U.S. DEPARTMENT OF ENERGY
NUCLEAR ENERGY RESEARCH INITIATIVE
ABSTRACT

PI: **Lloyd Brown** **Proposal No.: 99-0238**

Institution: **General Atomics**

Collaborators: **University of Kentucky, Sandia National Laboratory**

Title: **High Efficiency Generation of Hydrogen Fuels Using Nuclear Power**

Hydrogen is an environmentally attractive transportation fuel that has the potential to displace fossil fuels. If the hydrogen is produced using energy derived from fossil fuels, there is little or no environmental advantage.

The objective of this work is to define an economically feasible concept for the production of hydrogen, by nuclear means, using an advanced high temperature nuclear reactor as the energy source. Hydrogen production by thermochemical watersplitting, a chemical process that accomplishes the decomposition of water into hydrogen and oxygen using only heat or a combination of heat and electrolysis instead of pure electrolysis, meets these goals. Thermochemical watersplitting cycles have been known for the past 35 years but substantially neglected in the U.S. for the past 10 years. While there is no question about technical feasibility and the potential for high efficiency, cycles with proven low cost and high efficiency have yet to be developed. Hundreds of cycles have been proposed, but substantial research has been done on only a few. All the cycles available will be screened using objective criteria to determine which can benefit, in terms of efficiency and cost, from the high temperature capabilities of advanced nuclear reactors. Additionally, the cycles will be analyzed considering the latest improvements in materials of construction and new membrane separation technologies. Guided by the results of the screening process, one cycle will be selected for integration into the advanced nuclear reactor system. The required flowsheets will be developed and preliminary engineering estimates of size and cost will be made for major pieces of equipment. From this information, a preliminary estimate of efficiency and cost will be made.