Pilot-Scale Equipment Development For Pyrochemical Reduction of Spent Oxide Fuel*

by

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Argonne National Laboratory (ANL) has developed and is presently demonstrating the electrometallurgical conditioning of sodium-bonded spent metal fuel from Experimental Breeder Reactor II, resulting in uranium, ceramic, and metal waste forms. Equipment is being developed at ANL which will precondition irradiated oxide fuel and demonstrate the application of electrometallurgical conditioning to such non-metallic fuels as well.

The oxide reduction process preconditions irradiated oxide fuel such that uranium and transuranic (TRU) constituents are chemically reduced into metallic form via a molten Li/LiCl-based reduction system. In this form the spent fuel is further conditioned in an electrorefiner and waste handling equipment, thereby placing the uranium, TRU elements, and fissions products into stable forms suitable for placement in a long-term repository. Development of the Li/LiCl-based oxide reduction process has proceeded at lab- (nominally 50 grams of heavy metal (HM)) and engineering-scale (nominally 10-kg of HM) for unirradiated oxide fuel. This paper/presentation will describe the process and equipment design for scale-up from *lab-* and *engineering-scale* reduction of *unirradiated* oxide fuel in *gloveboxes* to *pilot-scale* (up to 100-kg of HM) reduction of *irradiated* oxide fuel in a *hot cell.*