

## SUMMARY OF SESSION 5 (Tae-Ryong KIM)

Session 5 mainly focuses on the topic of Advanced Technology Application. There are 12 papers orally presented and 8 papers posted. These papers could be categorized into 4 areas such as;

- Advanced reactor concepts and technologies
- Recent progress in small and medium nuclear reactors
- Fuel cycle technology
- Others

**Advanced Reactor Technology:** Dr. Duffey presented on behalf of supercritical water cooled reactor (SCWR) steering committee the major features of the SCWR conceptual designs under consideration by GIF members as well as relevant on-going and planned R&D efforts, because SCWR is the only GEN IV reactor that uses water as coolant. SCWR incorporates advances from supercritical fossil power technologies, such as a direct thermodynamic cycle concept for increasing thermal efficiency, material performance and water chemistry experiences, that have been successfully operating for long time. They assured that these features can make SCWR a very attractive reactor for utilities. But there are still some challenges such as; the selection of materials for the core components, and the specification of suitable water chemistry condition. In addition, R&D will be needed in some areas such as thermal-hydraulics and safety to extend the range of existing data to supercritical conditions. China recently joined GIF as a member, and they presented several papers about their concept and some technical R&D results of Chinese SCWR program.

There were two new advanced reactor technologies presented, that is, HP-BWR (high pressure boiling water reactor) from Sweden and nanofluids concept from Korea.

HP-BWR suggested a concept taking the advantages of both PWR and BWR like Super PWR proposed in plenary session. Its thermal efficiency seems to be obviously higher than that of conventional types. Several benefits were presented in the aspect of safety by showing the results of simulation and computations using RELAP, PARCS code and MATLAB.

Nanofluids concept using SiC as nanoparticles was proposed by experimentally investigating the effect of nanoparticles on the cooling performance of Inconel 600 cylindrical rod during quenching. It could be employed as coolant in an ESF system such as ECCS, but still many challenging works seem to remain.

**Small and Medium Reactor:** Several small and medium size reactor designs were presented in Session 5. CAREM 25 of Argentina has been included in the final program but did not show up.

IRIS was presented in poster, which is an international project of 24 organizations from 10 countries led by Westinghouse. The IRIS safety approach is focused on the safety-by-design which means that accidents are eliminated by design. Due to the simple design and enhanced safety, Westinghouse believes they can achieve a target cost of electricity at about 4 cents/kWh.

Fixed Bed Nuclear Reactor (FBNR) of around 7 MWe is being developed in Brazil with the support of the IAEA program, saying that it can maximize inherent safety and non-proliferation capability.

VK-300 is a nuclear co-generation desalination complex with simplified BWR being developed in Russia. To effectively and economically get power and fresh water, it was reportedly insisted that the most attractive option is a coupling of VK-300 reactor with distillation desalination units based on the multi-stage evaporation principle (MED),.

**Fuel Cycle Technology:** As one of solutions to the construction of huge repository and proliferation problem, some papers for plutonium management strategy and roadmap were presented in Session 5.

Slovakia proposed introduction of fast reactor to reduce the plutonium mass in their country.

China showed a roadmap for thorium-uranium recycle in PWR.

CANDU also showed in poster session a concept of enhancing proliferation resistance, so called "safeguardability" with fuel cycles employed in Enhanced CANDU 6 and ACR-1000.

**Others:** Feasibility study results were presented from Canada to investigate the application of nuclear energy to oil sands and hydrogen production. It seemed that 1000MW NPP can support the production of oil of 300,000 barrel/day. But there are still challenging works such as support of government and public, site selection, etc.

Combined heat and power (CHP) cycle of Rankine cycle of LWR and the absorption cycle was proposed from Korea, to utilize surplus nuclear energy as heat source in places far away from the plant. Some case studies in several conditions were presented.

Water chemistry management and ways of preventing corrosion in SCWR piping were presented from Russia based on the operating experiences of both supercritical fossil plants and pressure-tube BWR. Micro additives of depleted zinc into coolant could minimize corrosion processes and reduce active cobalt accumulation.

Optimization processes of CARA fuel element were presented from Argentina to obtain negative coolant void coefficient for passive safety feature.