

# GNEP and Yucca Mountain

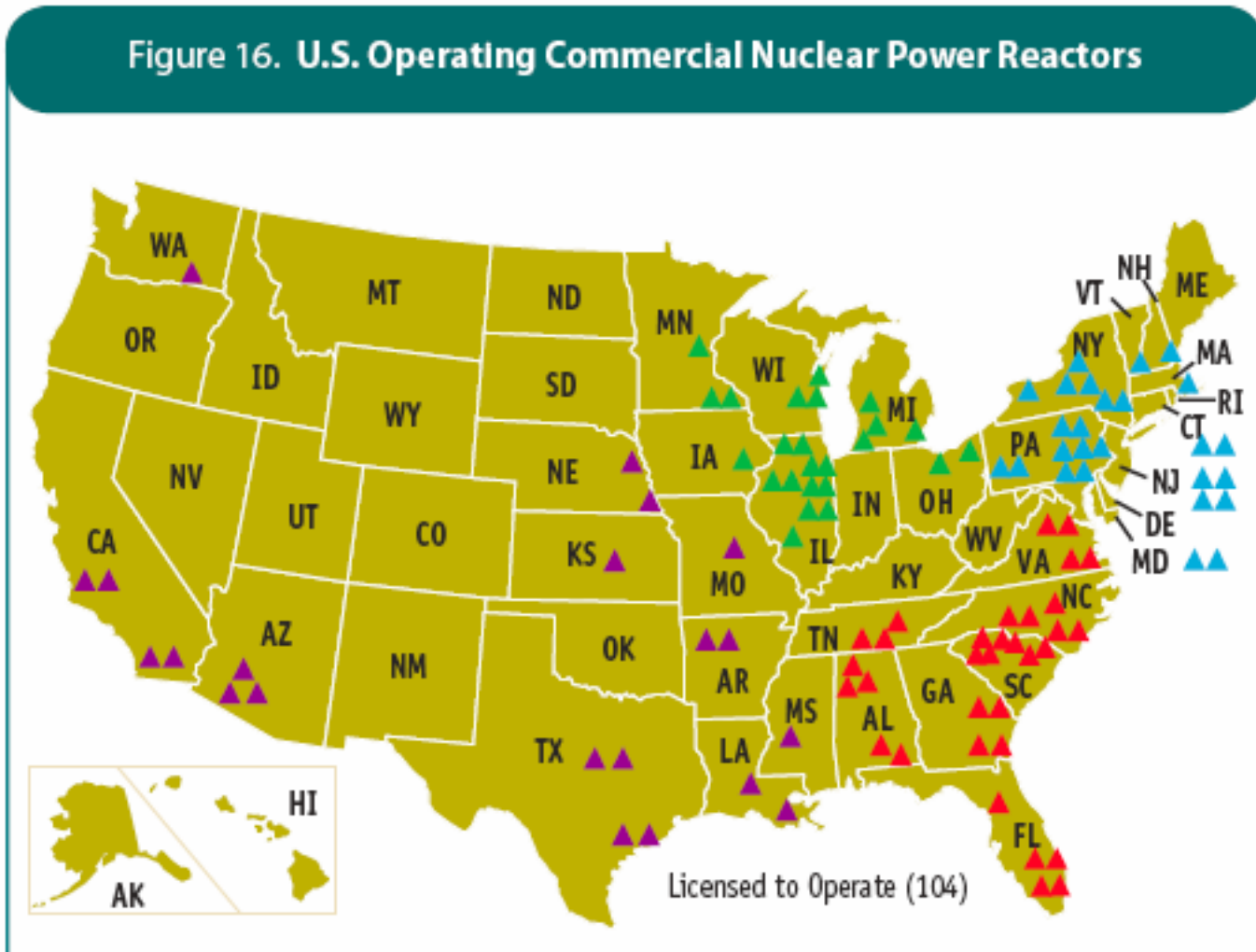
Victor Gilinsky  
at the  
American Association for the Advancement of Science  
San Francisco meeting  
February 17, 2007



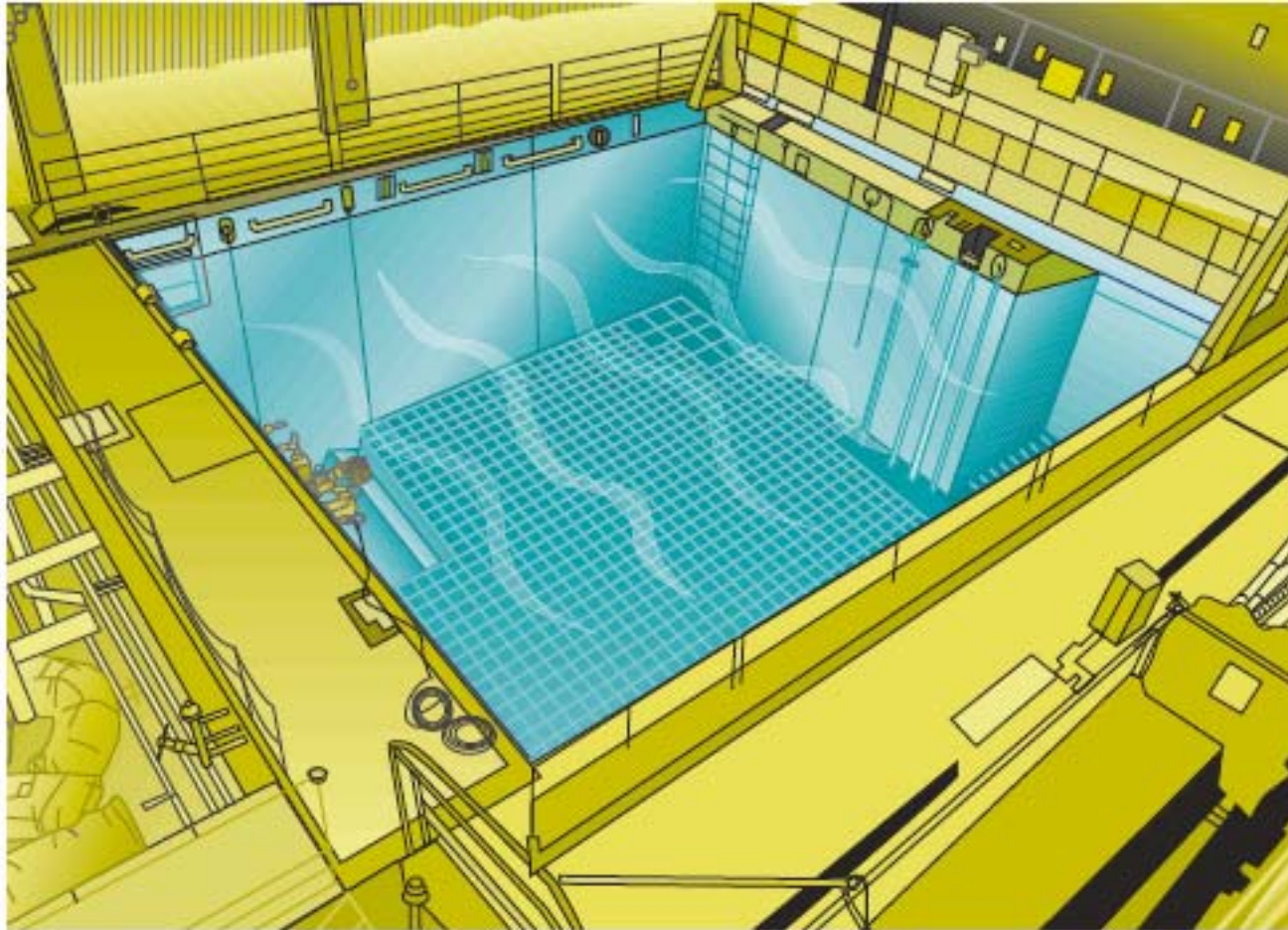
# What are GNEP and Yucca Mountain?

- GNEP stands for **Global Nuclear Energy Partnership**, a new US program to facilitate expanded nuclear energy use worldwide by many hundreds of power reactors
- **Yucca Mountain** in Nevada is the site of DOE's planned repository for *spent fuel* from US nuclear power reactors, operating and shut down
- It turns out Yucca Mountain is GNEP's *linchpin*; the argument is:
  - A much expanded nuclear program would need more underground repositories to house spent fuel, say about one for every additional 100 reactors
  - Public opposition to waste repositories (especially Nevada's opposition to Yucca Mountain) convinced White House/DOE there won't be another US repository after Yucca Mountain
  - But Yucca Mountain's spent fuel capacity is limited, which, they argue, would bar a large nuclear expansion if the US continues with an "open" fuel cycle that treats spent fuel as disposable waste
  - GNEP redesigns the nuclear fuel cycle so that "**One repository can meet US needs for the rest of the century**"--we'll see what this means
- But first let's see what's going on with nuclear waste today

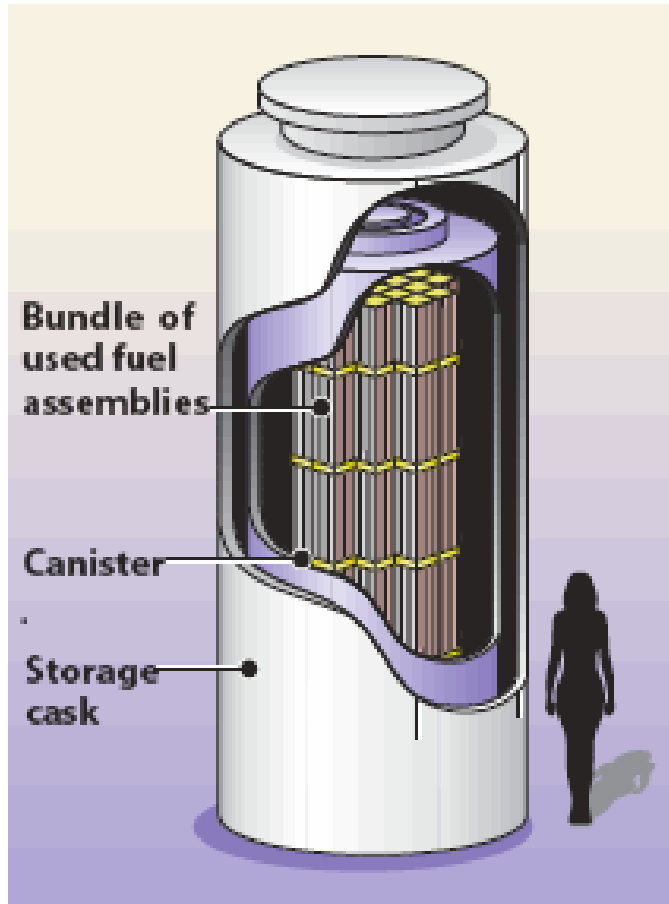
# About 20 tons of spent fuel/yr per reactor



# Spent fuel initially in deep reactor pool

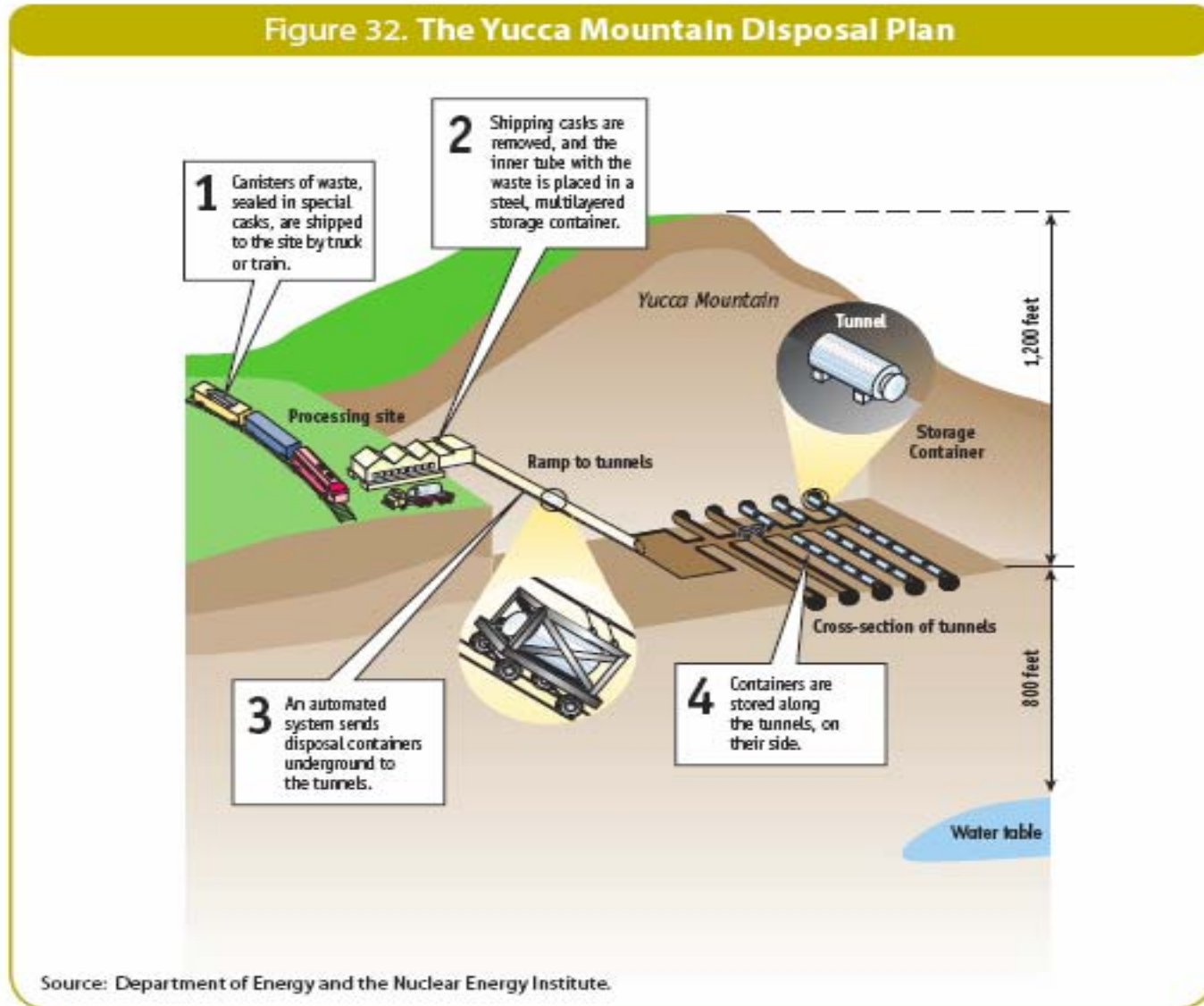


# After a few years--“dry casks”, simple, cheap



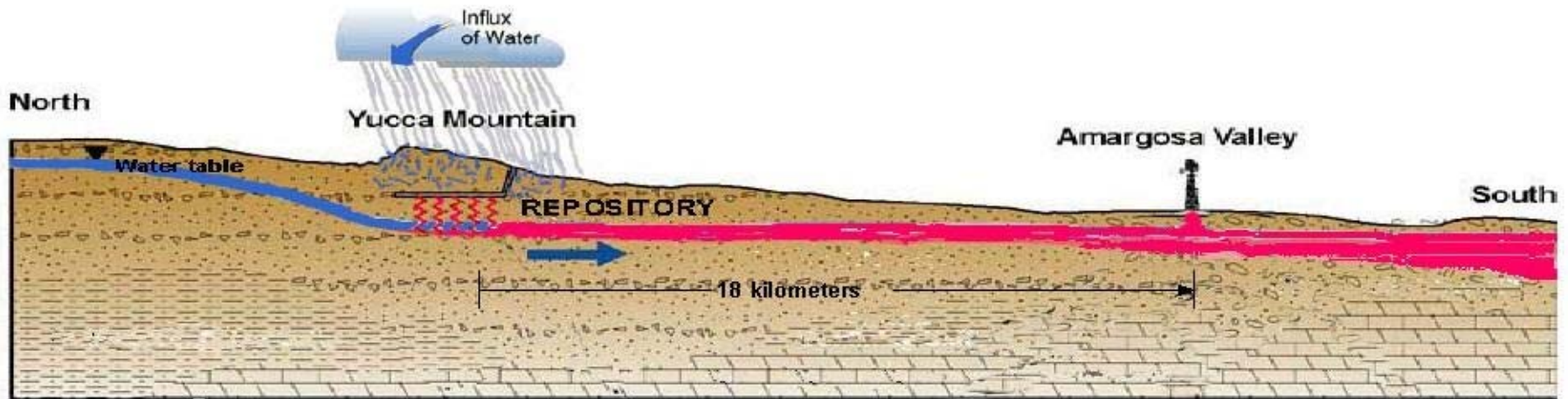
~10 tons  
per cask

# DOE's plan for disposal in Yucca Mountain



# But, Yucca Mountain project delayed

Stalled? DOE now puts opening after 2020 (originally 1998)



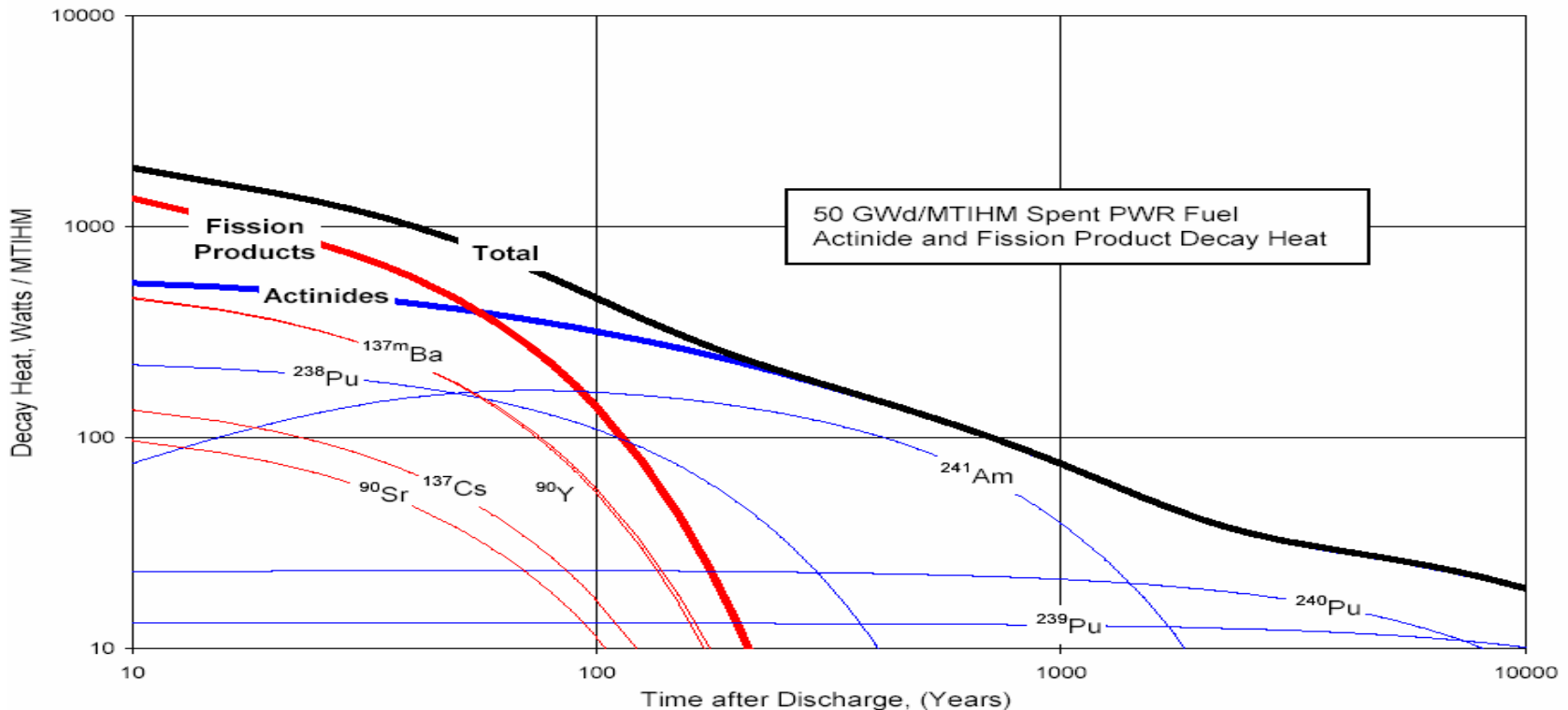
Problem is water: rain, infiltration, radioactive leakage, flow of contaminated water down to the moving water table, which then acts as a conveyor belt to Amargosa valley--DOE graphic on contamination sequence)

# De facto waste policy: surface storage



# GNEP: “One repository can meet US needs”

- GNEP rationale assumes
  - Must have a repository--the “public” won’t buy nuclear power without an underground waste repository for long-lived waste
  - But Yucca Mountain capacity is limited by the maximum design temperature of the rock tunnel walls and between tunnels (drifts)
- The GNEP solution is to get around these heat limitations by keeping the hottest spent fuel constituents out of the repository



# To do this GNEP would separate spent fuel constituents and treat each differently

LWR spent fuel rod

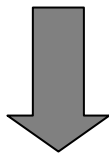


Uranium

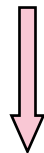
Other fission products:  
technetium  
iodine

Strontium,  
cesium

Plutonium, long-lived radioactive elements heavier than uranium



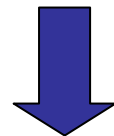
uranium  
95%



3. Dispose in  
Yucca  
Mountain



1. Store on  
surface

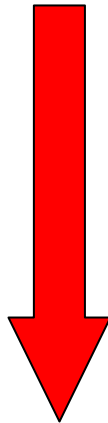


2. Recycle in fast  
reactors  
(to be developed)



# GNEP 1. Store hottest stuff *on surface*

Strontium and cesium

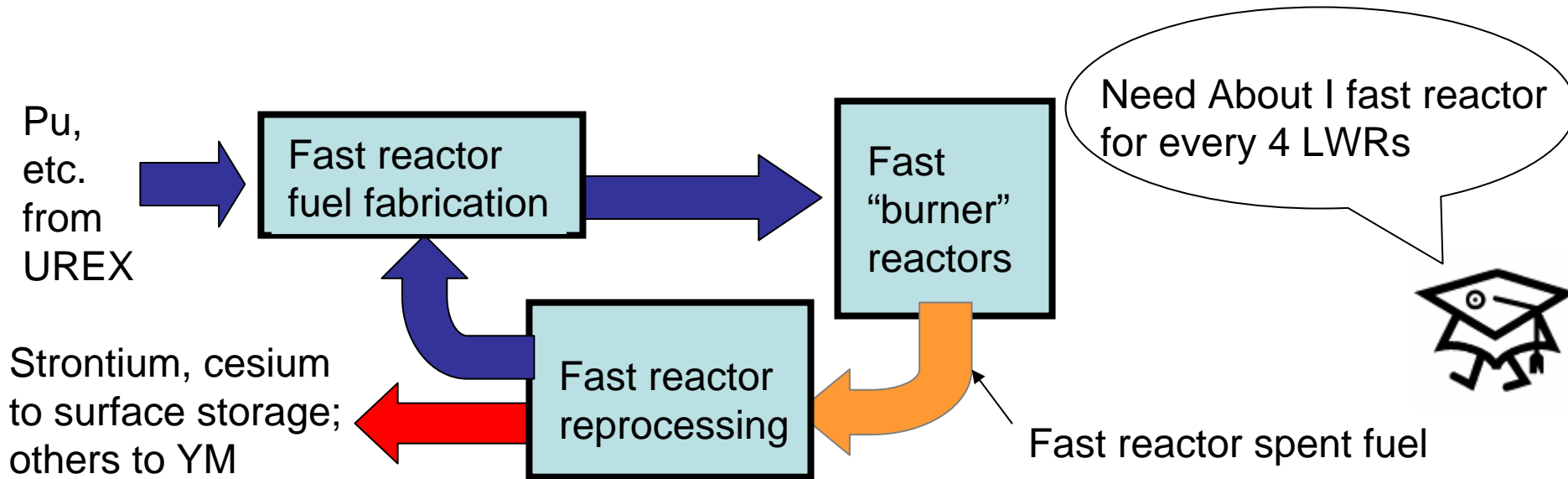


Surface storage

- Strontium and cesium main initial heat sources ~ 75 yrs
- Removing them lowers drift wall temperature (need to be <200 deg C)
- But strontium and cesium storage *would take roughly as much space as storing the original spent fuel (DOE)*
- For the next century, at least, this is likely to make the overall waste problem *bigger*

# GNEP 2. Burn transuranics in fast reactors

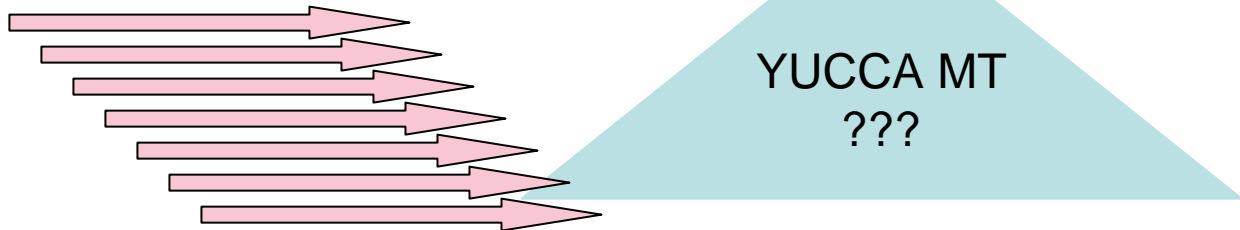
- After 75 years, actinides/transuranics main heat source
- Also the long-term radioactive sources
- *In principle*, they can all be used to fuel “fast reactors”
- To “burn” up most of the plutonium and other actinides would require *many passes* through the reactors
- This requires a different reprocessing scheme for the fast reactor fuel



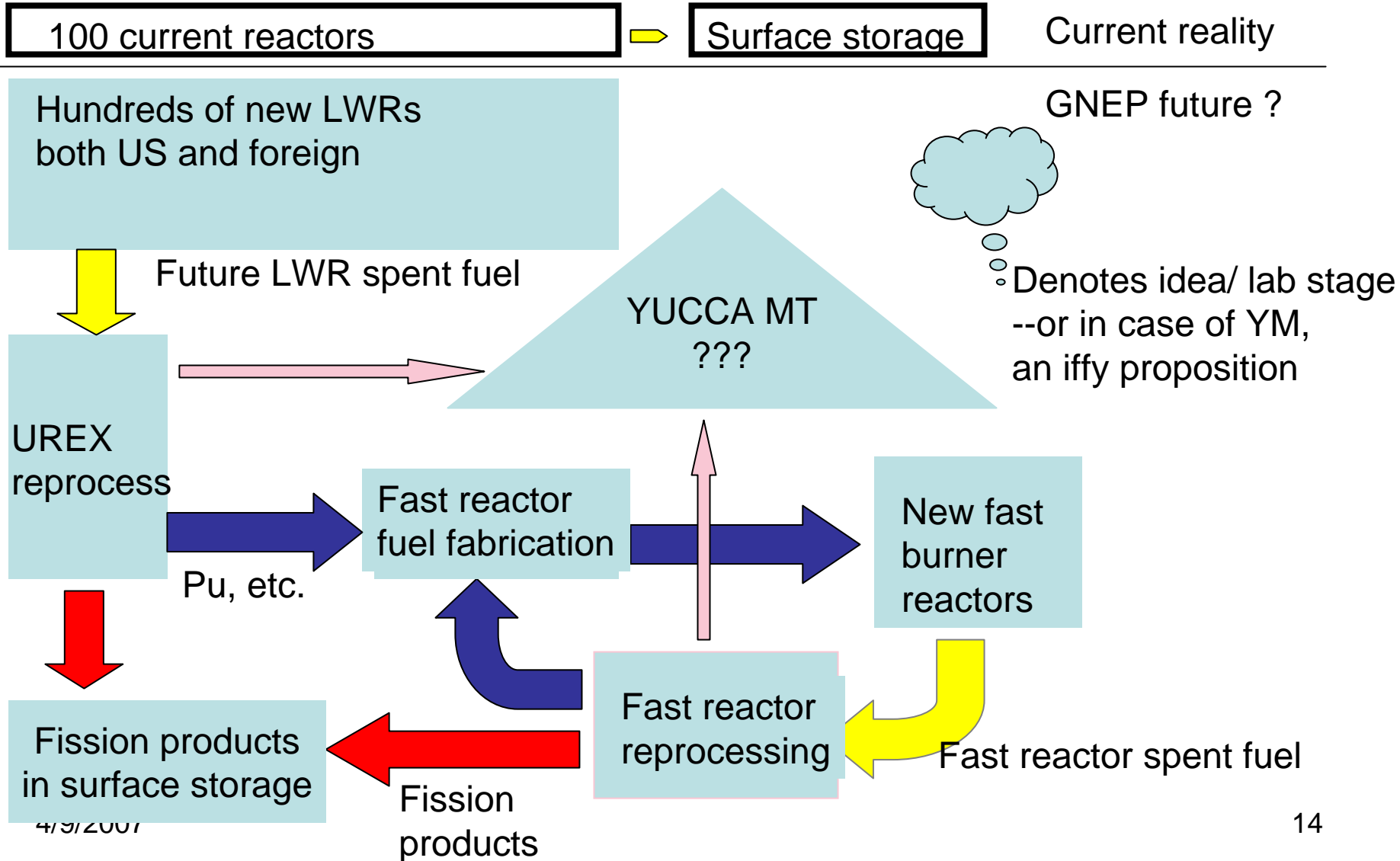
# GNEP 3. Dispose what's left in Yucca Mt.

- Long lived fission products: Technetium 99, Iodine 129--affect long term doses to biosphere
- Plus radioactive residue from reprocessing
- Basically, the idea is to put small fraction of each reactor's waste in Yucca Mountain--it doesn't increase repository *capacity*
- If there are hundreds of reactors--the operating assumption for GNEP--there will still be lots of waste in the repository, so this won't make Nevada happy

Tc 99, I 129, etc.  
Process residues



# Total GNEP technology vision



# Immediate federal budget decisions

- To demonstrate the technology DOE wants to jump start GNEP with
  - Commercial-scale reprocessing plant, and
  - Large fast reactor
  - (Fuel research facility)
- Getting way ahead of themselves--many uncertainties over scaling up fast reactor fuel and advanced reprocessing technologies from the lab
- “Fast tracking” first of a kind facility almost always leads to long delays and huge overruns
- No technical or economic reason to hurry

# More importantly, does it make sense?

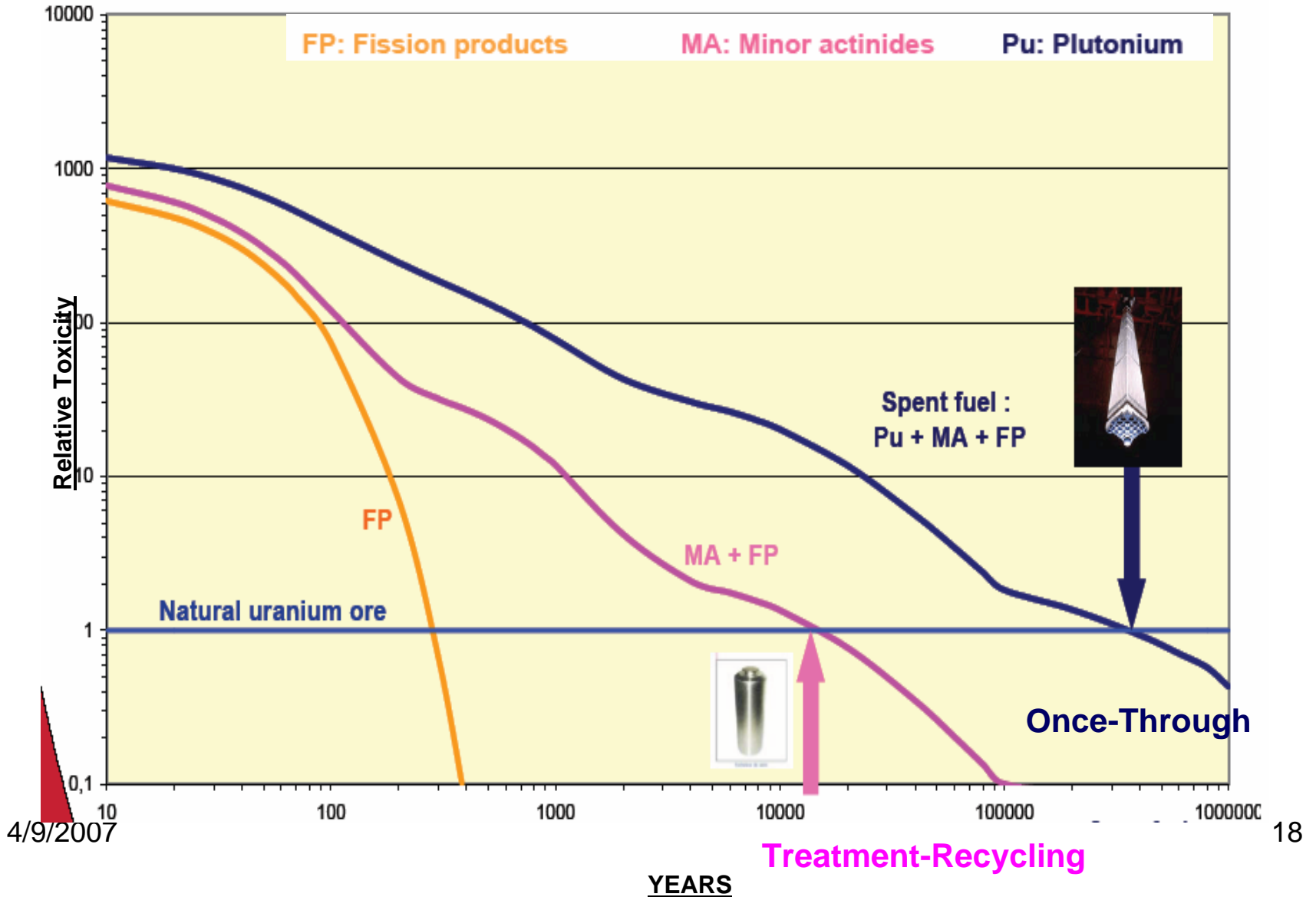
- *NOTE: GNEP does not claim we need to recycle for resource reasons, or that it would be economic--the traditional reasons for getting into reprocessing and fast reactors*
  - *See GNEP Strategic Plan, January 2007*
- GNEP--if it worked--would reduce the number of repositories BUT requires many reprocessing plants and expensive fast reactors AND fission product surface storage--where's the gain?
- All based on the idea the “public” will only embrace nuclear power if it looks as if one repository will do--a pretty thin rationale for something whose costs would likely be astronomic
- Finally, I doubt that Yucca Mountain will ever open, which will undo the whole enterprise

Why not just put the spent fuel in dry casks?



Backup slides

# Areva on GNEP vs PUREX vs once-through



# Pres. Bush on reprocessing

- “Listen, I proposed reprocessing agreements -- that stands in stark contrast to current nuclear theology that we shouldn't reprocess for proliferation concerns. *I don't see how you can advocate nuclear power . . . ,* in order to take the pressure off of our own economy, for example, *without advocating technological development of reprocessing*, because reprocessing will not only -- reprocessing is going to help with the environmental concerns with nuclear power. It will make there -- to put it bluntly, there will be less material to dispose.”
  - President Bush, New Delhi, India, March 2, 2006.