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Editors' Note

This double issue of the journal has a special focus on the use of computer modeling for understanding the proliferation risk from research reactors and small plutonium production reactors and advancing options for reducing this risk. Three articles explore questions of plutonium production, and a fourth article offers a new idea for furthering the conversion of highly enriched uranium fueled research reactors to low-enriched uranium fuel. Taken together, these articles demonstrate the significant advances in analysis that computer modeling now offers for supporting and improving nonproliferation policy. It may be fruitful to bring together the nonproliferation community and the computer modeling community in a focused effort to develop new dedicated open-source computer codes and tools for nonproliferation and disarmament studies.

In "Global Plutonium Production Capabilities with Civilian Research Reactors," Jochen Ahlswede and Martin B. Kalinowski provide a first order assessment of the potential proliferation risk from more than fifty civilian research reactors in the non-nuclear weapon states. Using generic designs for light-water and heavy-water-moderated reactors, the article uses reactor-modeling codes to simulate plutonium production in reactor fuel elements as well as by irradiation of targets. The results tend to support the practice of focusing international safeguards on research reactors with capacities of 25 MWt and larger.

Thomas Mo Willig, Cecilia Futsaether, and Halvor Kippe's article "Converting the Iranian Heavy Water Reactor IR-40 to a More Proliferation-Resistant Reactor" uses neutronics calculations to assess the option of converting Iran's still-under-construction 40 MWt heavy-water-cooled and moderated research reactor (IR-40) from natural uranium to low-enriched uranium fuel as a way to reduce its potential plutonium production capability. The analysis suggests moving from natural uranium fuel to 2.5–3.0 percent enriched fuel could reduce annual plutonium production by about two-thirds, a significant reduction in proliferation risk for this reactor.

"Combining Satellite Imagery and 3D Drawing Tools for Nonproliferation Analysis: A Case Study of Pakistan's Khushab Plutonium Production Reactors" by Tamara Patton demonstrates how the ability to extract three-dimensional data from commercial satellite images of the kind available on GoogleEarth can provide additional insight about facilities of proliferation concern. Her study of images of the cooling towers of Pakistan's Khushab reactors helps sharpen estimates of the thermal capacity of these reactors and also offers a model for assessing the capacities of research and plutonium production reactors. More broadly, however, it demonstrates how freely available imagery and computer programs offer independent analysts powerful new tools that were once only held by governments with advanced intelligence gathering and analysis capabilities.

The fourth article uses computer modeling to demonstrate the power of "virtual experiments" in informing technical and policy choices directly relevant to proliferation. "Neutron-Use Optimization with Virtual Experiments to Facilitate Research-Reactor Conversion to Low-Enriched Fuel" by Alexander Glaser and Uwe Filges uses Monte-Carlo computer codes to set up simulations of neutron scattering experiments that follow the neutrons from a research reactor down the neutron beam tubes all the way to the instruments used in such facilities. By looking at the facility as a whole, the analysis shows the large gains in performance available from moving to state-of-the-art beam-tube technologies and instruments. A strong policy conclusion is that combined convert-and-upgrade strategies would allow research reactor operators to more than compensate for any losses in neutron flux from converting from highly enriched to low-enriched fuel.

The previous issue of the journal (Volume 20, No. 1) carried the article "Radionuclide Evidence for Low-Yield Nuclear Testing in North Korea in April/May 2010" by Lars-Erik De Geer. It offered evidence from radionuclide signals detected in South Korea, Japan, and Russia that in May 2010 North Korea may have carried out a nuclear test with a yield of less than 50 tons of TNT equivalent (possibly up to 200 tons of TNT equivalent if the explosion was partially decoupled from the surrounding rock). In the current issue, David P. Schaff, Won-Young Kim, and Paul G. Richards respond with a detailed analysis of seismic signals from North Korea recorded by a nearby station in northeastern China on the days in May 2010 proposed by De Geer as possible dates for one or more tests. The article concludes that no well-coupled underground explosion above about one ton TNT equivalent occurred near the North Korea test site on those days. This offers a stringent limit on any testing scenario. It is noteworthy that the technique used in the article significantly increases the sensitivity of seismic monitoring for the region in question. This study suggests sensitive new tools for forensic, after-incident seismic analysis to complement the first response seismic methods used by the International Monitoring System of the Comprehensive Test Ban Treaty Organization.

The final contribution in this issue is a review by Vitaly Fedchenko of *Our Own Worst Enemy? Institutional Interests and the Proliferation of Nuclear Weapons Expertise* by Sharon K. Weiner (MIT Press, 2011). The book deals with U.S. efforts to organize cooperative threat reduction (CTR) programs with Russia and other former Soviet states to reduce the risk of former Soviet scientists and engineers with expertise in nuclear, chemical, or biological weapons from proliferating their knowledge. The review describes it as a "thorough, meticulously researched book" and recommends it as "an authoritative resource to those who study or want to successfully implement CTR-type projects, regardless of their geographical location."