

Graphical Abstract  
Modeling and Simulation of Online Reprocessing in the  
Thorium-Fueled Molten Salt Breeder Reactor

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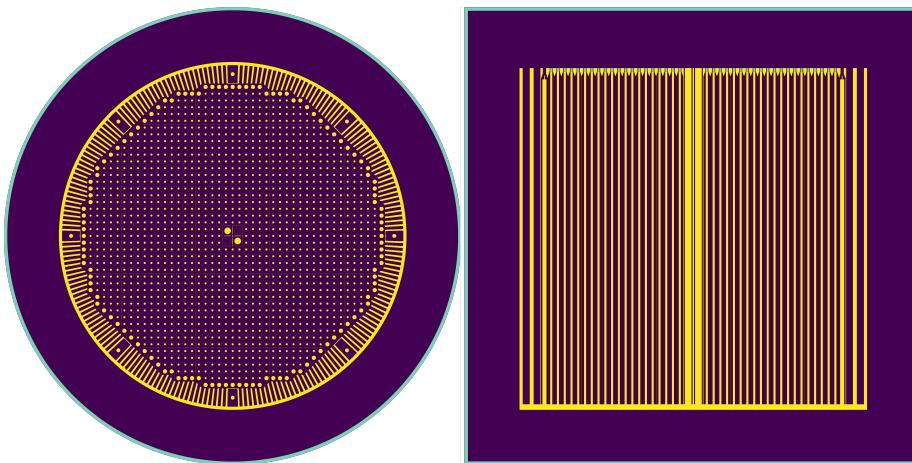


Figure 1: Plan and elevation views of SERPENT 2 Molten Salt Breeder Reactor model developed in this work.

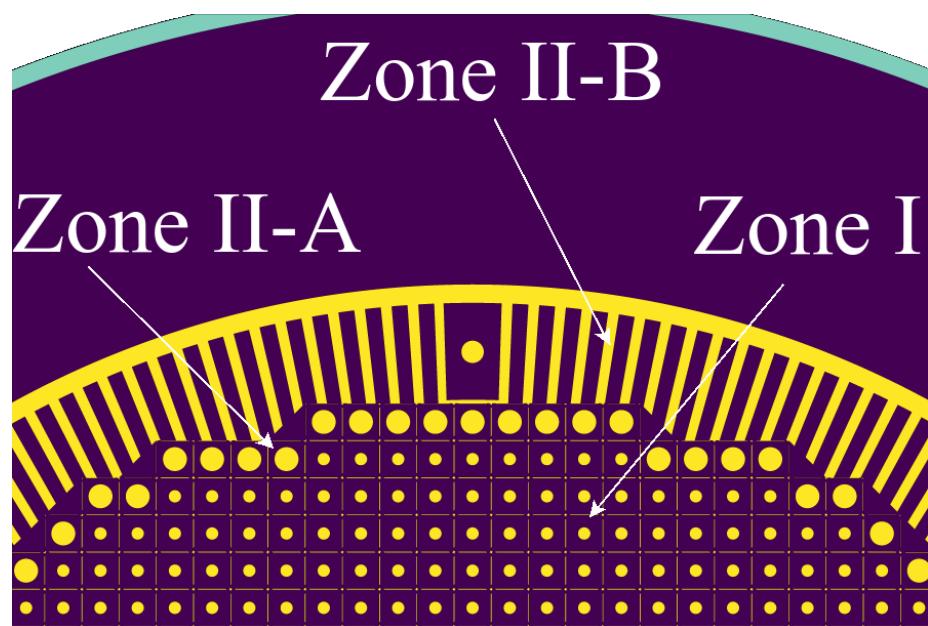


Figure 2: Detailed view of Molten Salt Breeder Reactor zone II model.

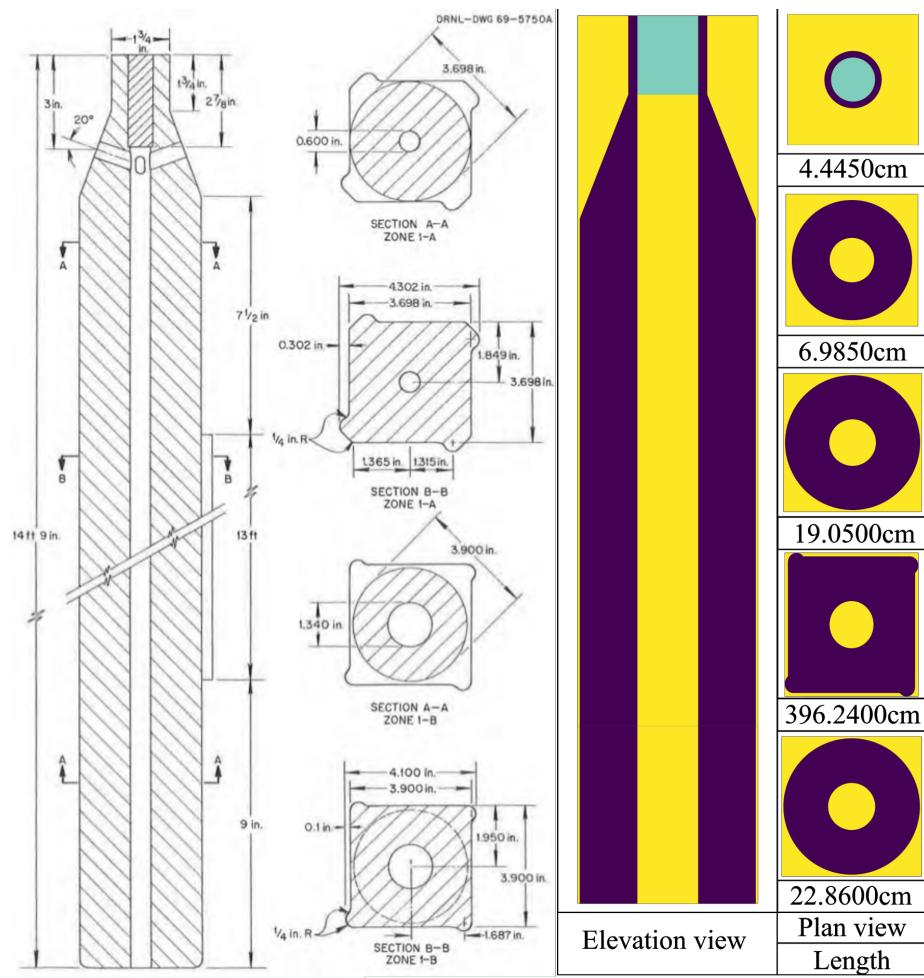


Figure 3: Graphite moderator elements for zone I.

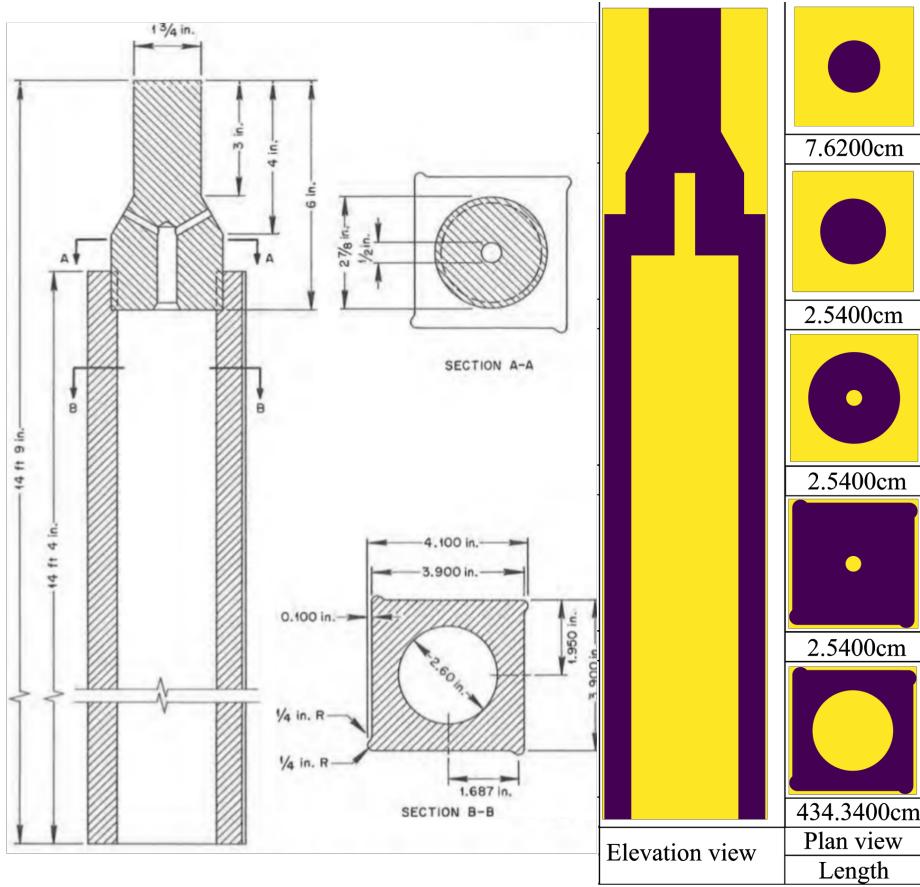


Figure 4: Graphite moderator elements for zone II-A.

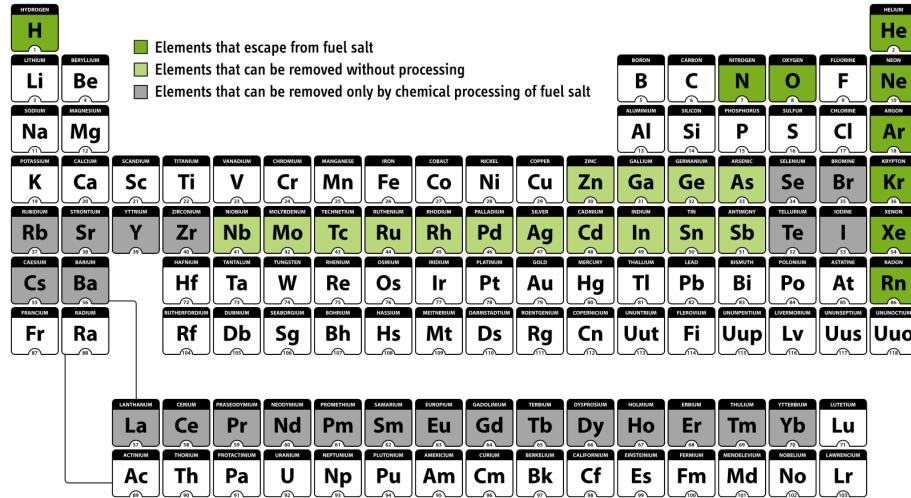


Figure 5: Processing options for Molten Salt Reactor fuels.

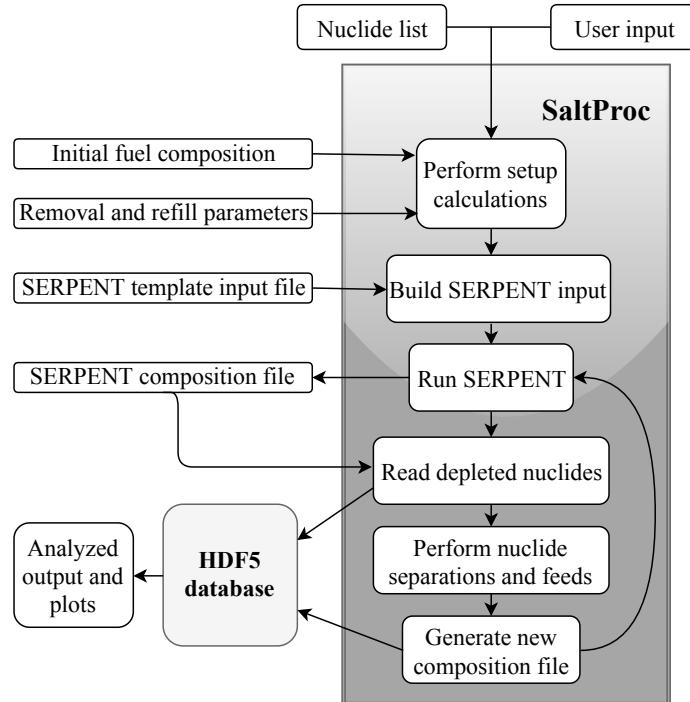


Figure 6: Flow chart for the Saltproc python-based tools.

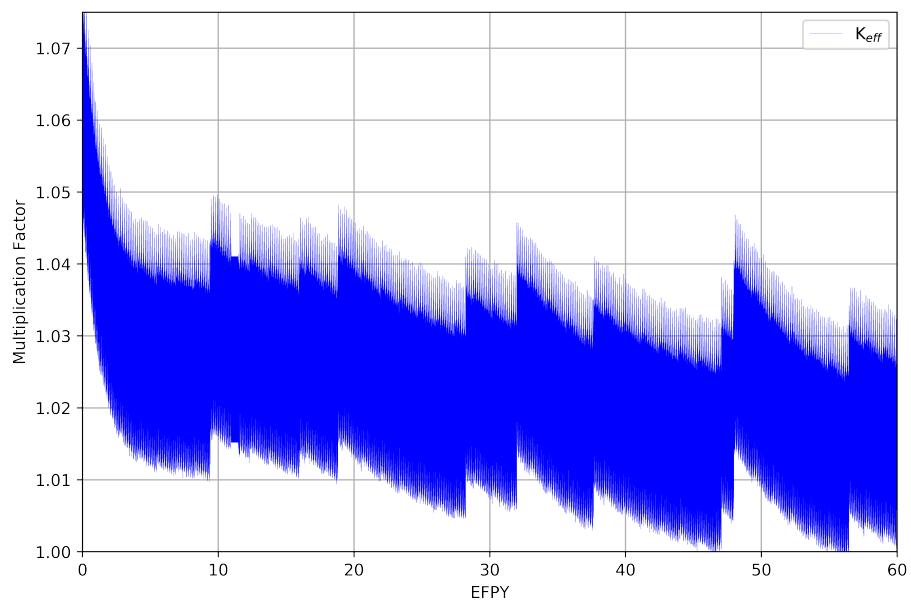


Figure 7: Effective multiplication factor dynamics for full-core model for a 60-year reactor operation. The confidence interval  $\sigma = \pm 15\text{pcm}$  is shaded.

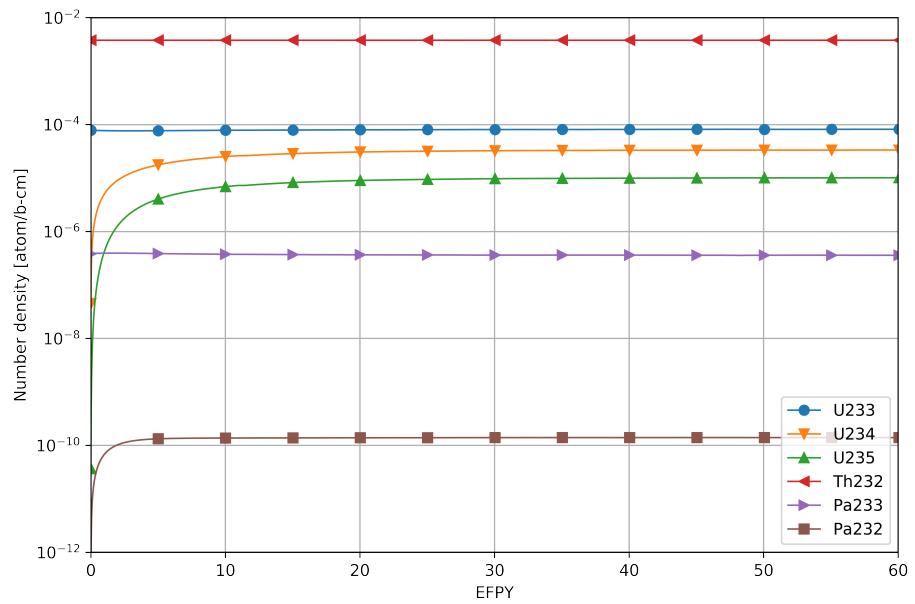


Figure 8: Number density of major nuclides during 60 years of reactor operation.

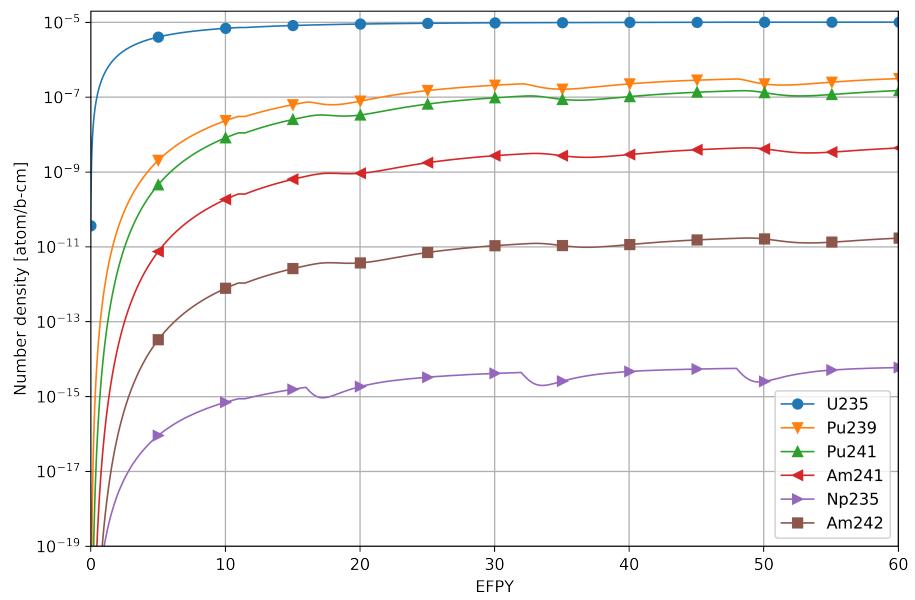


Figure 9: Number density of fissile in epithermal spectrum nuclides accumulation during the reactor operation.

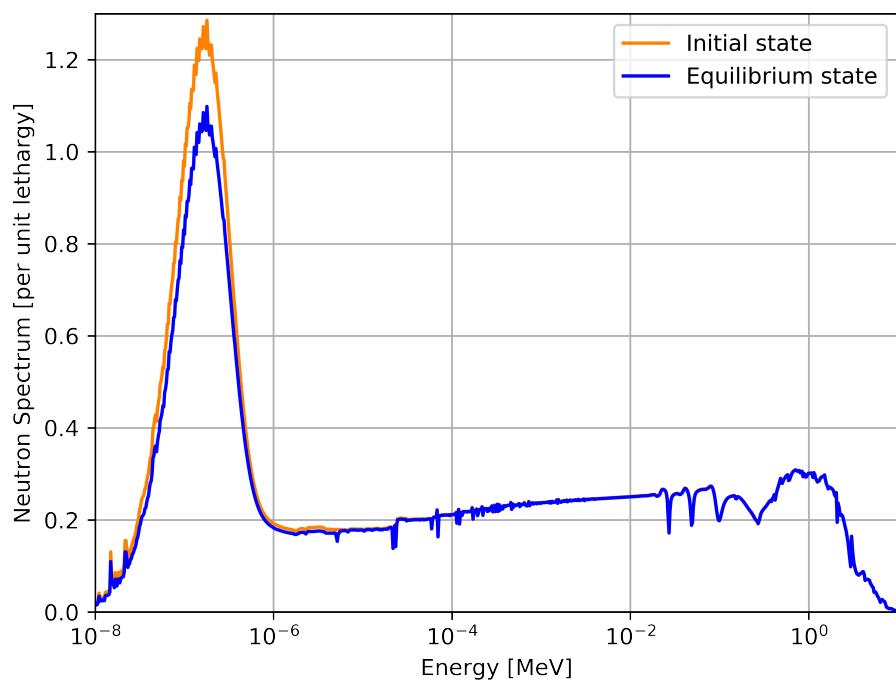


Figure 10: Neutron flux energy spectrum normalized by unit lethargy for initial and equilibrium fuel salt composition.

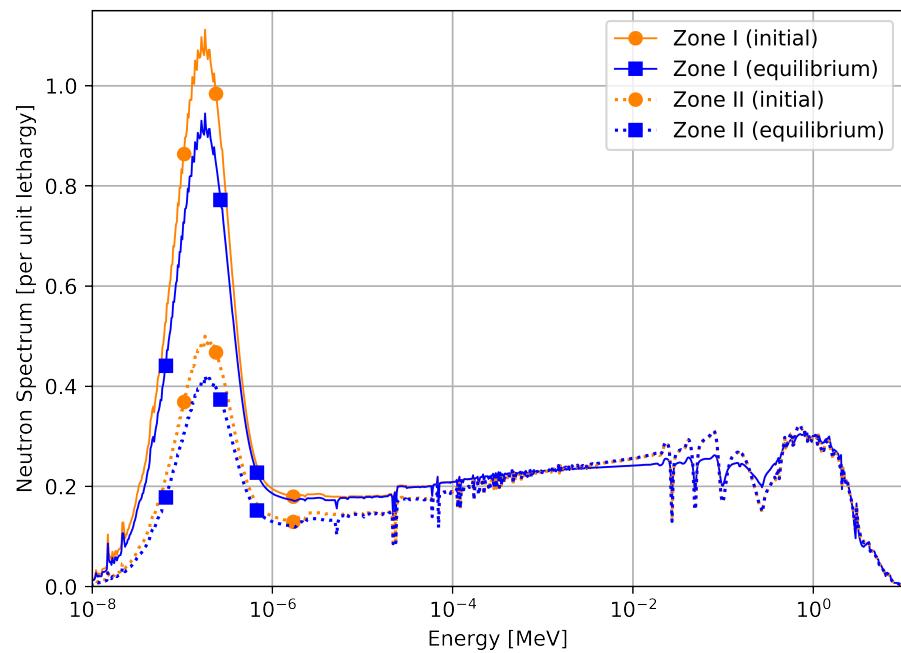


Figure 11: Neutron flux energy spectrum in different core regions normalized by unit lethargy for the initial and equilibrium fuel salt composition.

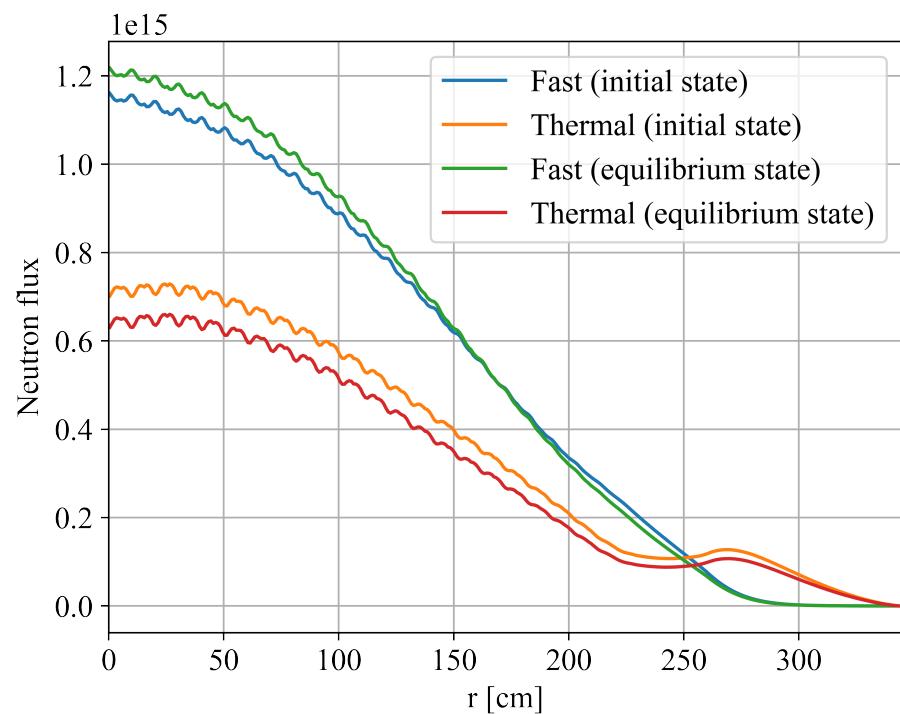


Figure 12: Radial neutron flux distribution for initial and equilibrium fuel salt composition.

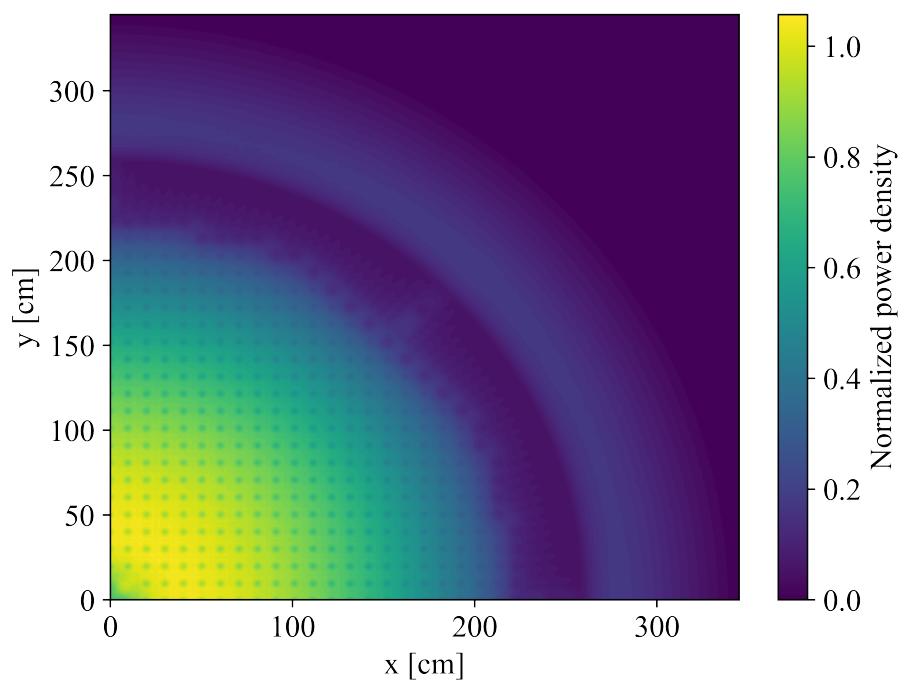


Figure 13: Normalized power density for both initial and equilibrium fuel salt composition.

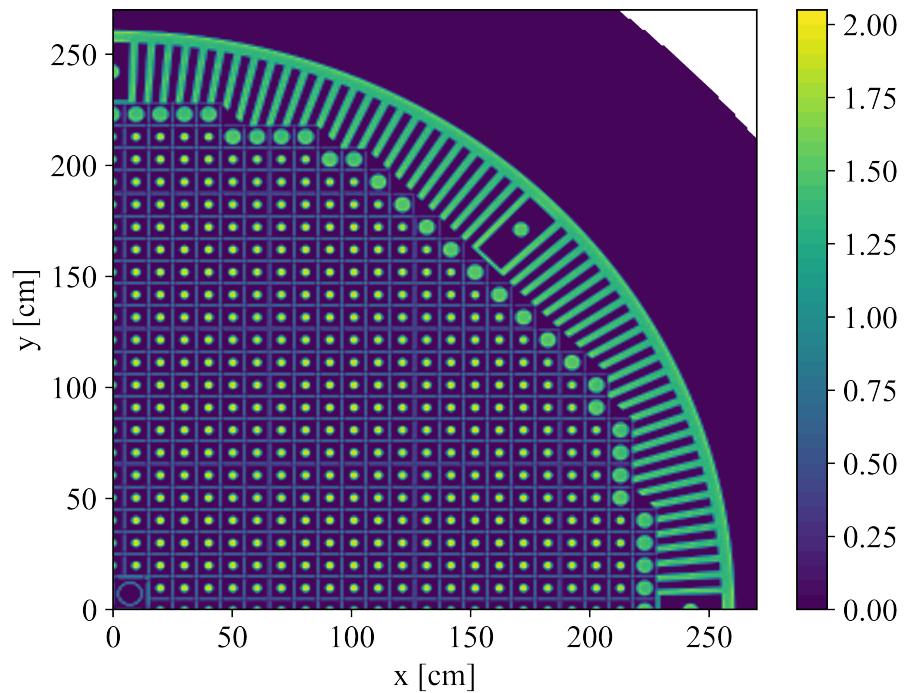


Figure 14:  $^{232}\text{Th}$  neutron capture reaction rate normalized by total flux for both initial and equilibrium fuel salt composition.

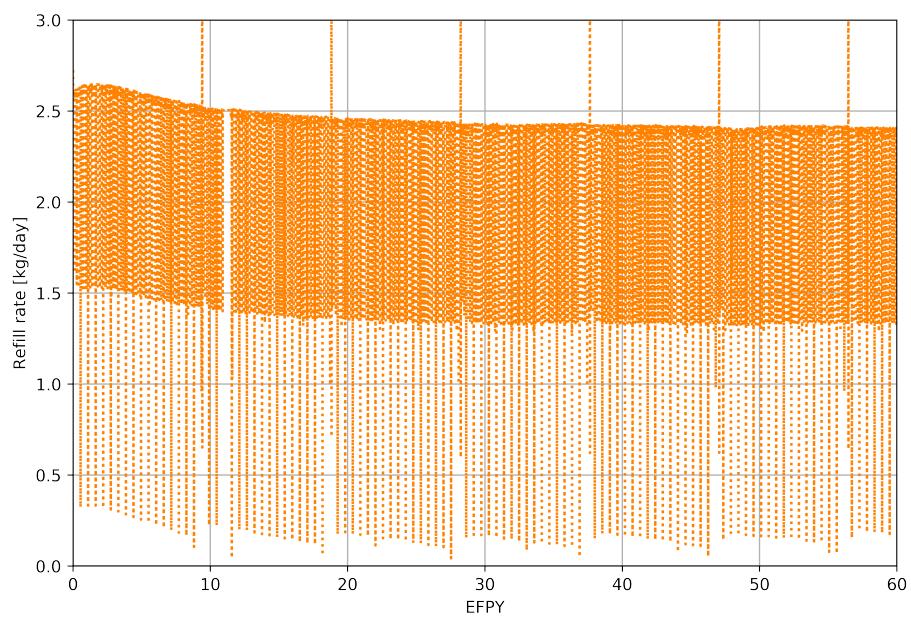


Figure 15:  $^{232}\text{Th}$  feed rate over 60 years of Molten Salt Breeder Reactor operation.

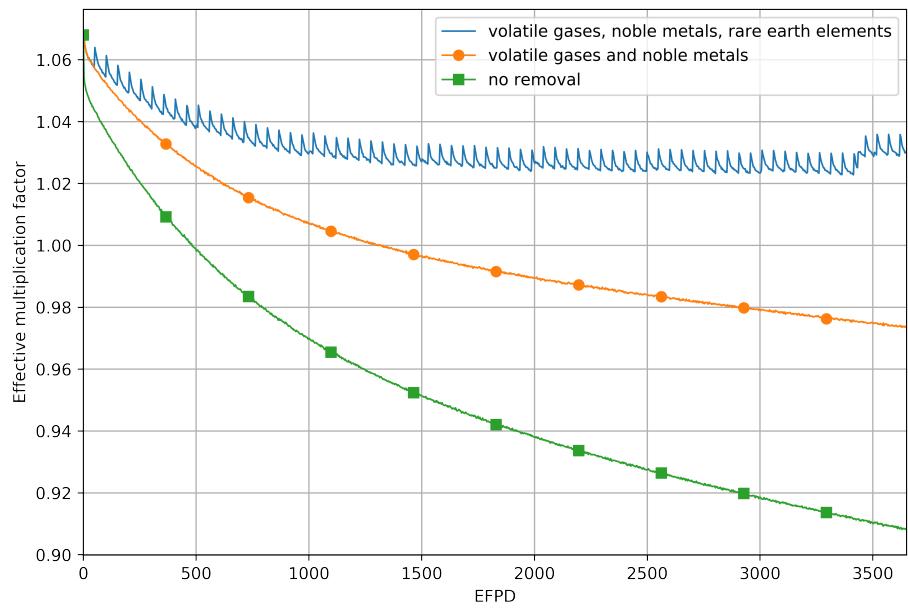


Figure 16: Calculated effective multiplication factor for full-core model with removal of different fission product groups over 10 years of operation. The confidence interval  $\pm\sigma$  is shaded.