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Computational investigation of transmutation efficiency of 237Np, 241/243Am spallation targets irradiated by 1 GeV proton

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Hazardous TRan-Uranic elements obtained by spent nuclear fuel can be transmuted to shorter half-life radioisotopes comparing before transmutation. Different scenarios are planned to transmute the TRUs in critical or subcritical reactor cores. Transmutation such radiotoxic elements can be considered via spallation process using charged-particle induced through a TRU target. In the present work, transmutation efficiency of 237Np and 241/243Am targets via 1 GeV proton irradiation has been studied separately. An optimized spallation target dimension has been determined to meet a keff less than 0.98 for both modeled targets. The obtained computational data showed 0.349 kg/y of 237Np transmutes due to fission reaction rate achieved by 10 μA current of a proposed proton beam irradiated the optimized-dimension target. Also, 0.336 kg/y of the irradiated 241/243Am target transmutes to short-lived radioisotopes. The neptunium target experiences higher axial and radial deposited heat than the modeled americium target.

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