

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

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Proposal No.: 99-0043

Institution: Argonne National Laboratory

Collaborators: Lawrence Livermore National Laboratory, Texas A&M University

Title: Monitoring and Control Technologies for the Secure, Transportable, Autonomous Reactor (STAR)

A new reactor and fuel system concept designated as the Secure, Transportable, Autonomous Reactor (STAR) has been proposed by a team of national laboratories, industry and universities. The STAR concept focuses on meeting the needs of developing countries for small, economical nuclear power stations while at the same time addressing proliferation concerns. The research proposed here supports this goal through (a) development of operations monitoring, control and remote surveillance strategies that exploit the passive safety and autonomous operation attributes of the STAR plant, and (b) development and demonstration of advanced technologies for implementing these strategies such that operational reliability and nuclear materials security are assured. Specific objectives of this research are to simplify active control and safety protection systems, to minimize reliance on on-site operating staff, and to assure high levels of operational safety, reliability and facility security. Proposed research tasks are (1) evaluate and compare the ability of candidate STAR reactor systems to operate autonomously with minimal reliance on active control for load adjustment and burnup reactivity loss compensation, (2) identify design and operating features that enhance operational autonomy and passive safety, (3) develop simplified and highly robust control strategies on the basis of the passive plant response, and (4) develop and demonstrate computer-based technologies that allow plant operations and safeguards to be monitored remotely at centralized facilities where maintenance and upset recovery functions are coordinated for several plants.

The proposed work is essential for the safe, reliable and cost-effective operation of small nuclear power stations deployed in developing regions and to minimizing on-site staffing levels and staff skill requirements. Although proposed in the framework of the STAR system development project, the research plan addresses questions of fundamental importance to the operation of passively safe and highly autonomous plants. Successful resolution of these questions will increase the immunity of passively safe plants to operator and control system errors and will provide a technical basis for reducing the cost of plant control and safety protection systems. This work is thus strongly supportive of the fundamental NERI goals of developing advanced nuclear power systems that are safe, proliferation resistant and economically competitive.

The team of national laboratories (ANL and LLNQ and universities (Texas A&M) proposing this research has the experience and credentials needed to ensure successful completion of the proposed work. The team's experience encompasses the development and analysis of passively safe reactors and the execution of leading edge research on technologies for monitoring, diagnosis, control, and security/safeguards of nuclear plants and other complex systems.
