

22.351 Systems Analysis of the Nuclear Fuel Cycle
Spring 2003
Problem Set #10

Several laboratories worldwide have considered developing non-fertile fuels to burn weapons grade plutonium (i.e., fuel without U-238).

One way to accomplish this is to employ the non fertile fuel in the peripheral assemblies of PWRs. Recall that 1 gram of fissile material is fissioned per MWd.

- (a) If 25 PWRs are employed in this manner, roughly how many years would it take in the U.S. to burn our excess WPu stockpile of ~ 50 MT of Pu_f. The reactors in question have the following characteristics:

TOTAL RATED POWER	3411 MWth
TOTAL U INVENTORY	88.2 MTHM (if all assy. are fertile)
TOTAL NO. OF ASSEMBLIES	193, of which
there are	48 on the periphery, which
operate at an avg. of	40% of core-average power: i.e.,
low-leakage management whether fertile or non-fertile type	
PLANT CAPACITY FACTOR	80%.

- (b) If fertile-loaded assemblies are discharged containing 0.8 w/o Pu_f at a burnup of 54,240 MWd/MT, determine whether the same scheme could be used to destroy the bred plutonium produced in the core interior at steady state; suggest any necessary improvements to achieve this goal.
- (1) What are the advantages and disadvantages of this scheme compared to using MOX to consume Pu_f?
- (2) What are the advantages and disadvantages of this scheme compared to using the same type of assemblies as a subcritical blanket driven by a spallation accelerator.