

China, North Korea and the Spread of Nuclear Weapons

Thomas Plant and Ben Rhode

Once described as ‘as close as lips and teeth’, in recent years the relationship between China and North Korea has become more strained. Beijing has conflicted motivations in its policy towards Pyongyang. It resents the disruption North Korean provocation brings to Northeast Asia. Some observers argue that Beijing’s North Korea policy is illogical, as it increases anti-Chinese resentment and support for America’s military presence in Asia.¹ (When Beijing gave Pyongyang diplomatic cover after North Korean forces sank the South Korean corvette *Cheonan* and shelled Yeonpyeong Island in 2010, it damaged China’s image and strengthened cooperation between South Korea, Japan and the United States.) And China’s indefinite protection of North Korea’s nuclear arsenal might one day encourage Seoul or Tokyo to seek their own nuclear deterrents, although this will remain unlikely as long as the United States retains a meaningful military presence in East Asia. In the shorter term, the North Korean nuclear threat has prompted Tokyo and Seoul to introduce ballistic-missile defences, much to China’s displeasure.

Beijing has apparently calculated, however, that these disadvantages are outweighed by the risk of regime collapse in North Korea, which would entail a large number of refugees entering northern China, and the likelihood of a reunified Korean peninsula under Seoul’s control and allied with the United States. The prospect of a US military ally as China’s direct neigh-

Thomas Plant is a Research Fellow at the International Centre for Security Analysis (ICSA), King’s College London, and is currently on secondment from the UK Ministry of Defence. **Ben Rhode** is a Senior Research Associate at the Belfer Center for Science and International Affairs, Harvard Kennedy School. The views expressed here are their own, and should not be taken as representative of any body or organisation to which they are affiliated.

bour, and possibly US troops on its borders, is deeply alarming to Beijing. Memories of Japan's invasion of China via the Korean peninsula remain strong among Chinese policymakers, and concerns about territorial vulnerability trump all others.² China's policy now seems to be focused on trade and investment in North Korea, in the hope that this will promote regime prosperity and stability, reduce any incentive to extort aid through military provocation, encourage Pyongyang to follow China's post-1979 path to economic reform, and maximise Chinese leverage. As Victor Cha, former director for Asian affairs at the National Security Council, has argued, China and North Korea are 'caught in a mutual hostage relationship – the North needs Chinese help for their survival, and the Chinese need the North not to collapse'.³ This prospect has been sufficient to deter China from fully exploiting its economic and diplomatic leverage over Pyongyang.

This equation may not hold, however, when it comes to the leakage of nuclear material from North Korea. China has very real interests in minimising the nuclear dangers that could emanate from North Korea, in particular the deliberate sale of nuclear weapons or material to non-state actors, whether directly or indirectly via sale to another state; and the leakage of nuclear weapons or materials in the event of the collapse or fragmentation of the Kim regime. Moreover, it can do so without causing serious deterioration (which would in any case be worth it) in relations with Pyongyang. If nuclear weapons or materials were to find their way into the hands of non-state actors, the damage done to Chinese interests would substantially outweigh that caused simply by regime collapse.

Beijing has gone to some lengths to demonstrate its credentials in the field of nuclear security.⁴ Former President Hu Jintao has argued that 'as a responsible country, China seeks nuclear security and firmly opposes nuclear proliferation and nuclear terrorism ... The potential threat of nuclear terrorism cannot be ignored, and the risk of nuclear material diversion and illicit trafficking is on the rise'.⁵ China has signed and ratified many of the major treaties and conventions that make up the existing nuclear-security patchwork. It has hosted regional nuclear-security training, established a nuclear security centre of excellence following a bilateral agreement with the United States in 2011, and participated in both Nuclear Security Summits.

At the 2012 summit in Seoul, Hu announced that China would take further nuclear security measures, make sure of the security of its own nuclear materials and facilities, and improve overall nuclear security.⁶

Perhaps the single most important way in which China can minimise the danger of nuclear weapons or material falling into the hands of non-state actors is indirectly, through its relationship with North Korea, its neighbour and client.⁷ Chinese policymakers may instinctively be reluctant to use their influence, believing that the costs to China's broader interests would not be justified by what appears to be a marginal reduction in the likelihood of an already remote threat, and one almost certainly directed at the United States and other Western countries.⁸

In private, Chinese analysts and officials may complain about North Korean behaviour,⁹ but most usually argue that Chinese leverage over Pyongyang is greatly exaggerated. A further common refrain is that North Korea is to China what Israel is to the United States. The implication is that America's interests are also often jeopardised by its support for a small, bellicose ally, but that China should no more be expected to cut off support for Pyongyang than Washington should end its partnership with Jerusalem.¹⁰

China also refuses to participate in US–South Korea contingency planning for North Korean regime collapse (which would include securing nuclear assets), believing that this would only anger Pyongyang and diminish Chinese influence.¹¹

Such arguments grossly understate the extent to which North Korea depends on China, both economically and diplomatically. The Kim regime may not consider itself beholden even to its only nominal ally, but for a country so ideologically wedded to self-reliance, North Korea's survival is remarkably dependent on Beijing's goodwill. China has enjoyed approximately 20–30% of North Korea's foreign trade for most of the last decade, dramatically expanding in recent years to more than 50% in 2011.¹² North Korea depends on China for around 500,000 tonnes of imported oil each year, which may constitute almost 100% of its requirements. China has exploited this vulnerability on at least one occasion: in 2003, during a period

*North Korea's
survival is
dependent
on Beijing's
goodwill*

of North Korean intransigence and following a short-range missile test, Beijing reportedly briefly suspended oil shipments. Pyongyang adopted a more conciliatory approach, and later agreed to join the Six-Party Talks.¹³ There have been recent, unconfirmed press reports that China was exerting pressure on North Korea to dissuade it from conducting a third nuclear test, which most analysts had considered almost certain to take place within months of a failed satellite launch in April 2012.¹⁴ If confirmed, such action would be encouraging, but would be an outlier in Beijing's general North Korea policy. And in any case Pyongyang conducted its third nuclear test in February 2013. Despite statements by some prominent Chinese analysts that North Korea had proven itself to be a strategic liability, and that Beijing should cut off support for Pyongyang in retaliation, the Chinese Foreign Ministry made clear that China would continue to 'conduct normal trade and economic exchanges with North Korea'.¹⁵

North Korea's nuclear programme

The majority of North Korea's known nuclear infrastructure is located at the Yongbyon nuclear research centre, where, over a period of around 20 years, workers have succeeded in separating enough weapons-grade plutonium to produce several nuclear weapons. According to most assessments, North Korea has some 30–50 kilogrammes of separated plutonium. North Korea's own claims are within, but towards the bottom end of, this range.¹⁶ The stockpile has not grown since 2009, after North Korea partially dismantled its plutonium-production reactor in 2008 and completed reprocessing the spent fuel.¹⁷ The plutonium-production infrastructure at Yongbyon is currently inoperable and is likely to remain so, at least until North Korea's first light-water reactor (also at Yongbyon) is finished and begins operation. Light-water reactors are generally considered inferior to heavy-water reactors for production of weapons-grade plutonium.

North Korea has, however, also developed a uranium-enrichment capability, part of which was dramatically revealed to US visitors Robert Carlin, Siegfried Hecker and John W. Lewis in November 2010. This facility, constructed in part of the nuclear-fuel fabrication facility at Yongbyon after April 2009 (when International Atomic Energy Agency inspectors left the

site for the last time), reportedly contained around 2,000 centrifuges and had a design capacity sufficient to produce at least 40kg of highly enriched uranium per year – enough for two implosion-type weapons.¹⁸ It is implausible that North Korean engineers, no matter how skilled, would be able to construct an enrichment plant in the time available without having set up at least a pilot facility elsewhere.

North Korea's pursuit of industrial-scale uranium enrichment technology dates from at least the early 2000s, though evidence of its production capability suggests a significantly earlier interest.¹⁹ By 2000–01 North Korea had almost certainly developed enrichment technology sufficiently to allow it to provide 1.7 tonnes of very slightly enriched uranium hexafluoride to Libya, via the A.Q. Khan black-market network.²⁰ By 2008, if not before, North Korean uranium enrichment may have advanced so far as to allow its highly enriched product to contaminate documents that it passed to the United States as part of agreed verification activity under the Six-Party Talks.²¹ (Isotopic analysis demonstrates that the material found on these documents could have come only from Pakistan or North Korea, but there are indications that it was produced after Pyongyang's relationship with A.Q. Khan had ended.²²) There are several plausible scenarios that suggest North Korea could have been producing weapons-grade uranium as early as 2005.²³

The uranium-enrichment programme has never been subject to controls or publicly reported external inspection, beyond the glimpses afforded to US visitors in 2010, yet it appears to have been operating for over ten years. This opacity makes it hard to estimate North Korea's potential stockpile of highly enriched uranium (HEU). At one extreme, it is conceivable that North Korea has operated a pilot-scale plant since the late 1990s.²⁴ One or more larger-scale facilities may then have been added during the 2000s. (One South Korean official has commented that there may be as many as four.²⁵) At the other extreme, it is conceivable that only one facility was built, during the 2000s, and that it was deconstructed and reassembled to provide components for the Yongbyon facility.

Depending on the assumptions, North Korea could have a stockpile of weapons-grade HEU amounting to over a quarter of a tonne or more, or it

could have almost no HEU at all.²⁶ The balance of probability is in favour of at least some HEU production, especially given North Korea's strong motive and the lack of international monitoring of its programme, but a stockpile at the lower end of the range is most likely. What can be said is that North Korea has the capability to rapidly and discreetly construct uranium-enrichment facilities, and (if the facility at Yongbyon is as efficient as claimed) the apparent capability to produce enough material for two weapons per year. The location of any putative HEU stockpile remains a mystery, as does the location of what Pyongyang says is 'weaponised' plutonium.²⁷

If North Korea has indeed produced nuclear weapons, as it frequently claims, then these could be transferred *in toto* to interested customers, and it does not matter whether they use uranium or plutonium.²⁸ But from the perspective of concerns about transfer of fissile material only, rather than complete weapons, this HEU capability presents a particular risk. It is technically easier to produce a nuclear weapon using HEU than using plutonium. The simplest type of nuclear weapon – a gun-type weapon such as that used at Hiroshima, in which a critical mass is assembled by firing one sub-critical mass into another – can readily be manufactured from HEU. It is also a relatively simple task to shield HEU from detection during transportation.

Pyongyang's calculus

North Korean state trading companies have a long history of selling whatever commodities they can to whomever will pay for them.²⁹ Such sales have included conventional weapons, counterfeit pharmaceuticals, narcotics, counterfeit currency, ballistic missiles and a wide array of other illicit products.³⁰ Pyongyang has also sold technology used in nuclear-weapon development on at least two occasions: the slightly enriched uranium hexafluoride to Libya (along with unenriched uranium hexafluoride feedstock), and reactor technology and perhaps other material and infrastructure to Syria.³¹ On neither occasion was Pyongyang directly punished or held accountable for its actions. North Korean decision-makers thus recognise that their nuclear expertise and technologies can be used as trade goods. The covert nature of the transactions also shows they recognise the potential costs associated with such trades.

Reports of North Korean ballistic-missile proliferation and conventional arms sales had been widespread for decades before Libyan leader Muammar Gadhafi decided to abandon his covert nuclear programme in 2003.³² As part of Libyan disclosures of previously undeclared activity, three canisters of uranium hexafluoride, one of which contained slightly enriched material, were shipped to Oak Ridge National Laboratory in the United States for technical analysis. This analysis revealed that the canisters had originated in North Korea, and that it was not possible to find another source of the enriched uranium other than North Korea. It became clear that A.Q. Khan had found another supporting partner for his network.³³ Importantly, this partner had shown itself willing and able, within the bounds of whatever capability it had at that time, to supply nuclear materials in a deal which could prove to be highly deleterious to its interests if detected, but promised to yield substantial financial reward if not. The reported \$2 million cost to Libya of the uranium-hexafluoride shipment was approximately 40 times the contemporary market rate, and Libya was reportedly seeking around 20 tonnes of uranium hexafluoride in total for research and development purposes.³⁴ This implies a cost of around \$20–30m for this supply of feed material.

A 1991 US Defense Intelligence Agency assessment cites the North Korean military sales relationship with Libya as one of its most significant of the 1980s, with a science and technology collaboration agreement in 1977 signifying, if not a warm relationship, at least an expanding and mutually beneficial one.³⁵ A key entity in the relationship was Changgwang Sinyong, a major North Korean military sales organisation established with the remit of earning foreign currency for the regime and perhaps to support North Korea's own weapons development.³⁶ Changgwang Sinyong has undergone many name changes over the years, but perhaps the most famous name it has operated under is KOMID, the Korea Mining and Industrial Development Corporation, now a proscribed entity under UN Security Council Resolutions 1718 and 1874.³⁷

Agents of North Korean weapons sales organisations had also been developing relationships with their Syrian customers for some time before their nuclear assistance became public. These ties can to some extent be tracked by observing the development of the parallel ballistic-missile relationship.

Sales of *Scud* B missiles in the early 1990s and *Scud* Cs shortly thereafter appear to have evolved into some form of production capability transfer for *Scud* Ds in the early 2000s.³⁸ Once again, Changgwang Singyong, later KOMID, was reportedly a key player in carrying out North Korea's business development activities with this important partner.³⁹

In 2007, Israeli aircraft attacked and destroyed what was alleged to be a non-operational nuclear reactor at Deir ez-Zor in Syria. Information subsequently revealed in a CIA public briefing indicated that the design of the reactor closely matched that of North Korea's plutonium-production reactor at Yongbyon, though the reactors were not identical. A photograph, apparently taken in Syria in which the head of Syria's Atomic Energy Commission, Ibrahim Othman, stands side by side with senior North Korea nuclear scientist Chon Chi Pu, further indicates a North Korean link.⁴⁰ In 2011, the International Atomic Energy Agency determined that the facility was indeed 'very likely' to have been a nuclear reactor under construction. Since an IAEA inspection in 2008, the Syrian authorities have denied access to three other sites alleged to be 'functionally related' to the reactor at Deir ez-Zor.⁴¹

A common factor in the Libyan and Syrian cases is the establishment of relationships between North Korean weapons firms and the recipient government some significant time before any nuclear-related transfer took place. In both cases the relationships were high value, established over a period of many years, and were generally intended to remain covert even prior to their nuclear dealings. In Libya, the middle-man, A.Q. Khan, had proved himself relatively trustworthy during an extended history of previous dealings with both supplier and customer. In both cases there is evidence that transfers of more sensitive items and technologies, such as ballistic-missile systems, involved deceptive measures to avoid detection as far as possible.⁴² This was for good reason: when Libya was receiving some of the benefits of North Korea's developing uranium infrastructure, Pyongyang was also seeking to extract the maximum benefit from the 1994 Agreed Framework with the United States. The longer-term effort involved in supplying a nuclear reactor to Syria overlapped the time frames of both the Agreed Framework and the Six-Party Talks.⁴³

Decision-makers in Pyongyang will have considered the possibility that the other parties would suspend the benefits provided by these negotiations, or impose further sanctions, if acts of proliferation were detected. That they went ahead suggests either that these consequences were insufficient to threaten those responsible for proliferating, or that the expected benefit outweighed the risks. That Pyongyang continued its nuclear relationship with Syria after the 2004 revelation that it had supplied nuclear material to Libya indicates a strength of nerve that could only have been supported by the lack of punitive measures in response to that revelation. And North Korea also escaped from its Syrian adventure without apparent cost. The George W. Bush administration decided not to punish it following Israel's destruction of the Deir ez-Zor reactor in 2007, but rather continue engaging it via the Six-Party Talks. If anything, the confidence of decision-makers in Pyongyang will have been increased by the lack of response, unilateral or multilateral, to their involvement. The uncomfortable truth is that international responses to North Korean nuclear proliferation have encouraged, not deterred, additional such acts. If North Korean decision-makers engage in future deliberations about nuclear exports, the events of the past decade will give comfort to those arguing that the benefits of such sales outweigh their costs.⁴⁴

*North Korea
escaped from
its Syrian
adventure
without cost*

Sceptics might argue that, despite the precedent for exports of nuclear technologies to states, North Korea would be far less likely to deliberately transfer nuclear weapons or weapons-useable material to a terrorist group, as the potential repercussions to the regime would be dramatically more severe, not least because terrorists would be much more likely than a state to use a nuclear weapon. Several factors suggest that this is indeed the case. Firstly, establishing a transactional relationship with a terrorist group would be much more difficult than building one up over many decades with states such as Syria or Libya. Secondly, most groups, having no access to state-level finance, would not have sufficient funds to make the transaction appealing to the North Koreans. The Libyan precedent suggests that tens of millions of dollars would be required for North Korea to supply meaningful quantities of basic

feed material, let alone more advanced technologies or complete weapons. Some non-state groups, such as Aum Shinrikyo and al-Qaeda, have previously demonstrated a willingness to pay large amounts for nuclear weapons, but even in those cases reduced capability and centralisation respectively have taken their toll on access to funding. Finally, it is very likely that North Korea will have been encouraged by the lack of US or Chinese response to its previous nuclear exports, and by the general failure of Washington more generally to enforce the various 'red lines' set for North Korea over many years. But the likely aftermath of a terrorist nuclear attack in a Western city, eventually traced back to North Korea, should give pause even to those decision-makers in Pyongyang with a particularly high tolerance for risk.

But this is not grounds for complacency. Firstly, the risk that, as North Korea's HEU stockpile increases, it could become increasingly easy for actors within North Korea to sell material abroad without authorisation from the regime should not be underestimated. Although the risks of such unauthorised sales would be enormous for the perpetrators, the potential financial rewards would also be immense. Secondly, one of the more likely routes by which non-state actors could obtain nuclear weapons or materials from North Korea would be indirectly via another state. Hizbullah, for example, might obtain North Korean HEU that had originally been transferred to Iran. North Korean policymakers could plausibly argue China would shield it from the long-term consequences of its sale of HEU, or even nuclear weapons, to Iran, given its past behaviour and fear of North Korean regime collapse. They might also assume that China's calculation of its interest would not be affected by whether or not Pyongyang had known or approved of any intent for subsequent transfer to a client terrorist group.

Risks to China

Chinese analysts privately acknowledge that the risk of North Korean nuclear exports for financial gain is real. They also recognise that, in the event that North Korean weapons or HEU were used abroad, the damage to Chinese interests could be severe. Yet, in general, they conclude that the most effective way for China to minimise these risks is essentially to buy off the North Koreans: if the Kim regime feels financially secure, it will have no incentive

to sell any of its nuclear assets. Conversely, if it is pressured by international sanctions, the risks of nuclear sales could be outweighed by their financial rewards.⁴⁵ This perspective is understandable, but short-sighted. It underestimates the consequences to China if North Korean nuclear material were to be used abroad and overestimates the effect of Chinese economic support in lowering incentives for nuclear exports.

Clear evidence of the transfer of nuclear weapons or material to a terrorist organisation could lead the United States to take military action, both to seize the weapon and to punish those who sold it. And if North Korean HEU does come into the hands of a terrorist group, that group will almost certainly try to use it in an improvised nuclear device against civilians, most likely in a major city. Even if the HEU were not immediately identified as North Korean (current nuclear forensic techniques entail a certain delay before the origin of material can be confirmed), any government that had suffered such a devastating attack would be under irresistible political pressure to retaliate almost immediately. Such a response might or might not itself involve nuclear weapons, but it would most likely be overwhelming. It is easy to foresee how a military response could escalate into a major war.⁴⁶ The indirect costs to China posed by refugee flows and the economic catastrophe in East Asia caused by such a war would be dramatically higher than the scenario of North Korean regime collapse. Moreover, the possibility that China would unintentionally find itself dragged into hostilities with the United States on the Korean peninsula is not inconsiderable.

Even if material or weapons transferred from North Korea were never used, a deeply unfortunate precedent would be set. It is unclear what meaningful penalties could be enacted against a recipient state that would be sufficient to induce it to relinquish its new deterrent. This could embolden other states to obtain nuclear weapons or material from abroad with a reduced fear of repercussions. For China this could have worrying effects, for example if Taiwan were to reconsider its decision (made in the 1970s) not to acquire nuclear weapons.

Analysts have been predicting the collapse of North Korea since its economic crisis of the early 1990s and the death of Kim Il Sung in 1994. That this has not happened does suggest a certain resilience, and argues against casual

use of the phrase 'regime collapse'. But past performance is not necessarily a guarantee of future survival; greater media penetration, the development of a trading class and tentative moves towards economic development will all pose challenges to North Korea under Kim Jong Un. Any changes will involve risks for those who have benefitted under the current system, and such parties might challenge the authority of those imposing the change. This is particularly true of changes that could be construed as challenges to the dominance of the military. The true risk in the context of nuclear terrorism is not regime collapse, but regime fragmentation, in which powerful interests would compete for dominance in a framework loosely defined by

the need to maintain an outward appearance of statehood, if not solidarity.

*The true risk
is not regime
collapse*

Under such circumstances, players in control of part or all of the nuclear infrastructure would have a powerful asset. The temptation to use it in some way would be great. Keeping it for external or internal political leverage would be one possibility, but another would be to sell at

least some of the nuclear material for significant quantities of hard currency to be used in an internal power struggle. The normal restraints on nuclear transfer would at the same time be somewhat relaxed: it is difficult to deter a sub-state actor with the same tools aimed at a state, and internal monitoring that might prevent nuclear material from being misappropriated under normal circumstances would be degraded.

While the United States, South Korea and China have all considered the need to secure nuclear materials in the event of regime collapse, so far China has refused to discuss such a scenario, or any contingency planning, with Washington or Seoul.⁴⁷ The most frequently cited reasons for this reluctance are the need to show solidarity with their ally, a desire not to aggravate this already troublesome neighbour, and mistrust of US intentions towards China.⁴⁸ The result is that neither Beijing nor Washington knows under what circumstances the other would consider North Korea's nuclear weapons and material to be at risk. Neither knows where the other considers the key sites to be. Neither knows what actions the other might take at any given point in a developing crisis.

What can Beijing do?

China's interests would be served by preventing the transfer of nuclear material from North Korea, and by working with the United States and South Korea to minimise the risk of miscalculation by any party in a crisis. To achieve this it has no need to impose the deeply coercive economic measures it fears could precipitate such a crisis, and may even be able to avoid upsetting its relationship with Pyongyang. Such tools, to be sure, have been effective in the past and should not be neglected entirely. The one-month suspension of oil transfers that persuaded North Korea to join talks in 2003 could be contrasted to the \$500m that Seoul needed to spend as part of its 'Sunshine Policy' to entice Kim Jong Il to a bilateral summit. China's continued relationship with Pyongyang following such actions further suggests that this tool could be deployed more often than Beijing has yet appeared willing to do.

There appear to be two conditions for North Korea to supply particularly sensitive goods (such as nuclear materials): firstly, North Korea must trust the customer, preferably as a result of a long clandestine association; and secondly, the customer should have the means to pay for the goods, in coin or kind. At present there are few, if any, non-state groups with the ability to service a long-term, multi-million-dollar relationship with a North Korean weapons trading firm, so the principal risk of transfer of nuclear material from North Korea to non-state groups is via an intermediary state, with which Pyongyang must have had long and lucrative illicit dealings. Thus the risk of use of North Korean nuclear material by non-state actors is strongly related to the continued activity of (mostly-proscribed) North Korean weapons trading.

This suggests an obvious and important response for Chinese policy-makers to consider. China gains nothing but negative attention from the activities of North Korean arms sellers operating within its borders.⁴⁹ The only beneficiaries are Pyongyang and its customers. Indeed, any acts of corruption perpetrated by these entities in order to run their businesses indicate a challenge to governmental authority that can only be costly to China. And without these firms, North Korea would find it hard to develop the contacts or relationships it would need to engage in further nuclear proliferation.

It might be possible to limit or halt these activities by mutual agreement between Beijing and Pyongyang, but it is certainly within Beijing's power to halt them more directly. North Korean anger at such action would likely be outweighed by its acknowledgement of the brutal fact of its financial dependence on its larger neighbour. The suspension of oil exports successfully used in the past is a coercive tool substantially more blunt in its effects than targeted action against proliferation-related entities. China's diplomatic relations with other powers would benefit from the expulsion of North Korean proliferation-related entities. So it has something to gain and little or nothing to lose by taking action. Such a move would greatly reduce the risk of North Korean-supplied nuclear materials being used in anger.

Managing the risk of miscalculation in a developing crisis for regime stability in the North is complicated by the apparent Chinese analysis that discussing the possibility of such a crisis would not be consistent with the behaviour of an ally. China may also calculate that such discussions increase the likelihood of the very crisis they seek to manage, by heightening Pyongyang's sense of insecurity. China could nevertheless reduce the risk of diversion of nuclear material in such circumstances, even without divulging the information it possesses (its intelligence about North Korean nuclear material, weapons and facilities is probably more reliable than that of any other state).

The simplest step would be to establish a mechanism for communication with the United States, and perhaps South Korea, designed solely to exchange information and intentions under crisis circumstances on the peninsula; this could even be restricted further, to nuclear issues only, if it were deemed necessary. It would be difficult at present for both Washington and Beijing to share detailed information about North Korea's nuclear capabilities and plans for addressing them in a crisis; conditions of mutual suspicion make it harder to contemplate revealing sensitive information to a potential rival. This does not mean that information exchange is not a useful tool for reducing the risks. A suite of options are available: back-channel meetings could establish protocols by which such information could be exchanged rapidly in future if warranted; similar meetings or other measures could also be used to signal intentions in relation to how border security might be

ensured under different circumstances; and both sides could use the North Korean nuclear situation as a spur to cooperation on nuclear forensics and detection methods. In fact, technical cooperation may prove to be the route for each side to enhance its understanding of the other's position, through greater appreciation of the factors and analyses that support their judgements (for example, that the risk of terrorist use of North Korean HEU is real). Another way to do this would entail Chinese cooperation with other states on nuclear forensics, for example by assisting in compiling a database of global nuclear material samples that could be used after a terrorist incident to exonerate countries from the charge of having been the source of the material used. This would also underline to Pyongyang that, if a terrorist nuclear incident were to occur, there would be methods to trace the source of the weapon's fissile material.

* * *

For at least the past decade, many Western observers have hoped that China could somehow solve the wider problems caused by North Korea – that Beijing could persuade North Korea to denuclearise, cooperate with its neighbours or enact economic reforms. In effect, these Western analysts hoped that China could be enticed to see things from a Western perspective and to pressure North Korea in ways that served the interests of neither Pyongyang nor Beijing. While Chinese observers could acknowledge the disadvantages posed by North Korean behaviour, these were trumped by China's own interests in preventing the Korean Peninsula from falling under the control of potentially hostile powers. Yet, if North Korean nuclear weapons or material is sold abroad, the consequences for Chinese interests, both short and long term, could be calamitous.

It would be unwise for Beijing to conclude that best way to prevent North Korean nuclear exports would be by providing the North Korean leadership with a financial cocoon. To do so would be to forget, or to ignore, that the two known examples of nuclear exports to other states occurred during the high point of economic assistance to North Korea from the United States and South Korea. Buying Pyongyang off with economic concessions may be

the best way of minimising its overt military provocations, but history suggests that this will not be enough to stop future nuclear exports. Although it would serve Western and East Asian interests more broadly, it would certainly also be in China's interests for it to communicate to Pyongyang the dramatic consequences of North Korean nuclear material reaching terrorist groups. It should also warn Pyongyang that China will not allow itself to be dragged into a larger conflict with a vengeful United States.

Notes

- 1 See Ralph A. Cossa and Brad Glosserman, 'The Illogic of China's North Korea Policy', *PacNet Newsletter* no. 32, 17 May 2012, <http://csis.org/files/publication/Pac1232.pdf>.
- 2 See R. Stapleton Roy, 'Responses to PacNet 32', *PacNet Newsletter* no. 32R, 7 June 2012, <http://csis.org/files/publication/Pac1232RA.pdf>.
- 3 Victor Cha, *The Impossible State: North Korea, Past and Future* (London: Bodley Head, 2012), p. 17.
- 4 For the purposes of this paper, 'nuclear security' is defined as efforts to prevent nuclear terrorism (the detonation of a yield-producing nuclear weapon by terrorists) or sabotage of a nuclear facility.
- 5 Wu Jiao, Tan Yingzi and Li Xiaokun, 'President Hu Offers Nuclear Security Support', *China Daily*, 14 April 2010, http://www.chinadaily.com.cn/china/2010-04/14/content_9725298.htm.
- 6 Hui Zhang, 'Advancing China's Nuclear Security', *Bulletin of the Atomic Scientists*, 25 October 2012.
- 7 China could also make a positive contribution via its relationship with Pakistan. The threat of nuclear terrorism emerging from Pakistan is most likely higher than from North Korea. However, although China enjoys a warm relationship with Pakistan, and could exert influence through its security and nuclear-energy connections, its leverage over its neighbour North Korea, and thus its potential to mitigate the threat, is far greater.
- 8 Authors' communications with Chinese officials and experts, IISS workshops, 2009–11.
- 9 For example, in 2009 Chinese Vice Foreign Minister He Yafei compared North Korea's behaviour to that of a 'spoiled child' in a discussion with American officials. See 'US Embassy Cables: China Reiterates "Red Lines"', *Guardian*, 29 November 2010, <http://www.guardian.co.uk/world/us-embassy-cables-documents/204917>.
- 10 Authors' communications with Chinese officials and analysts.
- 11 Sun Yun, 'Rowing Together? The Chinese Perspective on U.S.–ROK Trilateral Coordination on the Korean Peninsula', *Institute for Foreign Policy Analysis*, 10 May 2012.
- 12 Stephan Haggard and Marcus Noland, 'Economic Relations between China and North Korea: Evidence from a Firm-Level Survey', in Bonnie

- Glaser and Brittany Billingsley (eds), *Reordering Chinese Priorities on the Korean Peninsula* (Washington DC: Center for Strategic and International Studies, 2012), pp. 49–50; Aidan Foster-Carter, 'One Country, Two Planets: Is Korean Reunification Possible?', in *Twenty Years After the Fall of the Berlin Wall and Lessons for the Korean Peninsula* (Changwon: Kyungnam University, Institute for Far Eastern Studies, 2009), pp. 77–88. Higher figures from the South Korean government – sometimes reported at 80–90% – are driven in part by exclusion of trade between North Korea and South Korea, which itself has at times made up a large proportion of North Korea's external trade.
- ¹³ Jonathan Watts, 'China Cuts Oil supply to North Korea', *Guardian*, 31 March 2003. Other possible instances include month-long interruptions in 2006 and 2008, noted respectively in Joseph Kahn, 'China Cuts Exports of Oil to North Korea', *International Herald Tribune*, 30 October 2006; and Nathaniel Aden, 'North Korean Trade with China as Reported in Chinese Customs Statistics: 1995–2009 Energy and Materials Trends and Implications', *The Korean Journal of Defense Analysis*, vol. 23, no. 2, June 2011, pp. 231–55.
- ¹⁴ For example, see Benjamin Kang Lim, 'Exclusive: China Pushes North Korea to Drop Nuclear Test Plan: Sources', Reuters, 16 May 2012.
- ¹⁵ Shen Dingli, 'Lips and Teeth', *Foreign Policy*, 13 February 2013; Deng Yuwen, 'China Should Abandon North Korea', *Financial Times*, 27 February 2013; Charlie Zhu, 'China Moves Ahead with North Korea Trade Zone Despite Nuclear Test', Reuters, 28 February 2013.
- ¹⁶ See *North Korean Security Challenges: A Net Assessment* (London: IISS, 2011), ch. 5, pp. 112–14, 122–3; and David Albright and Christina Walrond, *North Korea's Estimated Stocks of Plutonium and Weapon-Grade Uranium* (Washington DC: Institute for Science and International Security, 16 August 2012).
- ¹⁷ Plutonium is produced in a reactor from uranium-238 (a non-fissile isotope which comprises around 99.3% of naturally occurring uranium). It must then be chemically removed ('reprocessed') from the remaining uranium and other fission products. For use in nuclear weapons uranium must be enriched from the naturally occurring 0.7% uranium-235 to over 90%, now often through the use of high-speed centrifuges to separate the isotopes.
- ¹⁸ Siegfried S. Hecker, 'A Return Trip to North Korea's Yongbyon Nuclear Complex', Center for International Security and Cooperation, Stanford University, 20 November 2010, <http://iis-db.stanford.edu/pubs/23035/HeckerYongbyon.pdf>.
- ¹⁹ A CIA estimate provided to Congress on 19 November 2002 contained an assessment that 'North Korea embarked on the effort to develop a centrifuge-based uranium enrichment program about two years ago'. The text of the estimate is available at <http://www.fas.org/nuke/guide/dprk/nuke/cia111902.html>.
- ²⁰ 'Implementation of the NPT Safeguards Agreement of the Socialist People's Libyan Arab Jamahiriya', International Atomic Energy Agency,

- GOV/2004/12, 20 February 2004; David E. Sanger and William J. Broad, 'Tests Said to Tie Deal on Uranium to North Korea', *New York Times*, 2 February 2005; and Ian Traynor, 'North Korean Nuclear Trade Exposed', *Guardian*, 24 May 2004.
- 21 Glenn Kessler, 'New Data Found on North Korea's Nuclear Capacity', *Washington Post*, 21 June 2008.
- 22 David Albright and Paul Brannan, *Taking Stock: North Korea's Uranium Enrichment Program* (Washington DC: Institute for Science and International Security, 8 October 2010).
- 23 Albright and Walrond, *North Korea's Estimated Stocks of Plutonium and Weapon-Grade Uranium*.
- 24 This would have been the source of the uranium hexafluoride sold to Libya. This was slightly enriched, implying that North Korea possessed not only uranium-conversion but also uranium-enrichment capabilities.
- 25 'Seoul, Washington Suspect More N. Korean Uranium Sites', *Chosun Ilbo*, 14 December 2010.
- 26 For example, a facility of the same scale as that currently in Yongbyon and producing weapons-grade HEU since the beginning of 2005 could have added around 300kg to any North Korean stockpile (using a production rate of 40kg per year, derived from claimed characteristics of the Yongbyon uranium-enrichment plant (see Hecker, *A Return Trip*). If North Korea had been operating a facility of this size from the beginning of the last decade, it could conceivably have produced around 500kg of weapons-grade material, although this is significantly less likely. Pilot facilities presumably would have added additional amounts.
- 27 'N.K. says Plutonium 'Weaponized' and Off-limits', *Korea Herald*, 19 January 2009.
- 28 Although North Korea tested nuclear devices in 2006, 2009 and 2013, this does not necessarily prove that it possesses easily deliverable nuclear weapons.
- 29 As former US Defense Secretary Robert Gates argued at the 2010 IISS Shangri-La Dialogue, 'there's a fairly sustained and elaborate record of North Korea providing ballistic missile technologies and technologies for weapons of mass destruction to other countries. This has been one of our concerns about the developments in North Korea is their willingness to essentially sell anything they have to anybody who has the cash to buy it.' See 'Remarks by Secretary Gates at the Shangri-La Dialogue, International Institute for Strategic Studies, Singapore', US Department of Defense, 4 June 2010, <http://www.defense.gov/transcripts/transcript.aspx?transcriptid=4634>.
- 30 For further information on North Korean illicit exports, see *North Korean Security Challenges: A Net Assessment*, chs 2 and 8.
- 31 Peter Crail, 'U.S. Shares Information on NK-Syrian Nuclear Ties', *Arms Control Today*, May 2008.
- 32 'Nuclear Non-Proliferation: Chronology of Key Events', International Atomic Energy Agency, http://www.iaea.org/Publications/Factsheets/English/npt_chrono.html.
- 33 David E. Sanger and William J. Broad, 'Using Clues from Libya to Study a

- Nuclear Mystery', *New York Times*, 31 March 2005.
- ³⁴ Douglas Frantz and Catherine Collins, *The Nuclear Jihadist: The True Story of the Man Who Sold the World's Most Dangerous Secrets ... and How We Could Have Stopped Him* (New York: Twelve, 2007), p. 274; approximate contemporary market price of uranium hexafluoride of \$45 per kg uranium, as cited in Peter R. Orszag, 'Privatisation of the U.S. Enrichment Corporation, An Economic Analysis', paper presented at the Brookings Institution, February 2000, p. 9; Glenn Kessler and Dafna Linzer, 'Nuclear Evidence Could Point to Pakistan', *Washington Post*, 3 February 2005.
- ³⁵ Defense Intelligence Agency, *North Korea: The Foundations for Military Strength* (Washington DC: DIA, October 1992), available at http://www.fas.org/irp/dia/product/knfms/knfms_toc.html; Lee Chae Sung, *Pukhan'ul Umjig'Y'nun Technocrat* (Seoul: Ilbit, 1998), p. 442.
- ³⁶ 'Factbox: U.S. Sanctions Target Shadowy N. Korea Network', Reuters, 30 August 2010.
- ³⁷ 'List of Entities, Goods and Individuals Subject to the Measures Imposed by Paragraph 8 of Resolution 1718 (2006)', United Nations, 16 July 2009, [http://www.un.org/sc/committees/1718/pdf/List 16 July 2009.pdf](http://www.un.org/sc/committees/1718/pdf/List%2016%20July%202009.pdf).
- ³⁸ SIPRI Arms Transfers Database, <http://www.sipri.org/databases/armstransfers>.
- ³⁹ 'U.S. Punishes North Korean Company', Associated Press, 23 August 2008.
- ⁴⁰ Erich Follath and Holger Stark, 'The Story of Operation Orchard: How Israel Destroyed Syria's Al Kibar Nuclear Reactor', *Der Spiegel*, 11 February 2009.
- ⁴¹ 'Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic', IAEA, GOV/2012/42, paras 2-4.
- ⁴² See, for example, Bertil Lintner and Steve Stecklow, 'Paper Trail Exposes Missile Merchants', *Far Eastern Economic Review*, 13 February 2003.
- ⁴³ Follath and Stark, 'The Story of Operation Orchard', suggest that construction was in its early stages in 2002.
- ⁴⁴ See Graham Allison, 'How to Keep the Bomb From Terrorists', *Newsweek*, 13 March 2009, <http://www.thedailybeast.com/newsweek/2009/03/13/how-to-keep-the-bomb-from-terrorists.html>.
- ⁴⁵ Authors' communications with Chinese officials and analysts.
- ⁴⁶ See Graham Allison, 'South Korea and the Nuclear Security Summit', 23 March 2012, http://www.nuclearsummit.org/files/belfer_center_articles_5_3741414169.doc.
- ⁴⁷ 'Chinese PLA to Occupy North of the Taedong River in North Korean Contingency Plan', *Defense 21+*, 25 May 2011; Yong-Sup Han, 'The ROK-US Cooperation for Dealing with Political Crises in North Korea', *International Journal of Korean Studies*, vol. 16, no.1, Spring-Summer 2012, pp. 54-73.
- ⁴⁸ Sun Yun, 'Rowing Together'.
- ⁴⁹ The most recent report from the Panel of Experts for UN Security Council Resolution 1874 provides one example of this kind of activity. 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)',

UN S/2012/422, para. 91. The Beijing office of a Hong Kong-based North Korean front company, New East International Trading Ltd, was used

in attempts, at least one successful, to ship missile-related equipment to Myanmar, according to information supplied by Japan.