

Engineering Physics 6D3
Modular Course Problem Set #5
Due 2003 December 18
E-mail Solutions to roubenb@aecl.ca

Problems 1 – 3: 10 marks each
Total: 30 marks

The lattice void reactivity in milli-k is defined in terms of the infinite-lattice multiplication constants for the cooled and voided lattice:

$$\rho_{void} = 1000 \left[\frac{1}{k_{\infty}(\text{cooled})} - \frac{1}{k_{\infty}(\text{voided})} \right]$$

The three problems in this set have to do with determining how certain lattice parameters affect the coolant-void reactivity, as calculated with POWDERPUFS-V in the “instantaneous irradiation” option (input parameter 71=2.0), up to an exposure (irradiation) of 3.0 n/kb.

Thus you will first have to do a calculation of the void reactivity with the standard input, as reference.

Then do 3 calculations of the void reactivity again, with 3 lattice parameters changed (one at a time), as listed below. In each case plot the void reactivity vs. irradiation and compare with the same plot for the reference case (you could plot them on the same plot for ease of comparison). Explain briefly in words how the change in the parameter has affected the void reactivity (and as a function of irradiation).

The 3 parameters to be changed are:

- Prob 1. Moderator poison: assume 2 ppm B added to moderator.
- Prob 2. Moderator purity: assume reduced by 0.1 atom %.
- Prob 3. Coolant purity: assume reduced by 1 atom %.