# NUCLEAR ENERGY RESEARCH INITIATIVE

## Enhanced Control of PWR Primary Coolant Water Chemistry Using Selective Separation Systems for Recovery and Recycle of Enriched Boric Acid

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The economics of operating existing and advanced pressurized water reactors (PWRs) clearly identify that increasing nuclear fuel enrichment will produce more energy. To operate within the nuclear reactor safety requirements, the concentration of natural boric acid used as a flux chemical shim would have to be increased. Enriched boric acid (B-10) has a greater cross section than natural boric acid and is favored over natural boric acid. This occurs because of primary side-water, corrosion-cracking issues associated with the increased requirement for higher lithium hydroxide (Li-7) concentrations to maintain operational pH with an increased natural boric acid concentration. However, the cost of producing and using enriched isotopes such as B-10 and Li-7 requires a means to cost-effectively recover and reuse them.

Under the NERI category of fundamental chemistry, under fundamental science, work is proposed to develop and field test polymeric sequestering systems designed to efficiently and selectively recover enriched boric acid/lithium hydroxide from the primary coolant water of reactors. These advanced separation materials will reduce the cost of operating existing and advanced light water reactor systems by improving the chemical control of the primary reactor coolant. Contaminants present in the coolant system will be characterized regarding their potential for interfering with the selective recovery of B-10 and Li-7, and counter measures will be developed to mitigate their interference. Cost benefits will result from greater energy production per reactor unit, reduced operational radiation exposure, and protection from accelerated corrosion of critical core components.