface storage
  - Likely outcome:
    - Hold spent nuclear fuel at reactors in dry storage for extended period

# The Current Reality

- Spent fuel is destined to remain at US reactor sites
  - Yucca Mtn will not start accepting spent fuel for a long time (assuming it is licensed)
  - Reactors will soon have produced more spent fuel than Yucca Mtn would be licensed to receive
  - May be difficult to license Yucca Mtn at all, never mind expand the capacity
- Should federal gov't take title to spent fuel?  
How?
- How should spent fuel funds be administered?



# Five Reasons to Change NWPA

- Lawsuits
  - US Gov't liability could be as high as \$11B
- Stranded Fuel
  - Spent fuel at shutdown reactor sites prevents/delays decommissioning
- Densely Packed Pools
  - Preferable to utilities but may introduce safety concerns
- R&D
  - More stable approach may save billions of dollars to better define fuel cycle research
- Nuclear Energy
  - Legal impediments to new construction undermines US influence in international issues: climate change, non-proliferation and fuel cycle technologies



# Five Options for Changing Nuclear Waste Policy Act (NWPA)

## A. Breeding

- Reprocess spent fuel after brief storage for use in breeder reactors

## B. Prompt Deep Burial

- Send spent fuel to a permanent deep burial facility

## C. Actinide Burning

- Reprocess spent fuel promptly for deep actinide burning to reduce required deep disposal space

## D. Holding in Dry Casks

- Delay final decision with above ground dry storage

## E. Elimination

- Build no more reactors and abandon spent fuel reprocessing



# Five Options for Changing Nuclear Waste Policy Act (NWPA)

- A. **Original plan abandoned for NWPA**
  - Reprocess spent fuel in breeder reactors
- B. **Plan selected by NWPA**
  - Send spent fuel to a geologic disposal facility
- C. **Bush Administration plan rejected by many**
  - Reprocess spent fuel to reduce required deep disposal space
- D. **Holding in Dry Casks**
  - Delay final decision with above ground dry storage
- E. **Supported by some NGO's but not by public**
  - Build new reprocessing





# Plan D Storage Options

- Operating reactor sites where the spent fuel was produced
- Reactor sites where the spent fuel was produced but the reactor has been shut down
- Reactor sites with the same owner/operator in the same state
- **Reactor sites with a different owner/operator in the same state**
- **Reactor sites with the same owner/operator in a different state**
- **Reactor sites with a different owner/operator in a different state**
- Away-from-reactor storage but not at a site licensed for deep burial or reprocessing
- A site licensed for deep burial
- A site licensed for reprocessing

# Reactor Storage Issues

- NWPA allows only “transshipment of spent nuclear fuel to another civilian reactor within the same utility system”  
[Title I, Subtitle B, Sec. 134(a)]

## **Question #1**

Should the NWPA be revised to explicitly allow the transshipment of fuel from one utility’s reactor site to another utility’s reactor site within the same state? A different state?



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  - A site licensed for deep burial
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# Away-from-Reactor Storage Issues

- Centralized above ground dry storage
- NWPA limits DOE-operated facility to 10,000 metric tons until geologic repository accepts 15,000 metric tons  
[Title I, Subtitle C, Sec. 148 (d)]
- Larger capacity allowable by private facility
  - 20 year license already issued for 44,000 metric ton private facility, but not constructed



# Away-from-Reactor Storage

## Question #2

In Subtitle C of Title I of the NWPA, should the capacity limits for a government monitored retrievable storage facility be changed, or are they adequate to allow longer-term storage in a private facility?



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# Retrievable Storage at Repository and Reprocessing Sites

- Past proposal to build 21,000 metric ton spent fuel aging facility at Yucca Mtn
  - Unclear whether there are legal limits on surface storage at a site licensed for deep burial
- Abandoned Morris reprocessing site (IL) currently houses spent nuclear fuel
  - Has become a *de facto* monitored retrievable storage facility



# Retrievable Storage at Repository and Reprocessing Sites

## **Question #3A**

Should licenses for reprocessing facilities be required to include provisions for long-term management of spent fuel and reprocessed materials, and, if so, should any limits be put on their intake of spent nuclear fuel?

## **Question #3B**

Should licenses for geologic repositories be explicitly allowed provisions for long-term management of spent fuel before deep burial, and, if so, should any limits be put on their intake of spent nuclear fuel?





# Benefits Provisions

- NWPA limits annual payments to a state or Indian tribe to
  - \$10M for retrievable storage facility
  - \$20M for geologic repository
  - No provision for inflation adjustment
  - [Title I, Subtitle F, Sec. 171 (a) (1)]

# Benefit Examples

- With 3% inflation, 2007 net value of Nevada's payments for Yucca Mtn are less than 0.5% of total \$96B repository cost
- Compare
  - Balance of petroleum-related Alaska Permanent Fund was about \$40B in 2007, despite having paid out \$15B since 1982
  - Sweden has allocated \$240M for a repository that is 7 times smaller, equivalent to about 2% of total YM costs



# Benefits Provisions

## **Question #4A**

Should the benefits allowed for states or Indian tribes in Subtitle F of Title I of the NWPA be revised, and, if so, how?

## **Question #4B**

Should such a revision no longer single out Nevada as the only host for the first geologic repository?



# Waste Management Payments

- NWPA mandates a fee of \$1/MWh<sub>e</sub> be paid to U.S. Treasury to relieve the “person” that generated the spent fuel from the obligation for long-term management  
[Title III, Sec. 302 (a) (3)]
- Decommissioning funds go into escrow
- Nuclear waste fees effectively vanish in exchange for unmet promise by federal government



# Waste Management Payments

## Question #5A

Should some or all of the charges for long-term waste management be administered under Nuclear Regulatory Commission guidelines in a manner that does not require annual congressional appropriation?

## Question #5B

If so, should this approach apply (1) only to new reactor licenses issued after some specified date, (2) also to existing reactors with license extensions issued after a certain date, (3) to all reactors for fuel discharged after a certain date, (4) retroactively, for reactor site owners willing to accept compensating disbursements from the Nuclear Waste Fund, or (5) retroactively, after disbursements from the Nuclear Waste Fund?

# Waste Management Payments

## Question #5C

Should there, in any case, be provision for possibly adjusting the charge rate from the currently specified face value of \$1/MWh<sub>e</sub> when inflation has substantially eroded the purchasing power of these payments?

## Question #5D

Should the reactor owners recover any escrow funds not deemed necessary for long-term management of spent fuel after it is moved to a long-term management facility?



# Three Guiding Principles

1. Only in the distant future will it likely become clear whether it is commercially advantageous to reprocess spent nuclear fuel
2. A spent fuel management system will be fully functional only when key stakeholders have substantial financial incentives to cooperate
3. Forging a broader consensus on a process for establishing a viable long-term management system well before individual facilities are utilized should provide a sufficient condition for success

# Recommendation #1

Set up regulated escrow funds for utilities to draw on to meet the costs of on-site management of aged spent nuclear fuel in dry casks



# Recommendation #2

Explicitly allow shipment of spent fuel from one utility to another utility's operating nuclear reactor site in the same state

# Recommendation #3

Provide a financial incentive for states to agree to have spent fuel shipped from an inoperative reactor site in one state to an operating reactor site in a neighboring state

# Recommendation #4

Require any licensed spent fuel reprocessing facility to be licensed as well for possible continuing on-site storage of spent fuel intake and of all reprocessing product streams

# Recommendation #5

Should the federal government not succeed in licensing long-term spent fuel management facilities in a timely manner, consider turning this task over to a tightly regulated corporation set up for this purpose


## Recommendation #6

Allow states to require that they receive substantially larger financial incentives for cooperating on hosting long-term spent nuclear fuel management facilities.

**Transferring nuclear waste management payments into a permanent fund set up to insure such a facility and allowing a state to tap interest earnings on that fund is one possible approach.**

# Recommendation #7

Consider licensing long-term management facilities for taking in spent fuel produced at many different reactor sites, but not utilizing such facilities until it becomes clear that it is more economically advantageous to do so than to continue holding spent fuel in dry casks at operating reactor sites.



Success will hinge on  
adoption of as many of the  
seven recommendations  
as possible

Questions?

<http://tinyurl.com/plan-D-spent-fuel>

<http://acdis.illinois.edu/publications/207/publication-PlanDforSpentNuclearFuel.html>



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