

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

---

**PI:** George Davis **Proposal No.: 99-0058**

**Institution:** ABB Combusion Engineering Nuclear Power

**Collaborators:** Sandia National Laboratory, Idaho National Engineering & Environmental Laboratory, Massachusetts Institute of Technology, North Carolina State University, Duke Engineering Services Inc., Egan Associates

**Title:** Risk Informed Assessment of Regulatory and Design Requirements for Future Nuclear Power Plants

---

The goal of this proposed research project is to develop a scientific, risk-informed approach for simplifying new nuclear plant designs, by using risk analysis tools to identify (and, then, eliminate or modify) deterministic regulatory requirements and industry standards that are not significantly contributing to reliability and safety.

Deregulation of the U.S. electric power industry will dramatically impact the way in which future plant buyers will consider capital costs for adding new generating capacity. The major impediment to nuclear energy's long term competitiveness in this newly developing marketplace will be its relatively high capital cost – which may need to be reduced on the order of 35% below the industry's current cost projections. To achieve such a substantial reduction, future designers will need to fundamentally reevaluate the current design bases for new nuclear plants – in particular, the regulatory requirements and industry standards.

The current collection of regulatory requirements and industry standards is a hodgepodge of deterministic criteria, based largely on non-quantitative criteria and engineering judgement that evolved over the last forty years of the nuclear energy industry. There is now a growing awareness within government and industry that many of the current requirements and standards are not contributing significantly to reliability and safety and, therefore, have needlessly driven the costs of new nuclear plants into a range that will not be economically competitive in the U.S. Moreover, the overly prescriptive nature of those requirements and standards also inhibits the introduction of new, more advanced technologies. The NRC, the Nuclear Energy Institute, and the rest of the nuclear industry are already working together to apply risk-informed, performance-based regulation to licensing issues that impact the operation of the existing nuclear plants. The Supplemental Information section of this proposal includes a very relevant article from the January 1999 issue of *Nuclear News*, in which NRC Chairman Shirley Jackson discusses "Transitioning to risk-informed regulation: The role of research". The Supplemental Information section also includes a copy of SECY-98-300, the NRC Staff's new recommendations to the Commissioners, as to how NRC should proceed with plans to risk-inform 10CFR50.

*This proposed research project would complement the ongoing effort by focusing upon issues that*

---

*impact the design and construction of new nuclear plants.* To do so, this project will:

- (1) develop a methodology for systematically evaluating all of the regulatory requirements and industry standards that affect future nuclear power plant designs, using Probabilistic Risk Assessment (PRA) tools to quantify their relative performance-benefits and costs;
- (2) develop a methodology for systematically applying the results of the preceding evaluations to all systems and structures in a nuclear power plant design, with the objective of simplifying the systems and structures (as a means to reduce plant costs), without sacrificing reliability and safety;
- (3) identify gaps in the nuclear industry's PRA database and then develop an industry program for filling in those gaps;
- (4) identify and prioritize the nuclear plant systems and structures that would yield the greatest benefits, in terms of performance and costs, from application of such an evaluation;
- (5) develop an integrated risk and cost benefit evaluation tool,
- (6) provide a sample application of the methodologies to a typical system; and
- (7) participate in the dialogue between NRC and the nuclear industry, concerning risk-informed, performance-based regulation, by adding a voice for new plant issues.