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

Development of Enhanced Reactor Operation Strategy through Improved Sensing and Control at Nuclear Power Plants

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Collaborators: Ohio State University (OSU); KAERI; Cheju University

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The project proposes that the Oak Ridge National Laboratory (ORNL), The Ohio State University (OSU), the Korea Atomic Energy Research Institute (KAERI), the Chosun University (CU) and the Cheju National University (CNU) collaborate to examine, develop, and demonstrate how modern sensing and control can improve the operation of nuclear power plants.

A more precise knowledge of the reactor system state (e.g., primary coolant temperature, core flux map, primary and feedwater flowrates) can facilitate operation closer to design margins, improved thermal efficiency, and extended fuel burn-up. As a result, advanced control methods (e.g., innovative control algorithms) need to be developed to realize the benefits offered by improved sensing capability.

The project consists of three tasks. The objective of the first task is to evaluate the basis for current reactor operation strategies including assessment of the state-of-the art for primary system measurement, investigation of the effects of measurements limitations on operational performances of existing NPPs, and identification of potential operational/safety improvements resulting from improved measurement and control. The objective of the second task is to develop three advanced sensors; a solid-state in-core flux monitor, a Johnson noise thermometer and a magnetic flowmeter. The objective of the third task is to take advantage of the benefits of improved sensors by devising advanced reactor operational strategies that optimize core performance and permit reduced operational margins.

Although the primary focus will be application to Generation IV reactors, the results will also have applicability to current operating plants.