

# INTRODUCTION TO THE ICAPP '06 SPECIAL ISSUE

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This issue of Nuclear Technology features selected papers from the 2006 International Congress on Advances in Nuclear Power Plants (ICAPP '06), an international embedded topical meeting held during the annual meeting of the American Nuclear Society in Reno, Nevada, June 4–8, 2006. ICAPP '06 was cosponsored by the American Nuclear Society, Korean Nuclear Society, Société Française d'Énergie Nucléaire, Atomic Energy Society of Japan, Sociedad Nuclear Española, International Atomic Energy Agency, Organisation for Economic Co-operation and Development/Nuclear Energy Agency, Chinese Nuclear Society, German Nuclear Society, Canadian Nuclear Society, and British Nuclear Energy Society.

ICAPP '06 provided a forum for leaders of the nuclear industry to exchange information, present results from new work, review the state of the art, and discuss future directions and needs for the deployment of new nuclear power plant systems around the world. Nearly 400 papers and presentations were given in the course of about 90 plenary, panel, and paper sessions.

The meeting covered major global programs and research initiatives in nuclear power, which were divided into the following 12 technical tracks:

1. Water-Cooled Reactor Programs and Issues  
Evolutionary designs; innovative, passive, light, and heavy water-cooled reactors; issues related to meeting medium-term utility needs; design and regulatory issues; business, political, and economic challenges; infrastructure limitations; and improved construction techniques including modularization.
2. High-Temperature Gas-Cooled Reactors  
Design and development issues, components and materials, safety, reliability, economics, demonstration plants and environmental issues, fuel design and reliability, power conversion technology, hydrogen production and other industrial uses, and advanced thermal and fast reactors.
3. Long-Term Reactor Programs and Strategies  
Reactor technology with enhanced fuel cycle features for improved resource utilization, waste characteristics, and power conversion capabilities; potential reactor designs with longer development times, such as supercritical water reactors, liquid metal reactors, and gaseous and liquid fuel reactors; Gen IV, INPRO, EUR, and other programs.
4. Operation, Performance, and Reliability Management  
Training; operations and maintenance costs; life cycle management; risk-based maintenance; operational experiences; performance and reliability improvements; outage optimization; human factors; plant staffing; outage reduction features; major component reliability, repair and replacement; in-service inspection; and codes and standards.
5. Plant Safety Assessment and Regulatory Issues  
Transient and accident performance including loss-of-coolant accident (LOCA) and non-LOCA; severe accident analysis; impact of risk-informed changes; accident management; assessment and management of aging, degradation, and damage; life extension lessons from plant operations; probabilistic safety assessment; plant safety analysis; reliability engineering; operating; and future plants.
6. Thermal-Hydraulic Analysis and Testing  
Phenomena identification and ranking, computer code scaling applicability and uncertainty, containment thermal hydraulics, component and integral system tests, improved code development

- and qualification, single- and two-phase flow, and advanced computational thermal-hydraulic methods.
7. Core and Fuel Cycle Concepts and Experiments  
Core physics; advances in computational reactor analysis; in-core fuel management; mixed-oxide fuel; thorium fuel cycle; low moderation cores; high conversion reactor designs; particle and pebble bed fuel design; testing and reliability; and fuel cycle waste minimization, recycle, storage, and disposal.
  8. Materials and Structural Issues  
Fuel, core, reactor pressure vessel, and internals structures; advanced materials issues and fracture mechanics; concrete and steel containments; space structures; analysis, design, and monitoring for seismic, dynamic, and extreme accidents; irradiation issues; and materials for new plants.
  9. Nuclear Energy and Sustainability Including Hydrogen, Desalination, and Other Applications  
Environmental impact of nuclear and alternative systems; spent fuel dispositions and transmutation systems; fully integrated fuel cycle and symbiotic nuclear power systems; application of advanced designs to nonpower applications such as the production of hydrogen, seawater desalination, heating, and other cogeneration applications.
  10. Near-Term Issues  
Applies to plants that have a significant percentage of their design completed and to issues related to the deployment of these plants in the near term (next couple of years); includes deployment activities such as licensing of sites/projects (such as early site permit and construction/operating license activities in the United States), detailed construction plans, use of three-dimensional models, and procurement activities/challenges.
  11. Reactor Physics and Analysis  
Nuclear design methodology and codes, cross-section libraries and lattice physics, and Monte Carlo and deterministic transport calculation.
  12. Space Power and Propulsion  
Large and small space nuclear power systems, nuclear thermal propulsion and bimodal systems, science and technology, missions, life cycle, operation and maintenance, system operation and safety analysis, radiation protection, and materials.

The papers included in this special issue were recommended by the ICAPP '06 technical program committee, which included technical track leaders, to capture the most noteworthy advances and new information in nuclear power plant technology. The authors were then invited to update their embedded topical papers and submit them for additional peer review for the special edition.