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Improving Inert Matrix Fuel Burnup Using a Linear Model

Inert Matrix Fuels (IMF) could be used in conventional reactors to recycle transuranics and reduce their overall production. Fuel residence time is a critical factor in maximizing the degree of transuranic burnup, and previous work has shown that it becomes difficult to maintain for discharge IMF burnup approaching 750 MWd/kgIHM. Achieving a balance between the number of UOX and IMF assemblies is important in maintaining criticality, as their discharge burnup, fuel pin pitch, uranium enrichment, etc. In previous work we presented a linear reactivity model that can be used to estimate the effect of UOX burnup, UOX enrichment, and pin pitch on criticality in a mixed IMF/UOX core. The linear reactivity model can be used to understand how to adjust the reactor design to cope with the decrease in reactivity associated with increasing the IMF burnup by 10 MWd/kgIHM. Reactivity estimates were validated against a single computer simulation of a full core, burn-up simulation of a modified Westinghouse AP1000 reactor with a mixed UOX-IMF core. Here we extend that work to reactor cores with six, seven, and eight IMF campaigns, and by adjusting uranium enrichment, pin pitch, and uranium burnup.