ORNL and SINAP cooperate on development of salt-cooled reactors

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Representatives from Oak Ridge National Laboratory and the Shanghai Institute of Applied Physics (SINAP) met at ORNL to discuss plans for building a salt-cooled test reactor. Pictured in front of ORNL's molten salt test loop are (from left) David Felde, ORNL; Yang Zou, SINAP; Guanyuan Wu, SINAP; Xiaohan Yu, SINAP; Naxiu Wan, SINAP; Zhimin Dai, SINAP; David Holcomb, ORNL; Kun Chen, SINAP; Kevin Robb, ORNL; Mike Laufer, University of California

at Berkeley; Guimin Liu, SINAP; Weiju Ren, ORNL. Credit: ORNL

Representatives from the Oak Ridge National Laboratory (ORNL) and the Shanghai Institute of Applied Physics (SINAP) are meeting at ORNL this week as part of an agreement between the two institutions to work together on the advancement of salt-cooled nuclear reactor technologies.

At this week's meeting SINAP staff members will describe their plans for building the first salt-cooled test reactor, and the two sides will begin planning the next steps in the shared research project.

The Cooperative Research and Development Agreement (CRADA) between ORNL and SINAP focuses on accelerating scientific understanding and technical development of salt-cooled reactors, specifically fluoride salt-cooled high-temperature reactors (FHRs). The project will draw on ORNL's expertise in fuels, materials, instrumentation and controls, design concepts, and modeling and simulation for advanced reactors, as well as the lab's experience in the design, construction and operation of the Molten Salt Reactor Experiment, the only molten salt reactor ever built.

The CRADA evolved from US-China interactions under a Memorandum of Understanding between the US Department of Energy (DOE) and the Chinese Academy of Sciences (CAS) on "Nuclear Energy Sciences and Technologies Cooperation."

DOE is responsible for developing nuclear energy concepts with the potential to provide significant safety and economic improvements over existing reactors, a mission carried out by the Advanced Reactor Technologies Program in DOE's Office of Nuclear Energy.

The CAS has initiated a large FHR development program with similar objectives and has provided resources for research, technology development, design and construction of an FHR test reactor in China. This initial test reactor will have a maximum thermal power of 10 megawatts. A second, 100-megawatt test reactor is also planned. Both FHR test reactors will use low-enrichment uranium fuel.

FHRs are an emerging class of salt-cooled reactors that feature low-pressure liquid fluoride salt cooling and solid coated particle fuel. This design provides a high-temperature power cycle that improves efficiency and a passive safety system designed to handle potential accident conditions without human intervention. FHRs have the potential to economically and reliably produce large quantities of carbon-free energy (both electrical and thermal), but technical challenges remain.

SINAP is leading the Chinese effort on behalf of CAS to develop FHRs to supply process heat and electricity to China's growing economy, especially in regions with limited water. The Institute is engaged in the full spectrum of activities necessary to evaluate, design, license, construct, and operate FHR test reactors, with several hundred staff devoted to its FHR development program. The United States has the most experience worldwide with technologies applicable to FHRs due to its historic and long-term investments in advanced nuclear reactors (in particular ORNL's experience in molten salt reactor development and demonstration), advanced materials, and coated particle fuel.

The CRADA is a formal agreement between SINAP and ORNL, covering work approved by DOE as consistent with the DOE's overall mission for advancing reactor technology. CAS is providing the entirety of CRADA funding, with an estimated $5 million a year. ORNL expects to engage other US institutions for additional support. The collaborations under the new agreement are authorized for 10 years. The CRADA focuses on resolving the technology issues associated with design,

construction, and operation of FHRs, and does not include activities related to fuel reprocessing or fissile material separation.

Development of advanced reactors in the United States will benefit through access to the information and experience produced by the large and rapidly advancing Chinese program. China will benefit by leveraging access to US advanced reactor capabilities, facilities, and experience.

The United States also has substantial manufacturing skills with high-value specialized materials and components necessary to construct advanced reactors. Cooperation between ORNL and SINAP will help to ensure that US manufacturers have the opportunity to compete in future salt-cooled reactor markets.

Provided by Oak Ridge National Laboratory