MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Nuclear Engineering

22.812 Nuclear Energy Economics and Policy Analysis Fall S '04

PROBLEM SET #6

Due: April 5, 2004

Question 1

According to Federal law, reactor operators are required to pay the U.S.
government a fee of 0.1 cents for each kilowatt hour of nuclear electricity sold in
order to cover the costs of high-level nuclear waste disposal. For a PWR
operating with a thermal efficiency of 33% and discharging spent fuel with an
average burnup of 35,000 MWD(th)/MTHM, what is the cost of disposal
expressed in dollars per kg of HM? How would this cost be changed by an
increase in discharge fuel burnup to 50,000 MWD(th)/MTHM?

Question 2

a. The U.S. uranium mining industry has long been struggling with weak
   domestic demand and competition from low-cost foreign producers. One
   strategy for increasing the demand for natural uranium would be to raise the
   tails enrichment assay at U.S. enrichment plants. If the tails assay were raised
   from a level of 0.2 weight percent of U-235 to 0.35 percent, by how much
   would the demand for natural uranium increase? (NOTE. Assume that the
   enrichment plants produce low-enriched uranium for light water reactors
   with an average U-235 enrichment of 4.5%.)

b. Another reason to increase the tails assay is that it would reduce the amount
   of electric power consumed by the enrichment plants. Assuming that the
   energy consumption is proportional to the amount of separative work, by
   how much would the energy requirement be reduced if the uranium tails
   assay is increased from 0.2 to 0.35 weight percent (again assume the average
   uranium product enrichment is 4.5%).