NUCL 40200 Engineering of Nuclear Power Systems

Assignment 5

(1) For gaseous diffusion enrichment plant calculate the number of stages in cascades required for the enrichment of fuel (product) from 2.5 weight percent to 5 weight percent with waste or tail assay of 0.2 weight percent. Use an increment of 0.2 weight percent of product in your calculation and plot the number of stages of cascade against product enrichment.

(2) In a PWR, one third of the core is removed and replaced with fresh fuel approximately once a year. For a nominal 1000 MWe PWR plant, each reload requires about 35,000 kg of 3.3 weight percent enriched UO_2. If the feed to the enrichment plant is natural uranium, and the tails assay is 0.2 weight percent
(a) how much feed is required per reload;
(b) how much would enrichment cost at the price of 150.7 per kg SWU.

(3) Assuming a fuel enrichment of 4.4 percent, a burnup of 2.55 TJ/kg U and LWR conversion factor of 0.56, what fraction of the uranium in the original ore is converted to energy through fission? The isotope separation tails assay is 0.002 $^{235U.}$