

Siegfried S. Hecker

*Lessons learned from the
North Korean nuclear crises*

In October 2006, some 50 years after North Korea began its nuclear journey, it detonated a nuclear device and declared itself a nuclear power. A second explosion, in May 2009, erased lingering doubts about its ability to build the bomb. It is instructive to learn how, but even more important to understand why, it built the bomb. Pyongyang has proclaimed its reason for going nuclear: “The DPRK made nuclear weapons and has strengthened its self-defensive war deterrent to maintain the sovereignty and the right to existence of the nation in the face of the increased aggressive threat by the U.S.”¹ But is the alleged threat to Pyongyang’s security the only reason it built the bomb? This essay briefly reviews what North Korea’s nuclear capabilities are and shows how technical capabilities and political intent were inextricably intertwined in shaping the program. The essay then turns to Scott Sagan’s theoretical framework of three models for the bomb² to show how Pyongyang’s deep security fears, augmented by domestic and diplomatic drivers, have dominated its decision to build and keep the bomb. The essay concludes with lessons learned

from North Korea for the nonproliferation regime.

The promise and peril of nuclear energy share a common technological foundation. Pursuit of a civilian fuel cycle – making fuel, building reactors to burn the fuel, and maintaining the back-end to deal with nuclear waste, including the option of extracting some of the valuable by-products from burning reactor fuel – enables nations to develop the capability to make bomb fuel, either highly enriched uranium (HEU) or plutonium. North Korea mastered the plutonium fuel cycle ostensibly for nuclear power and then used it to build the bomb.

This brief review of North Korea’s acquisition of nuclear capabilities will only touch on the important political milestones that helped to shape it; a more complete discussion will be presented in the next section. Kim Il-sung, the country’s founding father, laid the foundation for nuclear technology development in the early 1950s. The Soviet “Atoms for Peace” initiative, modeled after President Eisenhower’s initiative of the same name, enabled several hundred North Korean students and researchers to be educated and trained in Soviet universities and nuclear research centers. The Soviets built a research re-

© 2010 by the American Academy of Arts & Sciences

actor, the IRT-2000, and associated nuclear facilities at Yongbyon in the 1960s. North Korean specialists trained at these facilities and by the 1970s were prepared to launch a nuclear program without external assistance.

North Korea's decision to build gas-cooled, graphite-moderated reactors was a logical choice at the time for an indigenous North Korean energy program because gas-graphite reactors can operate with natural uranium fuel and, hence, do not require enrichment of uranium.³ Although North Korea may have experimented with enrichment technologies, commercial enrichment capabilities were beyond its reach and difficult to acquire.⁴ North Korea's ambitious program began with an experimental 5 megawatt-electric (MWe) reactor, which became operational in 1986. Construction of that reactor was followed by a scaled-up 50 MWe reactor and a 200 MWe power reactor, although neither was ever completed.

North Korea quickly mastered all aspects of the gas-graphite reactor fuel cycle. It built fuel fabrication facilities and a large-scale reprocessing facility, which enabled extraction of plutonium from spent fuel.⁵ Unlike the Soviet-built research facilities, the new facilities were built and operated without being declared to or inspected by the International Atomic Energy Agency (IAEA). Pyongyang had no legal obligation to declare these facilities because it was not a member of the Nuclear Non-Proliferation Treaty (NPT). American reconnaissance satellites picked up signs of the reactor construction in the early 1980s and the reprocessing facility in the late 1980s. It was not until 1989, when South Korea leaked American satellite data of the reprocessing facility, that the international community first became aware of and con-

cerned about North Korea's indigenous nuclear program. The concern stems from the fact that gas-graphite reactors are capable of producing weapons-grade plutonium while generating electrical power and heat. So, whereas Pyongyang's choice of gas-graphite reactors for its energy program was logical, it was also the best choice to develop a nuclear weapons option.

In parallel, North Korea asked the Soviets to build light water reactors (LWRs) to help meet North Korea's energy demands. North Korea joined the NPT in 1985 because the Soviets made consideration of LWRs contingent upon joining the Treaty. These reactors, though, never materialized because of the demise of the Soviet Union. Pyongyang kept inspectors out of its new facilities until 1992, by which time it had all of the pieces in place for the plutonium fuel cycle. This move coincided with several diplomatic initiatives and President George H.W. Bush's decision to withdraw all American nuclear weapons from South Korea. By this time, the 5 MWe experimental reactor produced electricity and heat for the local town, as well as approximately 6 kilograms (roughly one bomb's worth) of weapons-grade plutonium per year. The fuel fabrication and reprocessing facilities were operational, and the two bigger gas-graphite reactors were under construction.

In 1992, Pyongyang opened the window on its nuclear program for diplomatic reasons explained below, but closed it quickly when IAEA inspectors uncovered discrepancies between their own nuclear measurements at Yongbyon and Pyongyang's declaration. Pyongyang responded to IAEA accusations by announcing its intent to withdraw from the NPT. Pyongyang was apparently surprised by the sophis-

tication of the IAEA's nuclear forensics and by the strictures of the NPT. Negotiations started in June 1993 but stalemated. In 1994, when North Korea unloaded the reactor's fuel containing an estimated 20 to 30 kilograms of plutonium, Washington and Pyongyang came close to war before former President Jimmy Carter intervened and brokered a freeze.

Intense negotiations in Geneva led to the Agreed Framework,⁶ which changed North Korea's nuclear technical trajectory dramatically. Pyongyang agreed to give up its indigenous gas-graphite reactor program for the promise of two LWRs to be supplied by the United States, South Korea, and Japan. The spent fuel rods unloaded from the 5 MWe reactor were repackaged by an American technical team and stored in the cooling pool for eventual removal from North Korea. Operation of the 5 MWe reactor, the fuel fabrication plant, and the reprocessing facility was halted and monitored by IAEA inspectors per special arrangement under the Agreed Framework. Construction of the two larger reactors was stopped.

Although Pyongyang halted its plutonium program during the Agreed Framework, it continued to expand its missile program, including by conducting a long-range rocket launch over Japan in 1998. It also explored uranium enrichment.⁷ During its first formal encounter with Pyongyang in October 2002, the Bush administration, which was adamantly opposed to the Agreed Framework, accused Pyongyang of covertly pursuing the alternative HEU path to the bomb. This altercation effectively ended the Agreed Framework and changed Pyongyang's technical and political trajectory again.

In 2003, North Korea became the first nation to withdraw from the NPT. It ex-

pelled international inspectors and announced that it would strengthen its nuclear deterrent. By the end of 2003, which also marked the invasion of Iraq and the fall of Saddam Hussein, Pyongyang was eager to have Washington believe it had the bomb. It used my first trip to North Korea, an unofficial, Track II trip led by my Stanford University colleague John W. Lewis, to send that message back to Washington. In a carefully choreographed tour of the Yongbyon nuclear complex in January 2004, Pyongyang gave me remarkable access to nuclear facilities and nuclear scientists and allowed me to hold nearly a half-pound of plutonium bomb fuel (in a sealed glass jar), all to convince me it had a "deterrent."

Over the next five years, Pyongyang built and demonstrated its nuclear weapons capabilities while it was engaged off and on in the six-party talks, which it joined only because of Chinese pressure.⁸ We do not know exactly when Pyongyang got the first bomb, but we know it made significant strides during the past five years. In the early 1990s, the CIA reported that North Korea may have had enough plutonium for one or two bombs. Albright and O'Neill⁹ reported the uncertainty in that estimate, noting that it varied from 10 kilograms plutonium to perhaps less than 2 kilograms. They also reported that non-nuclear explosive experiments, which are prerequisites for a plutonium bomb, were conducted at Yongbyon in the 1980s, leaving little doubt that Pyongyang was pursuing the bomb.

Since its restart in 2003, the 5 MWe reactor has operated for approximately three years, but is currently not operational. The reprocessing facility is operational, but extensive corrosion of fuel fabrication equipment that occurred during the Agreed Framework left that

facility only partially operational.¹⁰ North Korea has conducted three reprocessing campaigns since 2003. The reprocessed plutonium, combined with the roughly 2 to 10 kilograms North Korea may have produced before 1994, yields an estimated plutonium production of 40 to 60 kilograms, of which 24 to 42 kilograms are available for weapons today.¹¹

North Korea also conducted two nuclear tests of plutonium devices, the first in October 2006 and the second in May 2009. The first was only partially successful; its explosion yield was estimated as slightly below 1 kiloton (compared to roughly 21 kilotons for the bomb at Nagasaki). The second was more successful, with an estimated yield of 2 to 4 kilotons. We know nothing about North Korea's nuclear design capabilities. I believe the test results indicate that North Korea can build a Nagasaki-like simple plutonium bomb with a yield of 20 or so kilotons, and most likely possesses a nuclear arsenal of four to eight such primitive weapons today. Based on the experience of other nuclear countries, North Korea appears a long way from developing both a missile and a warhead to launch a nuclear weapon to great distances. Fielding a nuclear weapon on its shorter-range No-Dong missiles would take less time, but it may require another nuclear test.

Following the initial 2002 altercation with the Bush administration over North Korea's alleged uranium enrichment program, Pyongyang denied ever having pursued such a program in spite of overwhelming evidence to the contrary. As part of its response to UN sanctions following the April 2009 missile launch, Pyongyang announced that it would now pursue enriching uranium for a domestic LWR program. On Sep-

tember 3, it informed the UN Security Council that it was in the final stages of enriching uranium, something that it could only have accomplished if it already had an active program long before April 2009. It appears that Pyongyang used the current crisis as an opportunity to admit to having a uranium program; however, that admission changes the North Korean threat very little. I still believe that Pyongyang has experimented with uranium enrichment for decades, but never developed it on an industrial scale.¹²

Pyongyang has pursued an extensive missile program for decades. It built its initial capability, obtained from the Soviets, into a formidable short-range missile force and developed an ambitious export business for re-engineered Soviet missiles. Its principal customers have been Pakistan, Iran, Syria, Libya, Egypt, and Burma. Pyongyang's long-range missile development has been slow and not a great technical success. After the 1998 launch, it delayed its second launch until July 2006, primarily because of the missile moratorium it declared in 1999. However, the second launch failed instantly when the rocket apparently hit the gantry. Its third test, in April 2009, successfully lifted the first two stages over the Pacific, but the third stage failed.

Many observers now look at the last two decades as a dismal diplomatic failure because Pyongyang's nuclear program was not eliminated. Let's take a closer look at what Pyongyang actually achieved technically – or, perhaps more importantly, what it did not achieve. It failed to get commercial nuclear power. Although Pyongyang now has nuclear weapons, its weapons program is much smaller than it would have been if left unchecked. With the capabilities it already had or was soon to complete by

the early 1990s, Pyongyang today could have an arsenal of a hundred or more nuclear weapons. Instead, it has enough plutonium for four to eight weapons and currently is not producing more. It has the capacity to put the 5 MWe reactor back into operation and produce one bomb's worth of plutonium annually for the foreseeable future, but it has not taken steps to do so, perhaps indicating that it believes its small nuclear arsenal provides a sufficient nuclear deterrent.

However, Pyongyang's export of missiles and nuclear technologies appears not to have been constrained. It has widely exported short-range missiles and manufacturing technologies. We have much less information about its nuclear exports. However, evidence is overwhelming that Pyongyang built a plutonium-producing reactor for Syria that was destroyed by an Israeli air raid in September 2007. It appears quite likely that it exported to Libya uranium hexafluoride, the precursor to HEU. There are also grounds to suspect nuclear cooperation with Pakistan and Burma.¹³ Cooperation with Iran is the greatest concern because Iran is putting in place all of the pieces for a nuclear weapons option, and its nuclear capabilities complement those of North Korea.¹⁴ The nature of the nuclear exports also suggests that North Korea may have undeclared uranium facilities.

No one outside Kim Jong-il's inner circle understands the decision-making process and motivations of North Korea's regime. I will use Sagan's framework to analyze Pyongyang's nuclear decisions and try to answer why it built the bomb. Sagan postulates three models for the bomb: the security model, the domestic politics model, and the norms model. The security model calls for states to build nuclear weapons to

increase their security against foreign threats, especially nuclear threats. States that face nuclear-armed or vastly superior conventionally armed adversaries will eventually attempt to develop their own nuclear arsenals unless credible alliance guarantees with a major nuclear power exist.

Security concerns have been the central driver of the North Korean ruling regime since the birth of the nation after World War II. Much of Pyongyang's nuclear decision-making can be understood by examining how Pyongyang saw its security environment evolve over the years. The devastating Korean War, resolved only by an armistice, and the U.S. threat to use nuclear weapons likely moved Kim Il-sung to pursue nuclear weapons early on. He likely strengthened his resolve to pursue his own bomb when China, shortly after its own first nuclear test in 1964, turned down his request to share its atomic secrets.

The late 1960s were turbulent times in Pyongyang's relations with the West. South Korea's military was bolstered by U.S. troops and U.S. nuclear weapons on its soil. Pyongyang watched the Cuban missile crisis unfold in a manner that shed doubt on Soviet commitments to its allies. It witnessed the Sino-Soviet split and the Chinese Cultural Revolution. Each of these developments reinforced the notion that Pyongyang could only rely on itself for the North's security. Although Pyongyang fielded an immense conventional army and its deadly artillery along the Demilitarized Zone (DMZ) was poised to destroy Seoul, nuclear weapons would help to balance the U.S. nuclear presence in the South. Therefore, the political drivers existed to match Pyongyang's sustained technological drive to develop or import the necessary reactor and reprocessing facilities to eventually build nuclear

weapons, a technological base that it completed by 1990.

By the early 1990s, Pyongyang's security environment deteriorated dramatically. As the Cold War drew to a close, Pyongyang lost financial assistance from the former Soviet bloc. Its archrival, South Korea, had pulled ahead economically as well as strengthened its military. China focused on its economic rise and reached out to South Korea, and Russia recognized the South as well. Pyongyang was devastated by these changes and began seriously to explore accommodation with the West, especially with the United States. Carlin and Lewis¹⁵ believe that Kim Il-sung made the strategic decision to engage the United States and even accept U.S. military presence in the South as a hedge against potentially hostile Chinese or Russian influence.

Kim Il-sung took bold steps toward reconciliation with the South. He signed a North-South reconciliation agreement and North-South denuclearization agreement, which altered the security landscape and offered a potential resolution to the nuclear issue.¹⁶ Following a difficult start with the Clinton administration, Pyongyang agreed to trade its gas-graphite reactors and associated fuel-cycle facilities for two LWRs and interim energy assistance in the form of heavy fuel oil. Carlin and Lewis point out that Pyongyang viewed the political provisions of the Agreed Framework, which called for both sides to move toward full normalization of political and economic relations, to be the heart of the pact.

However, reconciliation between Washington and Pyongyang proved difficult, as Washington saw the Agreed Framework primarily as a nonproliferation agreement. Struck by the Clinton administration as the best alternative to avoid war and put the North on a

path to denuclearization, the Agreed Framework was opposed immediately by many in Congress who believed that it rewarded bad behavior. Congress failed to appropriate funds for key provisions of the pact, causing the United States to fall behind in its commitments almost from the beginning. The LWR project also fell behind schedule because the legal arrangements were much more complex than anticipated. The Agreed Framework, which began as a process of interaction and cooperation, quickly turned into accusations of non-compliance by both parties.

The 1990s were also particularly difficult times domestically for North Korea. In addition to geopolitical changes, North Korea lost Kim Il-sung and had to cope with a series of natural disasters that added to its economic devastation and decimated its industrial capacity. Its once mighty conventional military was decaying. Its hope for receiving the benefits of nuclear electricity to help bolster its sagging economy appeared a distant hope because of delays in implementation of the Agreed Framework. However, the diplomatic crisis resulting from its 1998 rocket launch over Japan was resolved by the Perry Process, which brought Pyongyang's second-ranking official, Vice-Marshal Jo Myong-rok, to the White House in October 2000.¹⁷ The two sides issued a joint communiqué that pledged "neither would have hostile intent toward the other and confirmed the commitment of both governments to make every effort in the future to build a new relationship free from past enmity." This communiqué signaled to Pyongyang for the first time that the United States recognized the right of North Korea to exist. The follow-up meeting between Secretary of State Madeleine Albright and Kim Jong-il that was held in Pyongyang

a couple of weeks later appeared to put the nuclear crisis on a path to final resolution.

With the change in administrations in Washington, hope for a settlement was quickly dashed. Whereas Pyongyang was waiting for a U.S. response to the Perry Process, it ran into the Bush administration's adamant opposition to the terms of the Agreed Framework and to political accommodation. Pyongyang practiced restraint with the incoming Bush administration until North Korea was accused of a covert uranium enrichment program and saw the Agreed Framework come to an end. During the confrontation over enrichment in October 2002, First Vice Minister of Foreign Affairs Kang Sok-ju told his American counterpart, "We are a part of the axis of evil. . . . If we disarm ourselves because of U.S. pressure, then we will become like Yugoslavia or Afghanistan's Taliban, to be beaten to death."¹⁸ Pyongyang withdrew from the NPT and restarted its dormant Yongbyon facilities to produce fuel for a plutonium bomb.

Pyongyang's security fears were further heightened by the invasion of Iraq. Pyongyang now believed the bomb would assure its survival, so it no longer hid its nuclear weapons aspirations. At the six-party negotiations, Pyongyang again declared its willingness to denuclearize in return for political accommodation and economic and energy assistance. Although Pyongyang signed the Joint Denuclearization Statement on September 19, 2005, the talks were mired in distrust and accusations. They led to alternate cycles of dialogue and confrontation.

Pyongyang viewed U.S. financial sanctions imposed at the same time as a breach of the denuclearization pact. It withdrew from the talks and launched a second long-range rocket in July 2006

and conducted its first nuclear test in October 2006. The test drew UN Security Council sanctions, but Pyongyang appeared to offset the negative effects of sanctions with increased diplomatic leverage. Later that year, the Bush administration radically changed its negotiating strategy with Pyongyang for the remainder of its term. It conducted bilateral negotiations under the umbrella of the six-party talks, something that Pyongyang had desired but that the Bush administration had refused to do for six years. Pyongyang viewed this change as a direct result of its new nuclear status, whereas domestic U.S. politics and the results of the 2006 congressional elections may have played a greater role.

During the remainder of the Bush administration, Pyongyang agreed again to halt its nuclear program, but not to eliminate it. During my visit three weeks after the nuclear test in 2006, North Korean officials made it clear that their negotiation strategy had changed. They considered North Korea to be a nuclear power and wanted to talk arms control with Washington, not denuclearization focused on the North.¹⁹

In early 2009, Pyongyang decided not to wait for engagement by the Obama administration, but instead took aggressive steps to enhance its missile program. These steps prompted more UN sanctions, which Pyongyang used as an excuse to walk away from all its international nuclear obligations and to restart its nuclear program, including testing a second nuclear device in May. Although security concerns continue to dominate its decision-making, Pyongyang's actions were most likely driven by domestic and diplomatic factors rather than an increased sense of insecurity.

Sagan's domestic politics model posits that nuclear weapons may serve the

bureaucratic or political interests of individual actors, such as the military, the nuclear establishment, politicians, or the public. Such actors or coalitions of actors may influence the state's decision-making. Sagan cites the Indian nuclear program as a particularly convincing case of the importance of domestic politics and the influence of domestic advocacy groups. He further demonstrates that domestic political factors played strong roles in nuclear decision-making in South Africa, Ukraine, Argentina, and Brazil.

Domestic politics are clearly different in North Korea. The Kim dynasty, father and son, has ruled the country with an iron fist and based its legitimacy, in large part, on a cult of personality of its leaders. To stay in power, the regime tightly controls all information, limits contact of its people with the outside world, and warns its people that external forces constantly threaten the very existence of their nation. External threats are used to justify keeping the country on a constant war-footing that requires continued sacrifices by and harsh treatment of its people. Natalia Bazhanova²⁰ points out that in communist countries the pursuit of nuclear weapons to meet external threats helps to increase tensions at home and distract people's attention from their daily grievances and the failures of the regime. The need for nuclear weapons drives home the severity of the external threat.

The need for nuclear weapons was not directly invoked with the public until 2003, when Pyongyang openly declared its pursuit of nuclear weapons. Propaganda was greatest after the long-range missile and nuclear tests in 2006 and 2009. Although Pyongyang's leaders have not had to contend with political opposition or public uprisings, the nuclear card, along with the missile program, has helped to emphasize the

power and prestige of the regime. There was much speculation that a succession crisis was driving Pyongyang's decision-making in 2008, after Kim Jong-il was reported to have suffered a stroke and appeared frail. Kim Jong-il reemerged and appeared to have rearranged the domestic power structure and solidified his control. Still, any future succession crisis in the DPRK may make cooperation with the United States less likely, as potential leaders would want to avoid being branded as "weak" or as "appeasing" Washington in negotiations about the nuclear program.

Sagan's norms model views nuclear decisions as also serving important symbolic functions externally – both shaping and reflecting a state's identity. Norms and shared beliefs about what is legitimate and appropriate in international relations can drive nuclear decision-making. Symbolism becomes important. Nuclear weapons become part of what defines a legitimate, modern state. Sagan contends that the French decision to build nuclear weapons was more the result of French leaders' perceptions of the bomb's symbolic significance than its security calculus. Sagan also shows how international norms, such as the NPT, helped to restrain nations' nuclear ambitions and, in cases such as Ukraine, to relinquish a nuclear arsenal inherited from the Soviet Union.

Pyongyang does not appear to have allowed international norms to influence its nuclear decision-making. The record shows that its own needs always trumped international norms and obligations. Pyongyang signed the NPT because of the promise of Soviet LWRS, but did not sign the required safeguards agreement with the IAEA for years because it wanted to keep its nuclear construction hidden from the world.

Pyongyang withdrew from the NPT in 2003 and defied international norms and UN sanctions with its two nuclear tests and long-range missile launches. Pyongyang decided to hedge its bets during the Agreed Framework, violating the agreement and its NPT commitments by acquiring export-controlled materials and equipment from abroad in order to explore the uranium enrichment route to the bomb.

However, international symbolism and prestige derived from nuclear technologies and weapons played an important role. North Korea views itself as a small and weak nation in spite of its domestic propaganda to the contrary. Once Pyongyang acquired and demonstrated the bomb, it used the power and prestige derived from the bomb as a diplomatic lever to strengthen its negotiating position. Its decision to confront the Obama administration with a missile launch and a nuclear test was more likely an attempt to gain diplomatic leverage and possibly to support domestic changes, rather than an effort toward deterring an increased security threat.

Pyongyang may also simply have decided to take advantage of the transition to accomplish two objectives while the Obama administration was still formulating its Northeast Asia security policies and assembling its executive team. North Korea's long-range missile program needed additional flight tests, and Pyongyang needed to demonstrate to itself and the world that its nuclear weapons could do better than the 2006 test. The missile and nuclear tests must have been on the shelf ready to go for some time, looking for a convenient window.

What can we learn from how and why North Korea built the bomb? North Korea is unlikely to give up its nuclear arsenal anytime soon because it has become

crucial to how the regime assures its security. Nuclear weapons also play a supportive role domestically and provide diplomatic leverage. Pyongyang views its security concerns as existential. They are deeply rooted in history and, hence, are unlikely to be resolved by alliances with its neighbors, each of which North Korea believes to have ulterior motives. Pyongyang turned to the United States, but it found Washington unreliable and inconsistent. In spite of having received numerous security guarantees that promised to respect its sovereignty along with assurances not to invade the country, Pyongyang still feels threatened today. It will require much more than another security guarantee to make Pyongyang feel secure.

Even if North Korea's security fears are assuaged, domestic factors favor keeping the bomb. The external threat is used to justify the need for the bomb and the sacrifices North Korea's people are asked to make. That threat also helps keep its people submissive and isolated from the international community. It also helps the regime continue to control all information and to blind its people to progress in the rest of the world, especially south of the DMZ. Paradoxically, compared to a more democratic country, an autocracy like North Korea may find it easier to give up its weapons if doing so is seen to help the regime survive, because it does not have to deal with domestic opposition.

Military might is the only source of Pyongyang's diplomatic power today. Nuclear weapons have become central to the projection of its military might, in spite of the fact that its nuclear arsenal has little war-fighting utility. Pyongyang views nuclear weapons as diplomatic equalizers with its much more prosperous and powerful, but non-nuclear rivals, South Korea and Japan. Without

nuclear weapons, North Korea would get scant attention from the international community.

Many believe that the bomb is only a bargaining chip and that North Korea is willing to sell it for the right price. However, for reasons stated above, there is no price high enough for Pyongyang to sell. It is also not about to give up its nuclear weapons first as a condition of normalization. Pyongyang may agree to denuclearize in principle, but it will drag out implementation as it did during the six-party process.

It is also unlikely that North Korea can be forced to give up the bomb. Realistically, military options are off the table unless North Korea initiates a conflict. Additionally, sanctions are ineffective without China's support, but China will not support sanctions that bring Pyongyang to its knees. Beijing fears U.S. intervention in North Korea more than it does nuclear weapons in its neighbor's hands. It wants peace and stability on the Korean peninsula.

As undesirable as it may sound, the best hope is a long-term strategy to contain the nuclear threat while tackling the North Korean problem comprehensively, but in discrete steps.²¹ Both Beijing and Seoul favor taking the long view. Time is not on Pyongyang's side. The greatest threat to the regime is not from the outside, but from within. It can't hold back its people forever from the tide of change surrounding its borders. In the meantime, it is important to avoid a clash between Pyongyang and Seoul or Tokyo. And it is essential to stop Pyongyang from doing additional damage around the world through nuclear cooperation and exports. Beijing is likely willing to restrain North Korea from expanding its nuclear program and, most importantly, to stop it from exporting its nuclear materials or technologies.

That is how our joint efforts should be directed to reduce this dangerous threat.

The lessons of North Korea will not be lost on other potential proliferators, particularly Iran. Pyongyang broke new ground in defying international norms and took advantage of the international community's inability to respond effectively. Restricting supply of nuclear technologies through international treaties, norms, and arrangements slows down, but does not stop determined proliferators. We must understand the demand side of nuclear proliferation. Motivation may change over time; it becomes more difficult to reverse proliferation the longer a nuclear program has been pursued and the more successful it has become. In North Korea's case, the security motivation was augmented by domestic and diplomatic considerations and also by time and increased programmatic success. Many have called Pyongyang's actions unpredictable and bizarre, but I find that they are most likely based on a deliberate calculus of its needs, its negotiating strategy, and the necessarily inexact science of negotiations and implementation.

North Korea demonstrated how a sustained technical effort can develop the nuclear weapons option under civilian nuclear energy cover and, by exercising its NPT Article X rights to withdraw from the Treaty, how that option can be exercised quickly once proper political conditions emerge. The choice of fuel cycle for the civilian cover is important. Pyongyang selected the gas-graphite reactor technology, which was the best dual-use option. A lack of transparency and cooperation with the IAEA should serve as a red flag of a state's nuclear weapons aspiration. Pyongyang also confirmed that producing the fissile material – plutonium in this case – is the

critical step. It was able to build the bomb rapidly once it had plutonium because it had tested the non-fissile components of the weapon beforehand. North Korea taught us that we should not underestimate the indigenous capabilities of nations willing to commit resources to build the bomb. Both Russia and China underestimated this capability and, consequently, misjudged the severity of the threat. In Washington, the threat was often exaggerated for political purposes. Hence, it is important to get accurate, publically available technical assessments of nuclear capabilities.

Pyongyang showed that a nuclear arsenal does not have to be large or sophisticated to be politically effective. Nuclear tests strengthened the country's hands and tied the hands of the international community. Thus, it is crucial to stop aspiring programs short of demonstrating their capabilities. All nuclear threats are not equal; prioritization is critical. The Bush administration killed the Agreed Framework for domestic political reasons and because it suspected Pyongyang of cheating by covertly pursuing uranium enrichment. Doing so traded a potential threat that would have taken years to turn into bombs for one that took months, dramatically changing the diplomatic landscape in Pyongyang's favor. On the other hand, the Bush administration did not deal effectively with North Korea's egregious, secret construction of a plutonium production reactor in Syria, which constituted a serious proliferation threat. Moreover, Pyongyang may also be engaged in similar, and perhaps even more dangerous, liaisons with the likes of Iran and Burma.

The United States plays an indispensable role in proliferation prevention, but it can't go it alone. It cannot afford

to sit at the sidelines as it has done with Iran. We found that Pyongyang was willing to slow its drive for nuclear weapons only when it believed the fundamental relationship with the United States was improving, but not when the regime was threatened. Pyongyang was willing to tolerate the six-party negotiations, but progress was made only when Washington agreed to bilateral dialogue. Washington holds the key to incentives, but by itself cannot impose sufficient disincentives to eventually convince North Korea to give up its weapons. It must have support from Beijing and Seoul, both of which have very different strategic objectives.

The more divided we are at home, the more we yield advantage to the adversary. Political divisions in Washington in recent years resulted in our inability to negotiate the nuclear crisis effectively. American diplomats lament that it has been more difficult to negotiate in Washington than at the six-party table. Not only have we not been able to negotiate effectively, but also we have allowed Pyongyang to cross with impunity every red line we have drawn. The U.S. negotiating position has also been hampered by our inability to sustain consistent policies through transitions in administrations. Pyongyang has taken advantage of our political divisions to play a weak hand with success. Unless we learn from the lessons of North Korea, others may be able to do the same.²²

ENDNOTES

- ¹ See the article by So Ki-sok, senior researcher from the DPRK (Democratic People's Republic of Korea; or, North Korea) Institute for Disarmament and Peace, in "Three Perspectives on Korean Developments," presented at a July 2009 meeting of the Council for Security Cooperation in the Asia-Pacific (CSCAP) Study Group on Countering the Proliferation of Weapons of Mass Destruction, <http://csis.org/publication/pacnet-55-three-perspectives-korean-developments>.
- ² Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," *International Security* 21 (3) (Winter 1996/1997): 54–86; also updated in Scott D. Sagan, "Rethinking the Causes of Nuclear Proliferation: Three Models in Search of a Bomb," in *The Coming Crisis: Nuclear Proliferation, U.S. Interests, and World Order*, ed. Victor A. Utgoff (Cambridge, Mass.: MIT Press, 2000), 17–50.
- ³ The gas-graphite reactors were patterned after the British Calder Hall Magnox reactor, whose technical specifications were readily available because they were widely disseminated in the United Kingdom.
- ⁴ The alternative path for natural uranium-fueled reactors is a heavy water reactor, such as the Canadian CANDU reactor. This was India's choice for its first reactor, which was constructed by Canada with U.S.-supplied heavy water. However, after India used the plutonium produced by that reactor for its first nuclear test in 1974, it would have been difficult for North Korea to get external assistance. North Korea required external assistance because it did not have the capacity to produce heavy water.
- ⁵ The reprocessing facility resembles an extension of the design of the Eurochem reprocessing plant in Belgium.
- ⁶ The Agreed Framework signed between the United States and North Korea on October 21, 1994, in Geneva agreed to have North Korea freeze its existing nuclear program. In addition to U.S. supply of LWRs and delivery of heavy fuel oil, the two sides agreed to move toward full normalization of political and economic relations, and work together for peace and security on a nuclear-free Korean peninsula. See Joel S. Wit, Daniel B. Poneman, and Robert L. Gallucci, *Going Critical: The First North Korean Nuclear Crisis* (Washington, D.C.: Brookings Institution Press, 2004) for informative discussions of the Agreed Framework and North Korean crisis in the 1990s.
- ⁷ In the late 1990s, Pyongyang is reported to have acquired centrifuge technology from Pakistan's A.Q. Khan, as reported by Pervez Musharraf in his book *In the Line of Fire: A Memoir* (New York: Free Press, 2006). Additional evidence, including the purchase of aluminum tubes suitable for centrifuge rotors from Russia and attempted purchase from Germany, is discussed in Hui Zhang, "Assessing North Korea's Uranium Enrichment Capabilities," *Bulletin of the Atomic Scientists* (June 18, 2009), <http://www.thebulletin.org/web-edition/features/assessing-north-koreas-uranium-enrichment-capabilities>.
- ⁸ The six-party talks, which were initiated in 2003, involved the United States, North Korea, and its four neighbors: South Korea, China, Japan, and Russia.
- ⁹ David Albright and Kevin O'Neill, eds., *Solving the North Korean Nuclear Puzzle* (Washington, D.C.: Institute of Science and International Security, 2002).
- ¹⁰ For a detailed assessment of the state of the Yongbyon nuclear complex, see Siegfried S. Hecker, "Denuclearizing North Korea," *Bulletin of the Atomic Scientists* 64 (2) (2008): 44–49, 61–62.
- ¹¹ All of the plutonium estimates have high uncertainties. If we estimate a 10 percent loss during reprocessing (which includes waste and material held up in plant equipment), that reduces the amount to 36 to 54 kilograms before testing, leaving an estimated 24 to 42 kilograms after testing, assuming that North Korea expended 6 kilograms per test (roughly the amount in the Nagasaki plutonium bomb). In 2008, North Korea declared that it had 26 kilograms reprocessed and weaponized. (By that time, it had conducted one nuclear test

and it still had roughly 8 kilograms in the fuel rods that were reprocessed in 2009.) Although that number is low, it is possibly correct.

- ¹² This point has been made in Siegfried S. Hecker, "The Risks of North Korea's Nuclear Restart," *Bulletin of the Atomic Scientists* (May 12, 2009).
- ¹³ The evidence for North Korean assistance to Syria is strong; see David Albright and Paul Brannan, "The Al Kibar Reactor: Extraordinary Camouflage, Troubling Implications," Institute for Science and International Security (ISIS) Report, May 12, 2008, <http://isis-online.org/publications/syria/index.html>. Evidence of cooperation with Libya is less conclusive, yet likely; see David E. Sanger and William J. Broad, "Tests Said to Tie Deal on Uranium to North Korea," *The New York Times*, February 2, 2005. Evidence of nuclear cooperation with Burma is weak, but possible; see Julian Borger, "Burma suspected of forming nuclear link with North Korea," *Guardian.co.uk*, July 21, 2009, <http://www.guardian.co.uk/world/2009/jul/21/burma-north-korea-nuclear-clinton>.
- ¹⁴ Siegfried S. Hecker and William Liou, "Dangerous Dealings: North Korea's Nuclear Capabilities and the Threat of Export to Iran," *Arms Control Today* 37 (2) (2007), http://www.armscontrol.org/act/2007_03/heckerliou; and Siegfried S. Hecker, "From Pyongyang to Tehran, with nukes," op-ed, *Foreign Policy* (May 26, 2009).
- ¹⁵ Robert Carlin and John Lewis, *Negotiating with North Korea: 1992 – 2007* (Center for International Security and Cooperation, Freeman Spogli Institute for International Studies, Stanford University, January 2008), http://iis-db.stanford.edu/pubs/22128/Negotiating_with_North_Korea_1992-2007.pdf.
- ¹⁶ The North-South Denuclearization Agreement signed on December 31, 1991, vowed that neither would test, manufacture, produce, receive, possess, store, deploy, or use nuclear weapons. The Agreement on Reconciliation, Nonaggression, and Exchanges and Cooperation between South and North Korea (also known as the Basic Agreement), signed on February 19, 1992, reaffirmed a 1972 Joint Communiqué that the North and South are determined to end the state of political and military confrontation and achieve national reconciliation; to avoid armed aggression and hostilities; and to ensure the lessening of tension and the establishment of peace and the desire to realize multifaceted exchanges and cooperation to promote interests and prosperity common to the Korean people. At the time, this agreement was the more significant of the two. The denuclearization agreement never received serious consideration for implementation.
- ¹⁷ Former Secretary of Defense William J. Perry led a North Korea policy review for President Clinton. The full report can be found at http://www.state.gov/www/regions/eap/991012_northkorea_rpt.html.
- ¹⁸ Charles L. Pritchard, *Failed Diplomacy: The Tragic Story of How North Korea Got the Bomb* (Washington, D.C.: Brookings Institution Press, 2007), 25.
- ¹⁹ For a detailed description of the political developments in North Korea during the past decade, see Mike Chinoy, *Meltdown: The Inside Story of the North Korean Nuclear Crisis* (New York: St. Martin's Press, 2008).
- ²⁰ Natalia Bazhanova, "Economic Factors and the Stability of the North Korean Regime," in *The North Korean Nuclear Programs*, ed. Clay Moltz and Alexandre Mansourov (London: Routledge, 2000), 60.
- ²¹ In his 1995 analysis of the North Korean nuclear crisis, Michael Mazarr argued that complete denuclearization may be too high a standard for hard-core proliferators; progress will come instead in fits and starts. Michael J. Mazarr, *North Korea and the Bomb: A Case Study in Nonproliferation* (New York: St. Martin's Press, 1995).
- ²² The author is indebted for close readings and suggestions on an earlier draft made by Chaim Braun, Robert Carlin, Thomas Fingar, John Lewis, Michael May, Niko Milonopoulos, Scott Sagan, David Straub, Kevin Veal, and Philip Yun.