Topical Meeting of the ANS Nuclear Criticality Safety Division 2009: Realism, Robustness and the Nuclear Renaissance; Richland, Washington; September 13-17, 2009

INVESTIGATION OF THE NEUTRONIC REACTIVITY INCREASE CAUSED BY THE REMOVAL OF NEUTRON ABSORBER PLATES FROM GENERIC SPENT NUCLEAR FUEL CANISTERS OF DIFFERENT DESIGNS

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Fixed neutron absorbers control criticality in spent nuclear fuel canisters designed and used for storage, transportation or disposal of spent nuclear fuel. Depending on the application, the neutron absorbers may be designed as plates, tubes, or sheets. To ensure subcriticality, the fixed neutron absorbers must maintain their required geometrical relationship with spent nuclear fuel during the intended operating life. The spent nuclear fuel canisters are usually designed to have absorber plates or tubes surrounding each loaded assembly for a greater reactivity reduction. An undesirable increase in reactivity can occur when the neutron absorber plates or the neutron absorbing agent in the plate materials are missing. This increase can reduce the overall margin of criticality safety. Missing plates and/or absorbing agent can be caused by manufacturing errors, material degradation or other operational and natural phenomena events. This study investigates the neutronic reactivity effect of missing neutron absorber plates from a generic commercial spent nuclear fuel canister. Different common absorber materials and various initial fuel enrichments are investigated as they are applied to a generic canister design modeled both with and without neutron flux traps. The results indicate that missing two or four plates will have a negligible effect on canisters with 2-cm flux traps and a relatively significant effect on canisters without flux traps. The reactivity increase per missing plate was higher for borated aluminum as compared to borated stainless steel plates.