

# ***NUCLEAR ENERGY RESEARCH INITIATIVE***

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## **Development of Risk-Based and Technology-Independent Safety Criteria for Generation IV Systems**

PI: William E. Kastenberg, University of California at Berkeley

Project Number: 05-080

Collaborators: None

Related Program: Gen IV

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### **Project Description**

This project will develop quantitative safety goals for Generation IV (Gen IV) nuclear energy systems. These safety goals will be risk based and technology independent. The foundations for a new approach to risk analysis will be developed, along with a new operational definition of risk. This project will further the current state-of-the-art by developing quantitative safety goals for both Gen IV reactors and for the overall Gen IV nuclear fuel cycle. The risk analysis approach being developed will quantify performance measures, characterize uncertainty, and address a more comprehensive view of safety as it relates to the overall system.

Appropriate safety criteria are necessary to manage risk in a prudent and cost-effective manner. This study is also important for government agencies responsible for managing, reviewing, and for approving advanced reactor systems because they are charged with assuring the health and safety of the public.

### **Work Scope**

- Task 1: Formulate a trial set of quantitative safety goals, considering the risks to the general public and those residing near nuclear plants and analyzing NRC's safety goals for commercial reactors, DOE's safety goals for defense facilities, safety goals for other hazardous industries, and radioactive exposure information. Risk will be formulated in absolute, incremental, and relative terms.
- Task 2: Create an operational definition of risk, based on recent advances in Network Theory, which accounts for the complexity, uncertainty, and ambiguity of Gen IV systems. Create a nodal model for a nuclear energy system and numerically simulate loss of bulk materials, particulate and gaseous release, and waste materials to characterize risk.
- Task 3: Develop a benefit/cost risk management scheme to evaluate design options of Gen IV systems and formulate top-level safety goals for allocation to nuclear systems, sub-systems and components.