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Interim Storage of Power Reactor Spent Fuel

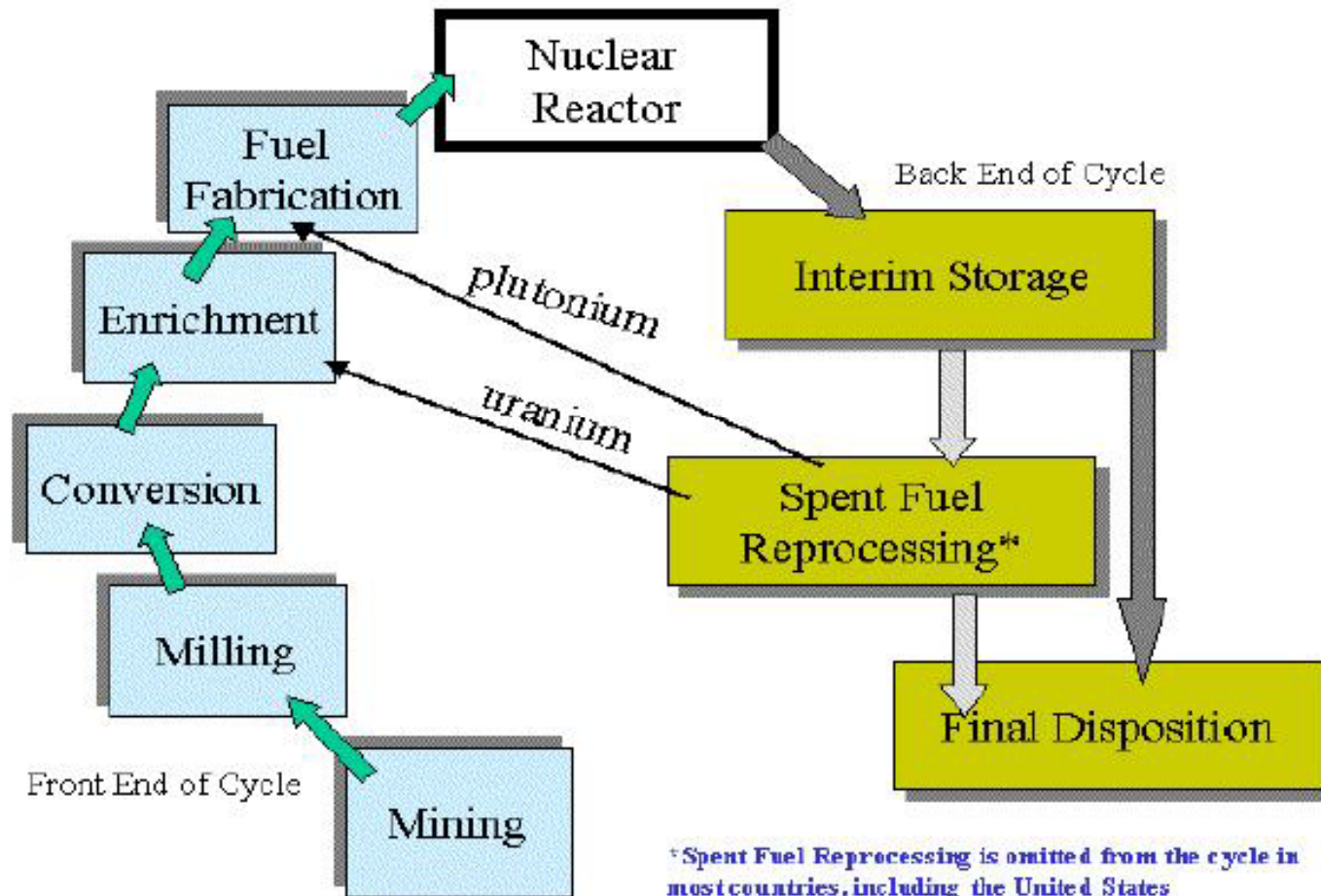
David Lochbaum
Director, Nuclear Safety Project

August 2010



Nuclear Fuel Cycle

Source: APS May 2005





Interim Storage Safety & Security Risk

Risk during reactor operation is so large that federal liability protection is required.

Nuclear
Reactor

Back End of Cycle

Interim Storage

Risk from irradiated fuel between these two high risk points cannot (and is not) benign.

Challenge of managing risk during disposition is so daunting that decades have passed and billions have been spent without resolution.

Final Disposition



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Interim Storage Options

Interim Storage Options

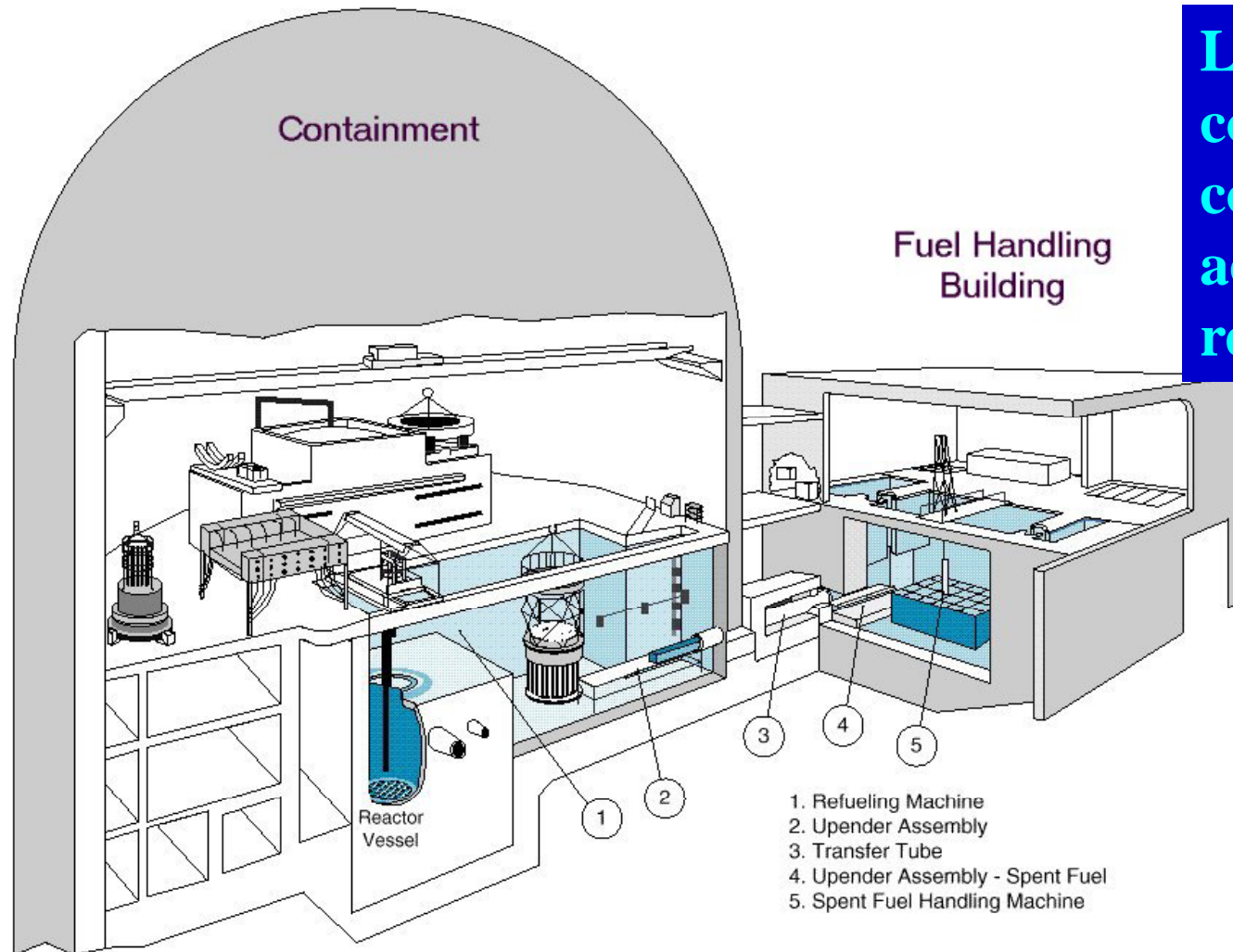
	Wet Pool Storage	Dry Cask Storage
Spent fuel inventory	Up to hundreds of tons	About 20 tons
Cooling method	Active heat removal	Passive heat removal
Source term	Up to entire pool	Absent common mode, limited to single cask



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Interim Storage PWR Spent Fuel Pools

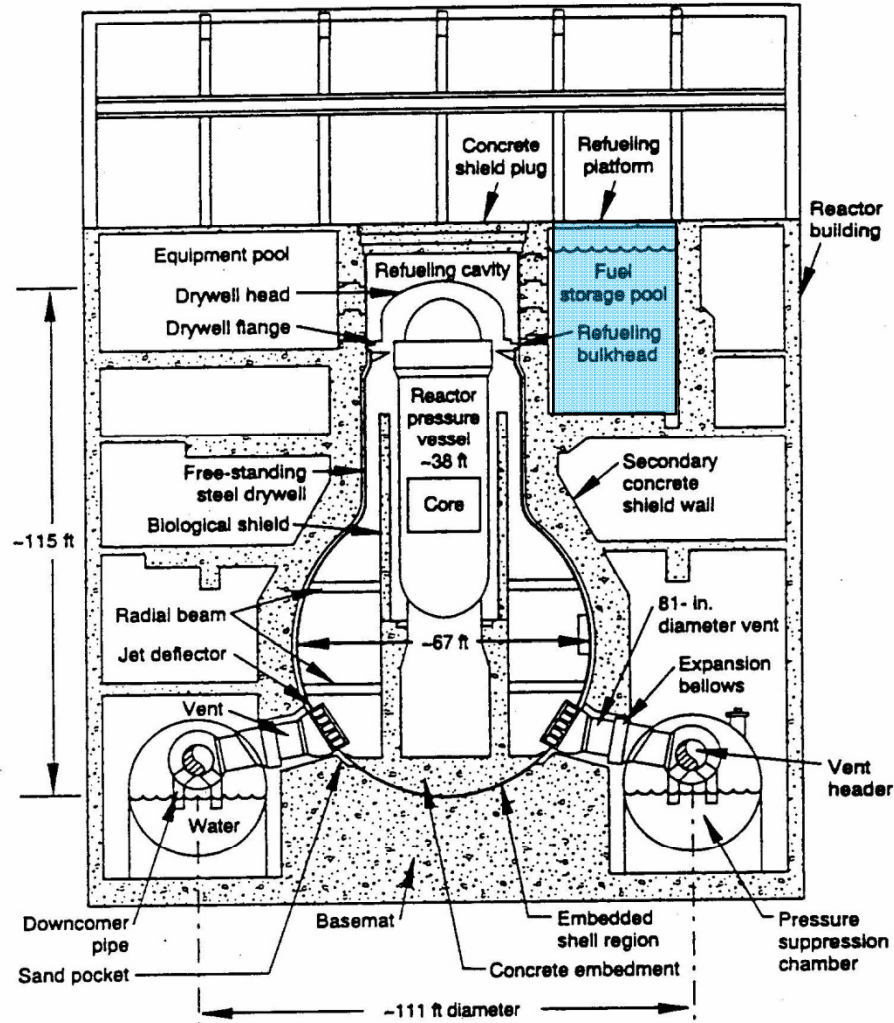


**Location outside
containment de-
couples SFP
accidents from
reactor accidents**



Interim Storage BWR Mark I Designs

Location inside
containment
couples SFP
accidents and
reactor accidents



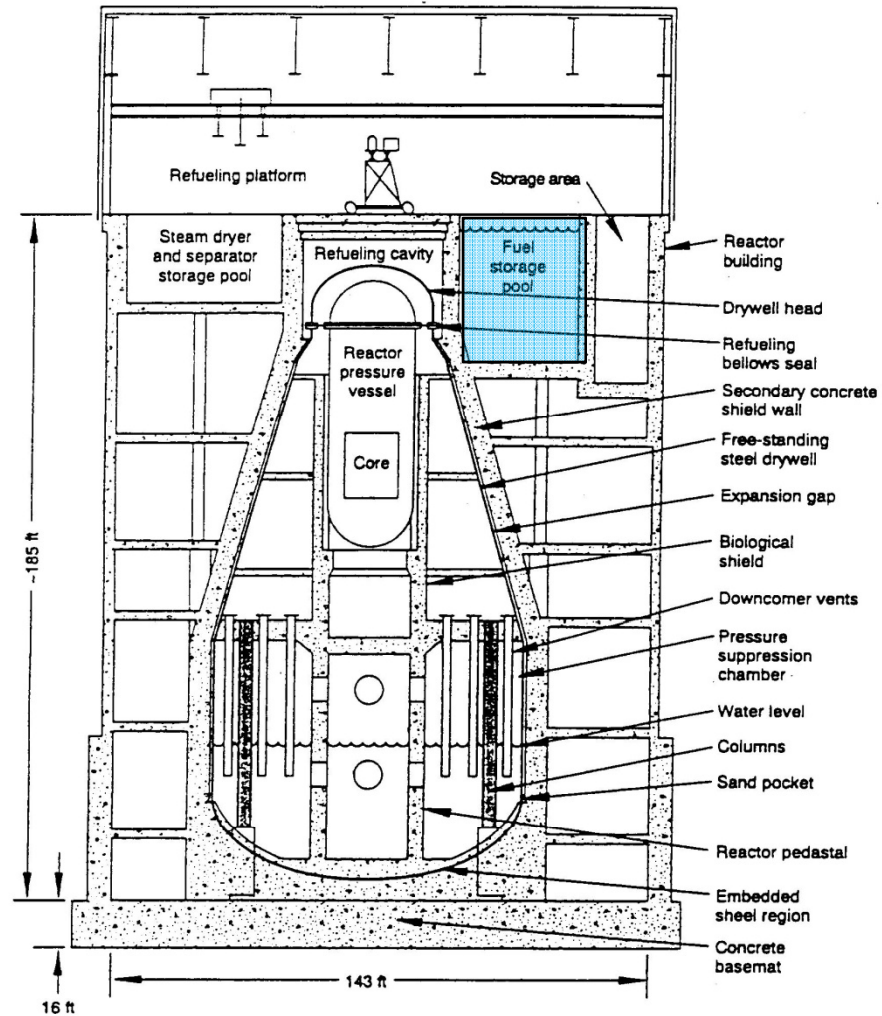


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Interim Storage BWR Mark II Designs

Location inside
containment
couples SFP
accidents and
reactor accidents





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Interim Storage Current Method

- ☹ **Irradiated fuel transferred from spent fuel pools to dry casks when pools are nearly full**
- ☹ **Transfers made only as necessary to create space for next spent fuel discharge**
- ☹ **Irradiated fuel dispersed semi-checkerboard-style within spent fuel pools to maximize time available to respond to inventory/cooling loss events**
- ☹ **Dry casks stored onsite on open pads**



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Interim Storage Preferred Method

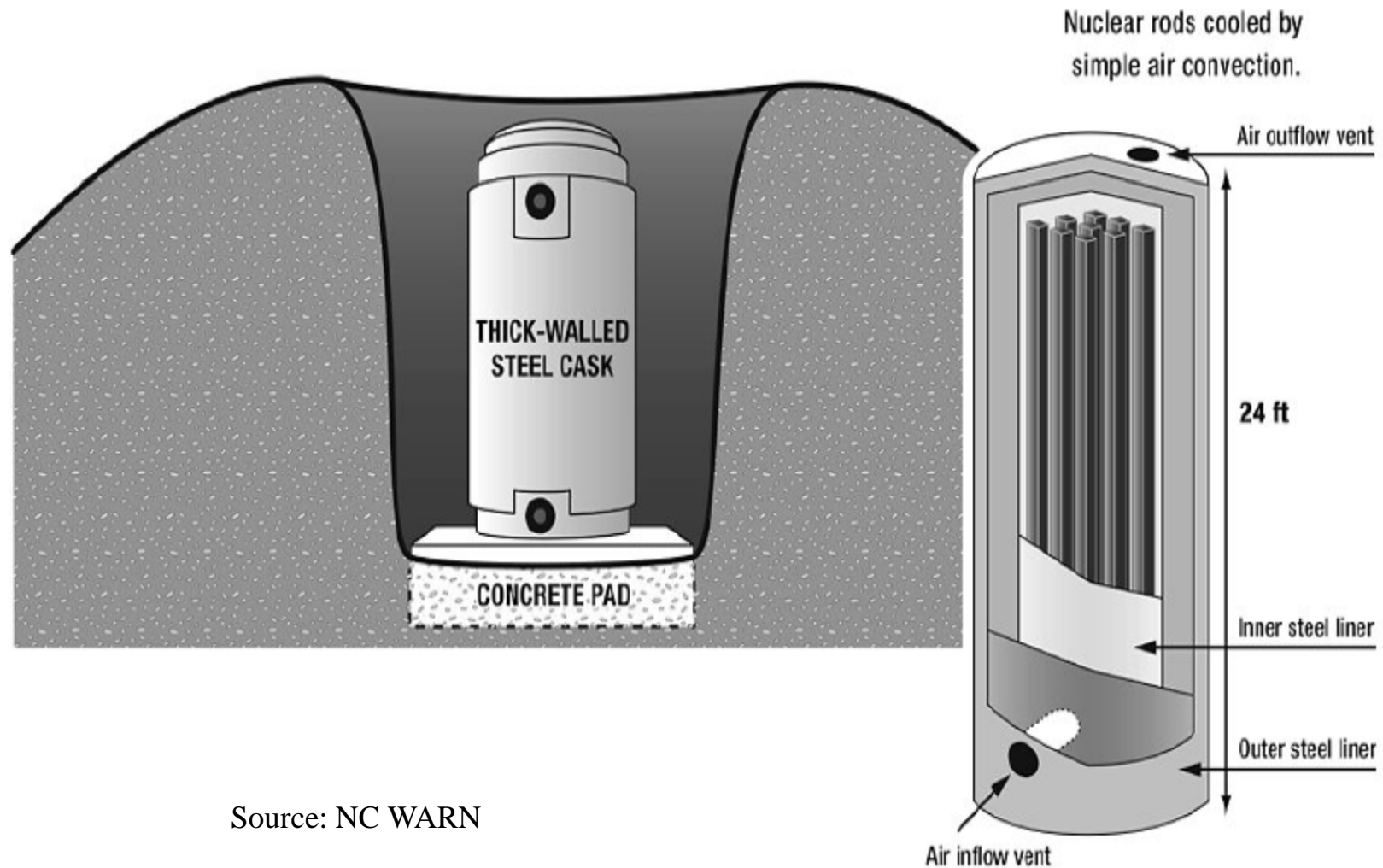
- ☺ **Irradiated fuel transferred from spent fuel pools to dry casks as soon as possible after being out of reactor for five years**
- ☺ **Irradiated fuel dispersed checkerboard-style within spent fuel pools to maximize time available to respond to inventory/cooling loss events**
- ☺ **Dry casks robustly stored onsite**



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Interim Storage Dry Cask Robust Storage



Source: NC WARN



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Interim Storage Dry Cask Robust-Lite





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Interim Storage Risk Management

Interim Storage Risk Management

	Current Method	Preferred Method
Probability of SFP accident	Higher	Lower
Consequences of SFP accident	Higher	Lower
Risk of SFP accident	Much Higher	Much Lower
Probability of cask accident	Lower	Higher
Consequences of cask accident	Same	Same
Risk of cask accident	Lower	Higher
Overall risk profile	Higher	Lower



Interim Storage Risk Management

Nuclear Plant Site Risk Management

	Site with Operating Reactor(s)	Site without Operating Reactor(s)
Risk of reactor accident	Highest	Zero
Risk of SFP accident	Medium	Zero
Risk of dry cask accident	Lowest	Highest

TAKEAWAY: Transferring spent fuel from operating plant sites to some interim location does little to reduce the sites' risk profile. But transferring spent fuel from permanently shutdown facilities flattens their risk profiles.



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Interim Storage Oft-Spoken Truth

“The most clear-cut example of an area where additional safety margins can be gained involves additional efforts to move spent nuclear fuel from pools to dry cask storage.”

Commissioner Gregory B. Jaczko
Speech at the Nuclear Energy Institute’s Dry Storage
Information Forum

May 13, 2008