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Redirecting North Korea's nuclear workers

Threat reduction programs with former Soviet states can serve as models to create new, peaceful jobs for the North's cadre of nuclear scientists and bomb makers.

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North Korea's pledge to dismantle and abandon its nuclear weapons infrastructure, rejoin the Nuclear Non-Proliferation Treaty (NPT), and cooperate with the International Atomic Energy Agency (IAEA) is only part of the international effort to denuclearize the North.

More than simply removing nuclear material and infrastructure, it's vital to provide the North's nuclear workers with alternative civilian jobs, since they could presumably resume the country's nuclear activities in the future or hire themselves out to help other countries build nuclear weapons. An approach similar to the Cooperative Threat Reduction (CTR) program between the United States and former Soviet states could be the best way to prevent future clandestine North Korean nuclear activities. The CTR program established in 1991 has made a positive contribution, helping to destroy the excess nuclear, chemical, and biological weapons and to support related nonproliferation objectives in Russia, Kazakhstan, Belarus, and Ukraine.

The Cooperative Threat Reduction program. The CTR program originated from the proposal by Senators Sam Nunn and Richard Lugar in the early 1990s to help eliminate and secure excess Soviet nuclear weapons, which after the disintegration of the Soviet Union in 1991 was a top U.S. concern. In 1995, the CTR program was expanded to redirect Soviet nuclear workers, providing them with funds for peaceful projects, and to destroy, transport, store, disable, and safeguard nuclear, chemical, and other non-conventional weapons. The CTR program also established verifiable safeguards against the proliferation of such weapons, their components, and weapons-usable materials and prevented the diversion of scientific expertise that could contribute to weapons programs in other nations.

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After 9/11, the United States became even more concerned about the potential proliferation of such weaponry to rogue nations or terrorist groups. To prevent their spread, the G-8 established in July 2002 the "Global Partnership Against the Spread of Weapons and Materials of Mass Destruction," a $20-billion global version of the CTR program.

Previous proposals to expand the CTR program to cover North Korea have come from the Union of Concerned Scientists, Senator Lugar, former Assistant Secretary of Defense Ashton Carter, and former Secretary of Defense William Perry. The North's response to these proposals has been promising. On February 14, 2008, Siegfried Hecker, the former Los Alamos National Laboratory director; Joel Wit, a former State Department official; and Keith Luse, a senior professional staff member of the Senate Foreign Relations Committee, visited the Yongbyon nuclear complex and met with current and former top-ranking North Korean nuclear energy officials. Although they told these U.S. representatives that their government was not yet ready to discuss redirection of nuclear workers, the North's officials said they would like to see the Yongbyon workforce redirected to peaceful uses of nuclear energy, specifically to service and run future light water reactors. These North Korean officials also showed interest in using the country's IRT-2000 research reactor for civilian research and medical and industrial applications.

The current Six-Party Talks, which encourage the elimination of the North's nuclear weapons program in return for security, economic, and energy benefits from the other five state parties, could already be regarded as a type of CTR program. A Center for Strategic and International Studies (CSIS) 2005 report by Wit, Jon Wolfsthal, a CSIS senior fellow, and Choong-suk Oh, a former CSIS visiting fellow, emphasized how the Six Party Talks could effectively implement a formal North Korean CTR program because its multilateral approach allows political and financial burden-sharing, brings together different skills and resources from each state party, and sustains a long-term effort in the face of national government changes or disputes among individual state parties.

To achieve verifiable denuclearization of North Korea, a CTR program would need to cover four areas: verifiable declaration and dismantlement of the North's nuclear weapons program, including nuclear weapons, nuclear materials, and relevant equipment, facilities, and documents; redirection of the country's nuclear weapons personnel; strengthened IAEA safeguards and continued monitoring to detect any future clandestine nuclear activities; and effective export controls to prevent import or export of sensitive materials and technologies related to spent-fuel reprocessing and uranium enrichment.

Moving toward a North Korean CTR. In June 2008, North Korea submitted to China a declaration of its nuclear activities. The North declared that it had extracted 30 kilograms of plutonium from spent nuclear fuel using its reprocessing facility and that it had used 2 kilograms of that amount in its October 2006 nuclear test. In addition, it appears that approximately 8 kilograms of un-extracted plutonium is contained in the 8,000 spent fuel rods at Yongbyon. The North's declaration of 38 kilograms of plutonium is less than the 40–60 kilograms that U.S. intelligence agencies had estimated, raising questions on the truthfulness of their declaration. In its declaration, North Korea acknowledged U.S. concerns about its uranium-enrichment activities. This was ground-breaking since the North has repeatedly denied having a uranium enrichment program.

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The Six Parties have begun to discuss a regime to verify the North's declared nuclear assets and reconcile differing opinions. Although existing IAEA full scope safeguards are effective in inspecting nuclear material and facilities and the Additional Protocol is effective in inspecting nuclear fuel cycle-related research and development activities, they might not ensure the completeness of North Korea's declaration. If the North is hiding undeclared nuclear material or activities, further measures such as access to all related sites, even potential nuclear test sites are necessary. Private interviews with North Korean nuclear workers, without monitoring, and access to detailed documentation would also allow for a comprehensive understanding of its weapons program.

The total amount of plutonium produced in the 5-megawatt graphite reactor at Yongbyon before mid-July 2007 when the North disabled the reactor, can be verified using the graphite isotope ratio method. The technique is used to estimate the total plutonium production in a graphite-moderated reactor without detailed information on the reactor's operating history. The process measures neutron-induced isotopic ratio changes in certain radionuclides within the graphite moderator, thereby giving a fairly accurate (within a few percentage points) picture of cumulative plutonium production. Verifying the amount of plutonium separated in the reprocessing facility at Yongbyon will depend on the quantity of plutonium loss during reprocessing in the past and can be estimated using samples of high-level waste produced during reprocessing.

For irreversible dismantlement of the North's nuclear weapons program, all nuclear weapons, plutonium pits, separated plutonium,

spent fuel rods containing plutonium, fresh fuel rods, highly enriched uranium (HEU) fuel from the IRT-2000 reactor, centrifuges, and blueprints of nuclear bombs, centrifuges, etc. must be removed and shipped out of the country as quickly as possible.

Physical destruction of the North's nuclear weapons fabrication facilities should follow quickly after verification, including demolition of the country's 5-megawatt reactor and its reprocessing, nuclear fuel, nuclear weapon, uranium enrichment, and reactor component fabrication facilities. Nuclear test sites should be closed, since further testing would be needed for the North to improve its primitive nuclear devices. Any significant uranium enrichment facilities identified would also have to be destroyed, including any centrifuge manufacturing facilities and any plants producing uranium hexafluoride.

To redirect the North's nuclear workers, it's necessary to know the current status of personnel involved in the country's nuclear weapons program and to have ideas for possible alternative jobs. According to an August estimate by Wolfsthal, North Korean nuclear personnel are likely to number in the thousands, including fewer than 100 top-level nuclear scientists and engineers. This is consistent with other estimates that number North Korea's nuclear engineers between 3,000 and 6,000, with 200 key personnel related to its nuclear weapons program.[1] For the denuclearization of North Korea to succeed, the international community must have full knowledge of all the nuclear workers at undeclared facilities as well as declared ones, and all of them must be redirected from the nuclear weapons program to civilian projects.

Peaceful nuclear energy activities are likely to be the most acceptable alternative to the North's nuclear personnel. The decommission and decontamination of Yongbyon's nuclear facilities, the utilization of the IRT-2000 research reactor after converting it to low enriched uranium (LEU) fuel, and a light water reactor project (a request of North Korea in return for giving up its nuclear weapons) should be considered as potential reassignments. The establishment of an International Science and Technology Center (ISTC) in Pyongyang, similar to the one in Moscow, could also be a useful way to redirect nuclear workers to more benign activities.

Since the decommissioning and decontamination would follow the dismantlement of the North's nuclear weapons program, the Six Parties should begin discussing a plan of action. Assuming facilities are placed in SAFSTOR condition (a temporary decommissioned state that is safe for decades, in anticipation of ultimate decommissioning), the mothballing of the 5-megawatt Yongbyon reactor, the reprocessing facility, the vitrifying of high-level waste, and the construction of a geologic repository would cost billions of dollars and

take decades to complete, according to estimates by Hui Zhang and Matthew Bunn of Harvard University's Belfer Center for Science and International Affairs.[2]

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The effort to decommission and decontaminate Yongbyon would require more than 100 of North Korea's nuclear personnel for site and facilities characterization, more than 500 for initial dismantlement, and more than 2,000 for full dismantlement. An additional staff of fewer than 100 international nuclear personnel would be needed for site and facilities characterization, a few dozen for initial dismantlement, and a similar number for full dismantlement, according to a recent estimate by Ronald K. Chesser and Carleton J. Phillips, both at Texas Tech University's Center for Environmental Radiation Studies.[3] The project could redirect more than 2,000 of the country's nuclear workers.

As confirmed by Hecker's visit to Yongbyon in February, North Korea showed interest in redirecting some of its Yongbyon personnel to work on the IRT-2000 reactor, which could be used for research and other purposes, including radioisotope production. Since the fuel contained in the reactor is HEU and has a risk of weapons diversion, it should be taken out of the country quickly once the reactor is converted to LEU fuel. Similar conversions in Libya and Uzbekistan are directly applicable, so the United States, Libya, and Uzbekistan could provide expertise in regards to core calculations and studies for the conversion process, which is estimated to require 2–3 years and cost $1.5 million–$2 million, according to a recent study by Ira N. Goldman and Pablo Adelfang of the IAEA's Division of Nuclear Fuel Cycle and Waste Technology.[4]

The North can use the IRT-2000 reactor to produce radioisotopes for medical, industrial, and agricultural purposes; for education and training; for environmental, industrial, and cultural heritage analyses; for materials science investigations; for supporting power reactor programs; and for fuel testing and qualification. About 200–500 personnel may eventually be employed at the IRT-2000 reactor, its ancillary facilities, experiments, and programs, according to the same IAEA study.

Ri Hong Sop, the former director of the Yongbyon nuclear complex, indicated to Hecker that North Korea would like to put some of their technical people to work on a light water reactor (LWR). The September 2005 Joint Statement of the Six Party Talks expressed an interest in discussing at a later time supplying LWRs to the North, though currently such a project seems impractical given

the inability of North Korea's electric grid to accommodate them. Yet if North Korea were to return to the NPT and overcome other challenges, including grid problems, the LWRs that were started following the 1994 Agreed Framework might be resumed in the future. More than 500 well-trained nuclear personnel could be used for such a project, one-third as licensed plant operators and the rest as support staff to maintain two finished 1,000-megawatt LWRs. In addition, about 100–150 personnel with undergraduate engineering degrees and about 5–10 years of professional experience will be needed to develop and implement a regulatory structure to inspect construction and to examine and license plants, according to a recent study by John B. Mulligan and Hankwon Choi, both former staff members of the Korean Peninsula Energy Development Organization (KEDO), which was responsible for the LWR projects.[5]

The ISTC, established in Moscow in November 1992 as part of the CTR program, has made a substantial contribution in redirecting former Soviet weapons scientists. The establishment of a North Korean ISTC in Pyongyang or in Yongbyon could provide internationally funded opportunities for North Korean nuclear scientists and technicians, allowing them to focus on research or commercial projects.

The ISTC has allowed roughly 65,000 former Soviet weapons scientists to work on 2,700 non-weapons projects and receive $770 million in funding from the United States, Japan, the European Union, and others.[6] Yet the ISTC has been criticized for not creating permanent jobs and for subsidizing scientists who also work part-time on weapons.[7] The ISTC has also been criticized for not having coordinated research project selection. Some of these projects involved collaboration with institutes outside of the closed cities in the former Soviet Union that were not supposed to receive funding. The North Korean version should keep these lessons in mind.

Upon establishing the North Korean ISTC, research projects must be able to withstand conflicts that arise between the North and individual state parties, such as Japan's ire regarding North Korean kidnapping of Japanese citizens in the late 1970s and early 1980s. At the same time, projects need to be based on the mutual interests of all of the Six Parties. To ensure the success of the North Korean ISTC, it must include a reliable and unambiguous project agreement, clear definition and regulation of projects, objectives of cooperation, agreed procedures and conditions, a clear scope and timeline of projects, professional project management through the ISTC, and qualified international management of the ISTC itself.[8]

As emphasized in the 2005 CSIS report, South Korea has the political interest, the financial resources, the technical know-how, the

common language, and the cultural affinity with North Korea to play an important role in efforts to redirect the North's weapons scientists. The South Korean government has also expressed interest in the idea of a CTR program, according to local news reports. South Korea trained the North Koreans during the KEDO project to build the two LWRs. Even though the project did not come to fruition, in 2002, the Korean Electric Power Company conducted a 13-week training session covering general and basic knowledge of nuclear power plant technology for 125 North Korean engineers. Fifty North Korean engineers participated in a separate nuclear regulatory training program held by the Korea Institute of Nuclear Safety in late 2002.[9]

Even though the disabling process at Yongbyon has been stop and go, the project is expected to be completed in a few months. At that point, the worry over North Korea will shift to the future of its nuclear workers. Further challenges will still exist even after this process has begun, such as fully identifying all of North Korea's nuclear workers and lingering suspicions whether the North is concealing its key nuclear personnel. Other stumbling blocks may include whether financial pledges by the other five state parties are contingent upon short time periods that may interrupt long-term projects.

A denuclearized North, where nuclear material and weapons are removed and where nuclear workers are reassigned to long-term nonmilitary projects, is vital to future peace on the Korean Peninsula. The implementation of a CTR program should be a priority at the next meetings of the Six-Parties. ■

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NOTES

1. North Korea has trained roughly 6,000 nuclear engineers since the 1950s, including 200 key personnel related to its nuclear weapons program, according to Science and Technology Policy Institute research associate Choon-Geun Lee, who spoke at the 20th International Summer Symposium on Science and World Affairs. A January Congressional Research Service report estimated there were about 3,000 nuclear scientists and research

personnel at Yongbyon.

2. Hui Zhang, "Decommissioning North Korea's Plutonium Production Facilities: Approaches and Costs," presentation given at the 20th International Summer Symposium on Science and World Affairs, Boston, July 25-August 1, 2008; Matthew Bunn and Hui Zhang, "Decommissioning North Korea's Nuclear Facilities: Issues, Options, and Costs," (January 2008 draft).

3. Ronald K. Chesser and Carleton J. Phillips, "Characterization and Foundation for Dismantlement of the Yongbyon Nuclear Facility in the DPRK," U.S.-ROK Workshop on DPRK Nuclear Scientist Redirection, Seoul, South Korea, October 20, 2008.

4. Ira N. Goldman and Pablo Adelfang, "Possible Cooperative Projects for Utilization of IRT-2000 Research Reactor," U.S.-ROK Workshop on DPRK Nuclear Scientist Redirection, Seoul, South Korea, October 20, 2008.

5. John B. Mulligan and Hankwon Choi, "Redirection of DPRK Nuclear Talent to the LWR Project," U.S.-ROK Workshop on DPRK Nuclear Scientist Redirection, Seoul, South Korea, October 20, 2008.

6. Uwe Meyer, "ISTC-Redirection of WMD-Scientists of the Former Soviet Union—Successes and Lessons Learnt," International Workshop on Science Cooperation: Redirecting North Korea's Nuclear Expertise, Beijing, March 5–6, 2008.

7. "Helping Russia Downsize its Nuclear Complex: A Focus on the Closed Nuclear Cities," Report of an international conference held at Princeton University, March 14–15, 2000. (Report released June 2000.)

8. Meyer, "ISTC-Redirection."

9. Mulligan and Choi, "Redirection of DPRK Nuclear Talent."

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