22.06 ENGINEERING OF NUCLEAR SYSTEMS - Fall 2010

Problem Set 3

Reactor Designs

Reference Textbook:

[RAK] = Knief, R. A. *Nuclear Engineering: Theory and Technology of Commercial Nuclear Power*. 2nd ed. La Grange Park, IL: ANS, 2008. ISBN: 9780894484582.

1) [RAK] Chapter 7, Problem 7-9 (NOTE: Pick the PWR(W) as the representative PWR design; skip the PTGR design)

2) Table IV-1 in Appendix IV of the Knief textbook reports representative values of the core-averaged power density (power per unit core volume, or kW/L). What is the main reason for the different values among the various reactor types (PWR, BWR, CANDU, HTGR and SFR)? What are the economic and safety implications of a high core power density?

3) Explain and determine the sign of the reactivity feedbacks associated with the fuel, coolant and moderator in the PWR, BWR, CANDU, HTGR and SFR designs.

4) Although the BWR design does not require the use of steam generators, explain (qualitatively) why the capital costs of BWR and PWR plants are very competitive.

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