Reduction, Mitigation, and Disposal Strategies for the Graphite Waste of High Temperature Reactors

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ABSTRACT:

The waste burden of irradiated graphite, or i-graphite, currently exceeds 250,000 metric tons worldwide, having been, and continuing to be the favored moderator for gas-cooled reactors. This IRP continuation seeks to enable advanced reactors through development of economically attractive and environmentally sound i-graphite management strategies. This is being achieved through a combined modeling, analysis, technology development, and repository science and regulatory studies campaign. In pursuit of our goals, a diverse team has been organized with Co-Project Leads at Stony Brook, Idaho National Lab and MIT. Our project takes advantage of key facilities and experts from the Idaho and Oak Ridge National Laboratories in close partnership with high-temperature reactor vendors Kairos Power and Xenergy, and with the graphite supplier Ibiden. As part of this continuation we will apply tools developed for nuclear block graphite waste mitigation under the original IRP to non-fueled graphite associated with fuel pebbles. This includes significant finding with regards to fabrication of low-nitrogen graphite bodies, measurement of the repository-critical Cl diffusion thermal diffusion coefficient and application of our simplified cleaning treatment of salted matrix graphite. Inclusion of matrix graphite into our source term reduction models (C-14 and metallic impurities) and disposal flowsheeting activity will also be carried out. Finally, our team will carry our hydraulic conductivity measurements both matrix and nuclear block graphite to support repository modeling.