

**NORTH KOREA'S CHEMICAL
AND BIOLOGICAL WEAPONS PROGRAMS**

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NORTH KOREA'S CHEMICAL AND BIOLOGICAL WEAPONS PROGRAMS

EXECUTIVE SUMMARY

This report examines North Korea's chemical and biological weapons capabilities in the context of its military doctrine and national objectives. It is based on open source literature, interviews and unpublished documents made available to Crisis Group. Companion reports published simultaneously assess the DPRK's nuclear and ballistic missile capabilities and what the policy response of the international community should be to its recent nuclear and missile testing.¹

North Korea's programs to develop weapons of mass destruction (WMD) and ballistic missiles pose serious risks to security. Pyongyang's nuclear capabilities are the greatest threat, but it also possesses a large stockpile of chemical weapons and is suspected of maintaining a biological weapons program. The Six-Party Talks (China, Japan, North Korea, Russia, South Korea and the U.S.) had been underway since August 2003 with the objective of ending the North's nuclear ambitions, before Pyongyang announced its withdrawal in April 2009, but there is no direct mechanism for dealing with its chemical weapons and possible biological weapons. The North Korean leadership is very unlikely to surrender its WMD unless there is significant change in the political and security environments.

The Six-Party Talks produced a "Statement of Principles" in September 2005 that included a commitment to establish a permanent peace mechanism in North East Asia, but the structure and nature of such a cooperative security arrangement is subject to interpretation, negotiation and implementation. Views among the parties differ, and no permanent peace can be established unless North Korea abandons all its WMD programs. The diplomatic tasks are daunting, and diplomacy could fail. If North Korea refuses to engage in arms control and to rid itself of WMD, the international community must be prepared to deal with a wide range of threats,

including those posed by Pyongyang's chemical and biological weapons capabilities.

Unclassified estimates of the chemical weapons (CW) arsenal are imprecise, but the consensus is that the Korean People's Army (KPA) possesses 2,500-5,000 tons, including mustard, phosgene, blood agents, sarin, tabun and V-agents (persistent nerve agents). The stockpile does not appear to be increasing but is already sufficient to inflict massive civilian casualties on South Korea. The North's CW can be delivered with long-range artillery, multiple rocket launchers, FROGs (free rocket over ground), ballistic missiles, aircraft and naval vessels.

North Korean military doctrine emphasises quick offensive strikes to break through enemy defences in order to achieve national military objectives before the U.S. can intervene effectively on behalf of its South Korean ally. However, the North's conventional military capabilities are declining against those of its potential foes, so the leadership is likely to rely on asymmetric capabilities for its national security objectives. This strategy poses a significant danger because it risks deliberate, accidental or unauthorised WMD attacks or incidents.

North Korea has not signed the Chemical Weapons Convention (CWC) but has signed the Biological and Toxin Weapons Convention (BTWC) as well as the Geneva Protocol, which prohibits the use of chemical and biological weapons in war. The government denies having CW or biological weapons (BW) programs but claims to be threatened by South Korean and U.S. CBW even though Seoul and Washington are parties to the CWC, BTWC and the Geneva Protocol. South Korea had a CW program but completed the destruction of its chemical weapons stockpile in 2008 and is in compliance with all its CBW arms control commitments.

Despite a dismal economy, the North Korean regime appears stable. However, leader Kim Jong-il's health problems in the fall of 2008 have raised concerns about succession problems. In a struggle for power or a coup

¹ Crisis Group Asia Report N°168, *North Korea's Nuclear and Missile Programs*, 18 June 2009; Crisis Group Asia Report N°169, *North Korea: Getting Back to Talks*, 18 June 2009.

d'état, the use or transfer of North Korean WMD would be unlikely but cannot be ruled out. In the case of state collapse, WMD and related materials would have to be secured as quickly as possible. This would require considerable planning and resources, but current international mechanisms would probably be inadequate in a sudden crisis. Diplomatic efforts should focus on the nuclear issue now, but preliminary efforts should also be made to address Pyongyang's chemical weapons and possible biological weapons. Understanding the motivations of North Korean leaders is essential to structuring a diplomatic solution for the elimination of their WMD, and if diplomacy fails, a clear assessment of capabilities and intentions will be imperative to counter the threats.

The proliferation of North Korean WMD materials or technology would endanger global security and non-proliferation regimes. An international norm against chemical and biological weapons has emerged, but a few nations and terrorist groups still seek to acquire them. Most states can produce chemical weapons on their own if they choose to, but North Korea could provide materials or technology for integrating CW munitions with delivery systems to shorten developmental and deployment timelines. The North's biotechnology capability is rudimentary, but any biological agents or BW technology in its possession would be highly valued. North Korean entities, with or without government authorisation, could be tempted to sell biological weapons or agents, believing the detection risk to be low. The likelihood of such a transfer would increase if the country were to become unstable or collapse.

The North's economy urgently needs reform, but the regime's failure to adopt changes leaves weapons and weapons technology as its vital source of foreign exchange. Abandonment of CW and BW and integration into the global economy will require compliance with international export control rules and norms, as well as significant aid.

Diplomatic efforts to eliminate North Korean WMD and ballistic missiles must continue, but the international community must be prepared for multiple contingencies including:

- ❑ a deliberate, accidental or unauthorised chemical or biological attack or incident;
- ❑ a chemical weapons accident in North Korea;
- ❑ an accidental release of biological agents in North Korea;
- ❑ the North's use of CW following an intentional or inadvertent military clash and escalation;

- ❑ North Korean use of biological or chemical weapons in a preventive war against South Korea;
- ❑ the transfer of chemical or biological weapons, precursors, materials and technologies to other states or non-state actors; and
- ❑ arms races.

There are a number of international institutions for dealing with the North Korean chemical and biological weapons programs. However, they may not be sufficient for addressing all issues, and new regional instruments may be necessary. Regional efforts could increase opportunities for cooperation through issue linkage and confidence-building aimed at the establishment of a collective peace and security regime. For example, the region could initiate processes for missile disarmament and cooperation in the peaceful exploration of outer space; the elimination of chemical weapons; conventional arms control; and non-traditional security cooperation in the realms of energy security, food security and public health.

While the diplomatic priority now must be to focus on the nuclear issue, progress on this front would create opportunities to address Pyongyang's other weapons of mass destruction, including a large chemical weapons stockpile and possible biological weapons, which must be eliminated before a stable and permanent peace can be established in North East Asia. If North Korea credibly commits to abandoning its nuclear program in the Six-Party Talks, a multi-faceted effort should be made to establish a fully WMD-free Korean Peninsula.

Seoul/Brussels, 18 June 2009

NORTH KOREA'S CHEMICAL AND BIOLOGICAL WEAPONS PROGRAMS

I. INTRODUCTION

For almost two decades, the international community has focused on eliminating North Korea's nuclear weapons and ballistic missile programs. However, the North (DPRK²) also maintains a large stockpile of chemical weapons and the capability to produce biological weapons. The Six-Party Talks (China, Japan, North Korea, Russia, South Korea and the U.S.) aimed to end Pyongyang's nuclear ambitions, before the DPRK announced its withdrawal in April 2009, but no similar effort is underway to address its chemical and biological weapons programs. Even if the DPRK abandons its nuclear weapons, a host of problems will remain before all weapons of mass destruction (WMD) can be eliminated from the Korean Peninsula. On 19 September 2005, representatives of the six parties signed a "Statement of Principles", whereby the DPRK agreed to abandon "all of its nuclear programs" in exchange for negative security assurances and other inducements. The statement also stipulated that the parties would seek the normalisation of relations and a lasting peace in North East Asia. This implicitly appears to require the elimination of Pyongyang's chemical and biological weapons (CBW).

The DPRK is one of only seven countries that has neither signed nor acceded to the Chemical Weapons Convention (CWC),³ but it is party to the Geneva Protocol of 1925 and the Biological and Toxin Weapons Convention (BTWC). It denies possessing chemical or biological weapons, though the consensus is that it has at least 2,500 tons of chemical weapons, as well as several biological agents that could be weaponised. The Geneva Protocol prohibits the use of chemical weapons (CW) and biological weapons (BW) in warfare but not their production or possession.⁴ The

BTWC, which was designed to address this weakness, prohibits production or stockpiling of BW but has no verification regime and permits the possession of biological agents for bio-defence research, as well as legitimate medical research. It was opened for signature in 1972 and went into effect in 1975. Pyongyang acceded in 1987 but is suspected of developing biological weapons in violation of its commitments.

The CWC, which was opened for signature in 1993 and went into force in 1997, bans the production and possession of chemical weapons, so Pyongyang would have to destroy its CW stocks under international monitoring if it were to become a party. However, the destruction of chemical weapons is dangerous and expensive, and North Korea has neither the technology nor the human and financial resources to dispose of its CW stockpile safely. The Organisation for the Prohibition of Chemical Weapons (OPCW), the CWC secretariat, could provide technical assistance and verify the destruction of Pyongyang's chemical weapons, but South Korea (the Republic of Korea, ROK) and other participants in the Six-Party process might provide additional help.

North Korea is unlikely to abandon its chemical weapons in the near future unless there is a sudden change in its political orientation. Progress in nuclear and missile disarmament probably must precede any initiatives for dealing with Pyongyang's CW and BW programs, but all the issues are linked to the overall security environment, so preliminary planning and diplomacy should begin at an early stage. North Korea's WMD disarmament will take considerable time and resources even under the unlikely conditions of perfect cooperation. If the DPRK were to collapse suddenly and the peninsula were unified on the South's terms, Seoul and the international community would have to secure and destroy the North's chemical munitions and biological agents with little or no warning.

² The Democratic People's Republic of Korea.

³ The others are Angola, Egypt, Iraq, Lebanon, Somalia and Syria. "Status of Participation in the Chemical Weapons Convention", OPCW Office of the Legal Advisor, 24 June 2008.

⁴ The complete name of the Geneva Protocol is: "The Protocol for the Prohibition of the Use in War of Asphyxiating,

Poisonous, or other Gases, and of Bacteriological Methods in Warfare".

Securing and eliminating Pyongyang's WMD are urgent tasks, but research and planning for these objectives are extremely challenging, as the Iraqi case has demonstrated. Countries may have incentives to conceal or to exaggerate their WMD capabilities, and governments try to protect their sources and methods for assessing the military programs of other states. International arms control and non-proliferation organisations also protect proprietary information and often have confidentiality agreements with member states to prevent release of sensitive information to the public.

The North Korean government takes extraordinary measures to conceal information about its military capabilities and doctrine, particularly in the area of WMD. Pyongyang openly declares itself a nuclear and missile power but denies possessing any chemical or biological weapons. Its policy process is opaque, and the details of national defence doctrine are difficult to assess. In recent years, the military has become more prominent in national affairs, as the country has endured famine and economic malaise. However, power is tightly centralised in the hands of Kim Jong-il. This report examines North Korea's chemical and biological weapons capabilities in the context of its military doctrine and national objectives. It is based on open source literature, interviews and unpublished documents made available to Crisis Group. Companion reports, published simultaneously, assess the North's nuclear and ballistic missile capabilities and the appropriate international response to its recent nuclear and missile testing.⁵

⁵ Crisis Group Report, *North Korea's Nuclear and Missile Programs*, op. cit.; Crisis Group Report, *North Korea: Getting Back to Talks*, op. cit.

II. ISSUES

A. MILITARY DOCTRINE AND BIO-CHEMICAL WARFARE

For at least three decades after the DPRK was founded in 1948, Pyongyang held a significant military advantage over Seoul, but the conventional balance has now turned against it. North Korea's alliance relationships with China and the Soviet Union basically were terminated after the Cold War, and three decades of economic stagnation has made it impossible for Pyongyang to maintain the industrial and technological base required to modernise its obsolete military hardware. This has led it to become more dependent upon asymmetric capabilities for national security. Though the Korean People's Army (KPA) was formally established with Soviet assistance on 8 February 1948,⁶ Moscow had begun two years earlier to train North Koreans and lay the foundation for the formation of the forces that enabled Kim Il-sung to launch an invasion of the South in June 1950.⁷ That attempt to unify Korea by force would have succeeded if the U.S. had not intervened under UN auspices.

Since the Korean War Armistice was signed in July 1953, North Korea consistently has sought military superiority over the South and has tried to eliminate the possibility of a second U.S. military intervention. This has led to an extraordinary allocation of national resources and a policy that aims to undermine and terminate the U.S.-ROK alliance. The KPA war-fighting strategy is offensive, focusing on achieving its military objectives quickly, before the U.S. can respond.⁸ It includes the use of chemical weapons to inflict massive casualties and lessen the ability of the ROK and U.S. to conduct combat operations or introduce rein-

⁶ Korea was demilitarised during the Japanese colonial period (1910-1945).

⁷ Japan's defeat in 1945 left Korea divided at the 38th parallel, with a Soviet zone of occupation in the North and a U.S. zone in the South. In June 1946, Joseph Stalin decided to support the establishment of a North Korean military after the U.S.-USSR Joint Commission on Korea collapsed, and the two superpowers failed to agree on establishment of a unified Korean government. 김광수 [Kim Kwang-su], "조선인민군의 창설과 발전, 1945~1990" ["Establishment and Development of the Korean People's Army, 1945-1990"], in 함택영 [Ham Taek-yöng] et al., *북한군사문제의 재조명* [Reflecting on North Korean Military Issues] (Seoul, 2006), pp. 65-85.

⁸ Joseph S. Bermudez, Jr., *The Armed Forces of North Korea* (New York, 2001); and 장명순 [Chang Myöng-sun], *북한군사연구* [North Korean Military Research] (Seoul, 1999).

forcements. Though nominally the North “conducts all activities under the leadership of the Korean Workers’ Party (KWP),”⁹ it is arguably the most militarised country on earth.

Under the leadership of Kim Jong-il, the military has become more prominent since the mid-1990s.¹⁰ The National Defence Commission (NDC) is the highest military authority, and its chairman (Kim Jong-il) “directs and commands all the armed forces.”¹¹ Kim has established firm control of the military, the party and the state; he has no peers or apparent challengers.¹² He appears to have chosen his third son, Kim Jong-un, who is only 25 years old, as his successor and reportedly informed North Korean institutions and organisations about this decision immediately after the country’s second nuclear test, on 25 May 2009.¹³

Foreign analysts debate whether the shift in the conventional military balance against North Korea has forced the political leadership to regard its asymmetric military capabilities as essential for deterrence, national survival and maintaining the status quo, and if Pyongyang remains wedded to “completing the revolution in the South”, with force if necessary or possible.¹⁴ According to the KWP by-laws, the party is committed to “achieving a complete socialist victory in the northern half of the republic and to completing a people’s revolution to liberate all Korean people throughout the nation”.¹⁵ However, DPRK leaders appear to

be preoccupied with the survival of their state and the Kim family regime and not likely to launch an unprovoked war that they know they would ultimately lose.

1. DPRK accusations of foreign CW and BW programs

DPRK government organisations and media often cite the “chemical and biological weapons programs” of the U.S., South Korea and Japan as either having harmed the Korean people in the past or as currently threatening the DPRK. Pyongyang often accuses the U.S. of possessing the world’s largest stocks of chemical and biological weapons, which the media frequently report as aimed at the DPRK.¹⁶ Furthermore, while consistently denying “having anything to do with chemical or biological weapons” itself, North Korea accuses the U.S. of having deployed CW and BW to South Korea and of having assisted the ROK in acquiring its own CBW capabilities.¹⁷

South Korea signed the CWC in 1993 and began destroying its CW stocks in 1999.¹⁸ When the destruction pro-

⁹ DPRK Constitution, Chapter 1, Article 11.

¹⁰ Kim Chol U, *Army-Centred Politics of Kim Jong Il* (Pyongyang, 2002).

¹¹ DPRK Constitution, Chapter 6, Article 100; Article 102.

¹² For more details on DPRK military doctrine, see Crisis Group Report, *North Korea’s Nuclear and Missile Programs*, op. cit.

¹³ A frequent foreign visitor to the DPRK told Crisis Group that during the period 25-28 May 2009, North Korean officials in Pyongyang informed him of the succession plans for the first time. They reportedly said they are worried and hope the transition does not have to be implemented in the coming weeks or months. South Korea’s National Intelligence Service confirmed the succession plans on 1 June 2009. Crisis Group interview, Seoul, 29 May 2009; “Spy agency confirms N.K. leader’s third son as successor”, Yonhap News Agency, 2 June 2009; Kim So-hyun, “Kim Jong-un named next ‘Dear Leader’”, *The Korea Herald*, 3 June 2009.

¹⁴ Homer T. Hodge, “North Korea’s Military Strategy”, *Parameters*, vol. 33, no. 1 (spring 2003), pp. 68-81; and Andrew Scobell and John M. Sanford, *North Korea’s Military Threat: Pyongyang’s Conventional Forces, Weapons of Mass Destruction, and Ballistic Missiles* (Carlisle, 2007).

¹⁵ 조선로동당 규약 [Korean Workers’ Party Bylaws], in *북한개요 2004* [North Korea Summary 2004], ROK Ministry of Unification, December 2003, pp. 504-529.

¹⁶ “U.S. termed world’s biggest biological and chemical war criminal”, Korean Central News Agency (KCNA), 10 August 2006; “U.S. storage of chemical weapons blasted”, KCNA, 15 June 2004; “North Korean radio accuses U.S. of using chemical, biological weapons in Korea”, Pyongyang Broadcasting Station, in BBC Worldwide Monitoring, 29 January 2003; and “U.S. branded as rogue state of worst type in world”, KCNA, 20 May 2001.

¹⁷ For example, see “Koreas: North committee denounces South ‘stockpile’ of chemical, biological weapons”, Central Broadcasting Station (Pyongyang), in BBC Worldwide Monitoring, 22 April 1999; “Development of Biological and Chemical Weapons Exposed in S. Korea”, KCNA, 8 April 1999; and “U.S. branded as rogue state”, KCNA, op. cit.

¹⁸ The ROK submitted its instruments of ratification on 28 April 1997, one day before the treaty went into effect. 박강문 • 문호영 [Pak Kang-mun and Mun Ho-yŏng], “화학무기 금지협약 한국 등 112 국 서명/오늘 새벽... 북한은 불참” [“Korea and 112 countries sign CWC early this morning...North Korea doesn’t participate”], *The Seoul Sinmun*, 14 January 1993; “화학무기 금지협정 발효/84 국 비준 북 등 서명 기피” [“CWC goes into effect: 84 countries ratify except North doesn’t sign”], *The Munhwa Ilbo*, 29 April 1997; “화학무기 수백 t 영동군서 폐기; 환경오염 가능성 없다” [“Hundreds of tons of chemical weapons being abandoned in Yŏngdong-gun: could there be environmental pollution?”], *The Chosun Ilbo*, 5 May 2000; “화학무기 극비 폐기; 금지협약 가입따라 작년말부터 시작” [“Chemical weapons abandonment top secret: started last year after joining convention”], *The Chosun Ilbo*, 5 May 2000; “Report: South Korea dismantling chemical weapons”, Associated Press, 9 May 2000; and

gram was revealed by a South Korean daily in May 2000, the DPRK media immediately condemned the “South Korean puppets” for their “criminal wish to wipe out their fellow countrymen”.¹⁹ Despite Pyongyang’s frequent accusations, South Korea completed the destruction of its stockpile in July 2008 after having been granted an extension beyond the previous deadline of December 2007.²⁰

The South’s destruction of its CW stocks has gone mostly unnoticed because Seoul has a confidentiality agreement with the OPCW and neither confirms nor denies the existence of its abandoned CW program. The issue is sensitive in the South, and the government is divided. Diplomats in the foreign and trade ministry generally favour disclosure, but the defence ministry prefers ambiguity because of the supposed residual deterrent effect on Pyongyang.²¹ The government is also reluctant to disclose controversial information for fear that domestic civil society groups might pick up the issue and protest. Full disclosure would nullify Pyongyang’s accusations that Seoul maintains a CW capability and could be a confidence-building measure for inter-Korean arms control, but officials have grown tired of waiting for the North to take reciprocal arms control measures or even respond to their overtures, and many see no need to be forthcoming when they expect no response from Pyongyang.²²

“Seoul owns up to chemical arms stocks”, *The Australian Financial Review*, 10 May 2000.

¹⁹“Hundreds of tons of chemical weapons”, op. cit.; “Chemical weapons abandonment top secret”, op. cit.; “South Korea dismantling chemical weapons”, op. cit.; “Seoul owns up to chemical arms stocks”, op. cit.; “North Korean radio decries South’s ‘game of scrapping’ chemical weapons”, Central Broadcasting Station (Pyongyang), in BBC Worldwide Monitoring, 12 May 2000; “Korean authorities’ moves for biological and chemical war”, KCNA, 13 May 2000.

²⁰“South Korea completes destruction of its chemical weapons stockpile”, Environment News Service, 17 October 2008, at www.ens-newswire.com/ens/oct2008/2008-10-17-03.asp; and Chris Schneidmiller, “South Korea completes chemical weapons disposal”, Global Security Newswire, 17 October 2008, http://gsn.nti.org/gsn/ts_20081017_3838.php; Crisis Group interviews, Seoul.

²¹Crisis Group interview, Seoul, 2 July 2008.

²²Crisis Group interviews, Dr Park Yong-ok, Seoul, 31 October 2008; Col. Lim Chae-hong (ret.), Seoul, 13 February 2009. Park is a retired ROK Army lieutenant general and former vice defence minister who led the South Korean delegation in inter-Korean military arms control talks in the early 1990s. He helped negotiate the “Joint Declaration on the Denuclearisation of the Korean Peninsula” in 1991 but is pessimistic about Pyongyang negotiating in good faith and implementing arms control agreements. Lim is a former

North Korean media occasionally cite Japanese CBW programs and use during World War II, including CBW experiments on human beings at Unit 731, a large-scale CBW research and production facility operated by the army.²³ The reports are part of an effort to demonise Japan and warn North Koreans about the threat of Japanese militarisation.²⁴ Allegations of CBW use by the U.S. during the Korean War are even more frequent.²⁵ These usually focus on the magnitude of supposed atrocities and the sense of injustice felt by North Koreans. They often include accusations of recent CBW use by the U.S. in Iraq, Vietnam and even Kosovo, reminding North Koreans that “Americans feel they can use CBW with impunity, CBW and nuclear weapons are part of the U.S. arsenal, and the United States would not hesitate to use WMD against the DPRK – so be prepared”.²⁶ While outsiders might discount such claims, the fear of CW attack could be real for many North Koreans.

KPA personnel are taught that ROK and U.S. chemical weapons would be used against the North, even though Seoul and Washington are both state parties to the CWC and the Geneva Protocol.²⁷ North Korean media cite this supposed threat as a justification for Pyongyang’s nuclear arsenal and strong military posture.²⁸ Though the country suffers from extreme shortages of food and consumer goods, the defence industry produces protective suits that must be replaced after every CW defence exercise. Kim Jong-il’s “military first politics” means these factories and training centres do not experience the shortages that are ubiq-

CW defence officer who was assigned to the ROK UN Mission and the Conference on Disarmament in Geneva.

²³“Atrocious living-body test by Japanese imperialists”, KCNA, 14 August 2006; “Japan’s monstrous experiments on living bodies of people under fire”, KCNA, 30 January 2007.

²⁴“RS. on imperial Japanese army’s biological and chemical war crimes”, KCNA, 31 October 2005; and “Dangerous moves of Japan for biological and chemical war”, KCNA, 25 November 2000.

²⁵For example, see “United States, germ and chemical war criminal”, KCNA, 21 June 2006; “Monstrous crimes committed by U.S. in Korean War”, KCNA, 16 July 2004; “Rodong Sinmun blames U.S. for threat of B.C. weapons”, KCNA, 20 June 1998; Democratic People’s Republic of Korea, *Facts Tell: Secret Documents Seized by North Korea from the South Korean Government Archives* (Honolulu, 2001; reprinted from 1960 DPRK edition).

²⁶“U.S. chemical warfare denounced”, KCNA, 4 December 2005; “U.S. chemical warfare in Iraq under fire”, KCNA, 23 November 2005.

²⁷The CWC requires members to declare and destroy all CW stocks; the Geneva Protocol bans the use of chemical and biological weapons in war.

²⁸“U.S. storage of chemical weapons blasted”, KCNA, 15 June 2004.

uitous in the civilian economy.²⁹ Civilians are forced to accept the allocation of resources to the military as “necessary to protect the people from foreign aggression”.³⁰

2. Command and control

During peacetime, the NDC and its chairman (Kim Jong-il) have ultimate control of military planning, arms production and procurement. The NDC delegates some responsibilities to the party and the Ministry of the People's Armed Forces but remains the final authority for WMD and ballistic missile assets. It can declare war and issue orders for national mobilisation and, in wartime, its chairman would assume the position of Supreme Commander of the Korean People's Army (SCKPA). Nominally, power is more decentralised in peacetime, but Kim Jong-il maintains tight control through a system of formal and informal networks throughout the military and the party. Decentralisation otherwise keeps party and military organisations divided, forcing them to check each other and compete for access and rewards from him. Kim disdains meetings and prefers to bypass the formal institutional lines of authority, often delivering instructions directly to relevant secretaries.³¹

B. CHEMICAL WEAPONS

Chemical weapons (CW) are notorious for their widespread use in World War I, but they have also been employed by Iraq against Iran in the 1980s, by Japan against China in World War II and by others.³² CW agents are divided into five basic categories: choking, blister, nerve, blood and generally non-lethal riot control agents such as vomiting agents and tear gas. They can be dispersed across wide areas by aircraft, missiles and artillery, and some are odourless and colourless. Civilians are particularly vulnerable, because they generally do not have the detection and protective equipment to cope with chemical attacks. On the other hand,

the military usefulness of CW has declined, because militaries have the means to defend themselves. However, CW can degrade or delay the ability to conduct operations, so the KPA might employ it as part of its strategy to achieve a quick victory against the South before the U.S. could intervene effectively.³³

1. History of the program

The DPRK's motivations for acquiring offensive and defensive CW capabilities date to the Korean War, when it suffered extensive damage from U.S. bombing and was the target of implicit nuclear threats. China's motivations to develop its own nuclear deterrent in the 1950s and early 1960s to counter “U.S. blackmail” are well documented,³⁴ and North Korea followed a similar, if considerably delayed, trajectory to acquire chemical as well as nuclear weapons. Pyongyang probably wanted to develop a nuclear arsenal soon after the Korean War, but the long timeline and heavy resources involved forced it to consider CW as an immediate alternative.³⁵

In 1954, when still in ruins from the war, North Korea established a chemical department under the operations bureau in the defence ministry's general staff.³⁶ This focused on defensive measures, until the country could develop an offensive capability. It was upgraded to a bureau in 1961 and reorganised into the Nuclear and Chemical Defence Bureau (NCDB) in 1981.³⁷ In 1961, Kim Il-sung issued a “declaration for chemicalisation” (化學化 宣言) that was aimed at developing an independent chemical industry, with dual civilian and military use. On 1 November 1980, he told the KWP Central Military Committee (CMC) that it would be

²⁹ Internal third country government memorandum made available to Crisis Group.

³⁰ Crisis Group interviews, Pyongyang, April 2007.

³¹ Crisis Group interview, Seoul, 3 November 2008; internal third country government memorandum made available to Crisis Group.

³² Egypt used chemical weapons against Yemen in 1966-1967, Italy against Ethiopia in the late 1930s, Spain against Morocco in 1925, and Britain against the Bolsheviks' Red Army during the Russian Civil War in 1919. Julian Perry Robinson, “Chemical Weapons Proliferation: The Problem in Perspective”, in Trevor Findlay (ed.), *Chemical Weapons and Missile Proliferation* (Boulder, 1991), p. 21.

³³ CW defence is demanding logistically, and cases show that CW attacks can impact the morale of its targets and thus weaken their resolve to fight. Al Mauroni, *Chemical and Biological Warfare* (Santa Barbara, 2003), pp. 132-154.

³⁴ For example, see John W. Lewis and Xue Litai, *China Builds the Bomb* (Palo Alto, 1988).

³⁵ 장준익 [Chang Chun-ik], *북한 핵-미사일 전쟁* [North Korea: Nuclear Missile War] (Seoul, 1999), pp. 355-357; Joseph S. Bermudez Jr., “CW: North Korea's Growing Capabilities”, *Jane's Defence Weekly*, vol. 11, no. 2, 14 January 1989, p. 54.

³⁶ *북한 핵-미사일 전쟁* [North Korea: Nuclear Missile War], op. cit., p. 358.

³⁷ Ibid, p. 358; and “North said owning enough chem-weapons to wipe out South”, Japan Economic Newswire, 22 March 1994.

“effective to produce poison gas and germ weapons for use in combat”.³⁸

The DPRK probably was unable to acquire an independent CW production capability until 1980 or later.³⁹ However, many sources claim it actually began developing its CW arsenal in the 1960s,⁴⁰ and others believe that it began producing chemical weapons in the 1970s.⁴¹ In the 1960s, China and the Soviet Union reportedly transferred training and technical information, as well as CW equipment and munitions used in World War II.⁴² According to a South Korean report, the Soviet Union provided “small amounts of mustard gas and nerve agents” in 1966.⁴³ An American analyst asserted that “North Korea probably produced its first small quantities of mustard and nerve agents in 1966 with Soviet assistance”.⁴⁴ In the late 1970s, a DPRK military attaché in Berlin reportedly acquired “technical know-how” for CW production from the East German government.⁴⁵ And according to a U.S. Defense Intel-

ligence Agency (DIA) report, Pyongyang had acquired a defensive CW capability by 1979 and was then prepared to develop an offensive capability.⁴⁶

2. Capabilities and inventory

Open source estimates of the country's CW capabilities are vague. According to the U.S. Central Intelligence Agency (CIA), North Korea in 2003 had a “sizeable but ageing chemical industry” and continued to acquire dual-use chemicals that could potentially be used to support Pyongyang's long-standing CW program”.⁴⁷ In recent years, there have been several reports of the DPRK importing dual-use CW precursors, apparently because it “lacks a certain number of indigenous precursors”.⁴⁸ Several shipments have been intercepted before reaching the DPRK.⁴⁹ Over the last decade, several South Korean firms exported sodium cyanide, a precursor for sarin (a nerve agent), to North Korea through China, which has led to more restrictive South Korean export controls.⁵⁰ The North has acknowledged the sodium cyanide imports but claims the chemical is

³⁸ 북한 핵-미사일 전쟁 [North Korea: Nuclear Missile War], op. cit., p. 358; and ROK Ministry of Unification, 북한개요 2004 [North Korea Summary 2004], op. cit., p. 123.

³⁹ Loise Waldenström, Lena Norlander and Gertrud Puu, “North Korea's Chemical and Biological Programmes in 2005: Real or Outdated Threats?”, Swedish Defence Research Agency, October 2005; 장명순 [Chang Myōng-sun], 북한군사연구 [Research on the North Korean Military] (Seoul, 1999), p. 286; 2004-2005 東北亞 軍事力 [“2004-2005 North East Asia Military Power”], Korea Institute for Defense Analysis (KIDA), 2005, p. 179; 신성택 [Sin Sōng-t'aek], “북한의 화학무기 위협 및 대응방안” [“The North Korean Chemical Weapons Threat and Proposed Countermeasures”], Chapter 3 in 북한의 대량살상무기별 위협분석 및 대응책연구 [Analysis of North Korean WMD Threats and Research on Policy Measures] (Seoul, 2000).

⁴⁰ 북한 핵-미사일 전쟁 [North Korea: Nuclear Missile War], p. 373; Im Hong-gūn, “Hündillinūn Pukhan'gun”, 2005, in “DPRK Defector Discusses North Korean Chemical, Biological Weapons Capability”, Open Source Center (OSC), Document ID: KPG20050601000138.

⁴¹ Bermudez, “CW”, op. cit., p. 54; “South Korea says North has biological, chemical weapons”, Kyodo News Service, 23 October 1992.

⁴² Some or all this equipment and munitions could have originated from imperial Japan's extensive program in Manchuria. 북한 핵-미사일 전쟁 [North Korea: Nuclear Missile War], op. cit., p. 358.

⁴³ Pak Tong-sam, “Pukhan”, January 1999, in “How Far Has the DPRK's Development of Strategic Weapons Come?”, OSC Document ID: FTS19990121001655.

⁴⁴ Eric Croddy, with Clarisa Perez-Armendariz and John Hart, Chemical and Biological Warfare (New York, 2002), p. 50.

⁴⁵ Prepared statement of Ju-hwal Choi, former official, Ministry of the People's Army, North Korea, “North Korean Missile Proliferation”, hearing before the Subcommittee on Inter-

national Security, Proliferation, and Federal Service of the Committee on Governmental Affairs, U.S. Senate, 21 October 1997, at www.fas.org/spp/starwars/congress/1997_h/s971021choi.htm. Choi's testimony is not entirely credible. He never served in a KPA missile or WMD-related unit.

⁴⁶ Joseph S. Bermudez Jr., “North Korea's Chemical and Biological Warfare Arsenal”, *Jane's Intelligence Review*, vol. 5, no. 5 (May 1993), p. 226.

⁴⁷ “Attachment A: Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July through 31 December 2003”, CIA, https://www.cia.gov/cia/reports/721_reports/july_dec2003.htm#5.

⁴⁸ Croddy et al., *Chemical and Biological Warfare*, op. cit., p. 52.

⁴⁹ Jay Chen and Deborah Kuo, “U.S. lauds Taiwan for seizure of chemicals aboard N. Korean freighter”, Central News Agency (Taiwan), in BBC Worldwide Monitoring, 13 August 2003; “Report: gas chemical shipped to N. Korea”, United Press International, 18 February 2003; Tom Kelly, “Scud ship ‘delivered nerve gas agent to North Korea’”, Press Association, 18 February 2003; “U.S. intercepts two deliveries of nuclear material for North Korea”, *The Korea Herald*, 2 June 2005; “US has intercepted N Korea-bound nuclear, chemical materials – spokesman”, Yonhap News Agency, in BBC Worldwide Monitoring, 1 June 2005.

⁵⁰ “Six South Korean firms punished for illegal chemical exports”, *International Export Control Observer*, issue 8, June 2006, p. 15, http://cns.miis.edu/pubs/observer/pdfs/ieco_0606e.pdf; “NK's chemical imports raise alarm”, *The Korea Times*, 25 September 2004; “South Korea exporting large quantities of sodium cyanide Since 2000”, Yonhap News Agency, in BBC Worldwide Monitoring, 7 October 2004.

not for military use.⁵¹ Mining of precious metals is a common legitimate use of this chemical, which is plausible in North Korea, but the final end-users and the disposition of these chemicals are unknown.

In 2006, the CIA's unclassified assessment was that: "North Korea has had a longstanding CW program. North Korea's chemical warfare capabilities probably include the ability to produce bulk quantities of nerve, blister, choking, and blood agents. We assess Pyongyang possesses a sizeable stockpile of agents".⁵² On 9 March 2006, General B.B. Bell, Commander, U.S. Forces Korea, testified before the House Armed Services Committee that: "The size of North Korea's chemical weapons stockpile is likely significant. We assess North Korea is probably capable of weaponising chemical agents for conventional weapons systems, missiles, and unconventional delivery".⁵³ However, he did not mention North Korean CW in his prepared statements before the same committee and the Senate Armed Services Committee in March 2008.⁵⁴

Recent ROK government estimates place the North's CW stockpile at between 2,500 and 5,000 tons of various agents, including mustard, phosgene, blood agent, sarin, tabun, and V-agents (persistent nerve agents).⁵⁵ This stockpile is not believed to be increasing, however, because there is no indication of what would be a necessary expansion of storage facilities. Furthermore, even 2,000-3,000 tons would be sufficient to inflict massive casualties on the South. ROK intelligence estimates that North Korea has the capacity to produce about 4,500 tons of CW per year, which is enough for both its own needs and a significant export potential.⁵⁶ The KPA could deliver CW with its artillery, MRLs (multiple rocket launchers), FROGs (free rocket over ground), ballistic missiles, aircraft and

naval vessels.⁵⁷ However, it would be difficult to sustain the distribution of CW munitions from storage facilities to delivery systems and launch them to targets during war.

3. Research and production

The South Korean government assesses North Korea has the capability to produce all types of chemical weapons, but most, if not all, of the stockpile is believed to be unitary munitions. Binary CW munitions consist of two inert chemical compounds that once mixed together become lethal. These are more stable, safer to handle and have a longer shelf-life, but the North probably has not fully mastered this technology.⁵⁸

North Korea's Second Natural Science Academy conducts weapons-related research and development, but the General Staff Department's Nuclear Chemical Defence Bureau (NCDB) manages special research facilities for CW and CW defence. The main CW research facility is co-located with a production plant in Kanggye City, Chagang Province.⁵⁹ Academic institutions are also involved in CW-related research. For example, in 2007, researchers at Kim Il-sung University published an article on the properties of mustard gas decontamination absorbent.⁶⁰ This technology could be applied to defensive or offensive operations, so it is impossible to do more than speculate about the real intentions behind the research.

The General Staff Department in the Ministry of People's Armed Forces drafts plans for chemical munitions demand and concomitant production requirements and

⁵¹ "北 '시안화나트륨 반입 문제안돼'" ["North 'importing sodium cyanide not a problem'"], *The JoongAng Ilbo*, 5 October 2004.

⁵² "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July through 31 December 2006", CIA.

⁵³ B.B. Bell, statement before the House Armed Services Committee, 9 March 2006.

⁵⁴ B.B. Bell, statement before the House Armed Services Committee, 12 March 2008.

⁵⁵ 장준익 [Chang Chun-ik], *북한 핵-미사일 전쟁* [North Korea: Nuclear Missile War], op. cit., pp. 366-367; "김태환 의원 '북한 생화학무기시설 49 곳'" ["National Assemblyman Kim T'ae-hwan says North Korea has CBW Facilities at 49 locations"], *The Chosun Ilbo*, 17 October 2006.

⁵⁶ Internal memorandum made available to Crisis Group; Crisis Group interview, Seoul, 30 October 2008.

⁵⁷ Ibid.; 신성택 [Sin Söng-t'aek], "북한의 화학무기 위협 및 대응방안" ["The North Korean Chemical Weapons Threat and Proposed Countermeasures"], Chapter 3 in *북한의 대량살상무기별 위협분석 및 대응책연구* [Analysis of North Korean WMD Threats and Research on Policy Measures] (Seoul: KIDA, December 2000); 장준익 [Chang Chun-ik], *북한 핵-미사일 전쟁* [North Korea: Nuclear Missile War], op. cit., pp. 369-375.

⁵⁸ Crisis Group telephone interview, Jonathan Tucker, professional staff member, U.S. Commission on the Prevention of WMD Proliferation and Terrorism, 11 November 2008. The U.S. and the former Soviet Union conducted research on several binary agents, but the only practical binary munition proved to be sarin nerve agent.

⁵⁹ Internal third country government memorandum made available to Crisis Group.

⁶⁰ Pak Hyök-ch'öl, Kim Il-ryong, Chöng Ch'öl-ho, *긴일성 종합대학보 자연과학* [Monthly Science Journal of Kim Il-sung University], pp. 105-107, in "DPRK Researchers on Properties of Sulfur Mustard Decontamination Absorbent", 10 March 2008, OSC Document ID: KPP20080721327001.

submits them to the KWP's Central Military Committee (CMC) and the National Defence Commission for approval. The NDC delegates procurement and production authority to the Second Economic Committee (SEC), which is under the CMC's Munitions Industry Department and is responsible for the procurement, production, import and export of weapons.

The SEC, which manages the extensive munitions industry, consists of eight support bureaus, eight production bureaus and six affiliated or subordinate agencies. Its Fifth Bureau is in charge of CW production at nine dual-use facilities also capable of producing chemicals for peaceful industrial purposes. Since the chemical industry ministry manages chemical plants, the SEC has to coordinate or schedule production runs at dual-use facilities. That ministry and other relevant ones also provide materials and components when necessary. Following production runs, the NCDB manages distribution, since the munitions require special handling.⁶¹

The SEC probably focuses its CW production on mustard agents, phosgene, sarin, and V-agents (persistent nerve agents) that would be practical for meeting KPA strategic objectives and are not difficult to produce.⁶² The open source literature cites many suspected CW production plants but not all produce chemical munitions. The Kanggye plant is also the site of several other munitions factories and a suspected nuclear warhead storage facility.⁶³ There are six storage sites for CW and CW-related materials and precursors, including the "Central Chemical Supply Centre" in the southern part of Pyongyang.⁶⁴ Most storage sites are not located near forward-deployed KPA troops, so CW munitions would have to be delivered to operational units prior to use, although storage or deployment at unknown sites cannot be ruled out.

4. Doctrine

Most of the literature on the North's CW doctrine contains broad assumptions, including that the DPRK would employ chemical weapons in an effort to defeat ROK forces very rapidly and achieve national unification by force before the U.S. could make its strength felt. Given the relative decline in the DPRK's conven-

tional capabilities, chemical weapons are considered critical for the KPA to prosecute its war plans successfully.⁶⁵ The DPRK has deployed a large portion of its military forces in forward areas near the demilitarised zone (DMZ), so many analysts believe it would use CW immediately in a war.⁶⁶ U.S. Army General Leon LaPorte, former Commander, U.S. Forces Korea, asserted in August 2005 that North Korean leaders do not consider CW to be WMD, and "current North Korean doctrine states that every third [artillery] round fired would be a chemical round".⁶⁷

North Korea has an estimated 8,000-10,000 artillery and multiple rocket launcher (MRL) tubes deployed near the DMZ that could strike the Seoul-Inch'ŏn metropolitan area. The KPA could use CW munitions to attack Seoul but probably would not do so indiscriminately against civilians, because this would have no real effect on military objectives, and the regime would risk massive – possibly even nuclear – retaliation. Furthermore, KPA commanders could subsequently face war crimes charges.⁶⁸ But that does not mean Pyongyang is not prepared to use CW to implement its wartime objectives. If it were to use CW, it would likely target ROK and U.S. military facilities in the South, including command and control centres and transport facilities such as airfields and ports – the latter to deny access to U.S. reinforcements. Hwasŏng (Scud) missiles would be the likely delivery system. Since their accuracy is poor, the KPA would have to launch several missiles at each target, so as to saturate the area with chemical agents and degrade enemy operations.

As the balance of conventional forces continues to go against it, asymmetric capabilities, including CW, will remain an important pillar of DPRK military strategy. North Korea does not appear to be prepared to sign the

⁶¹ Internal third country government memorandum made available to Crisis Group.

⁶² Bermudez, *The Armed Forces of North Korea*, op. cit., p. 226.

⁶³ Internal third country government memorandum made available to Crisis Group; Crisis Group interviews.

⁶⁴ Internal third country government memorandum made available to Crisis Group.

⁶⁵ Bruce Bennett, "Weapons of Mass Destruction: The North Korean Threat", *The Korean Journal of Defense Analysis*, vol. 16, no. 2, Fall 2004; 신성택 [Sin Sŏng-t'aek], "북한의 화학무기 위협 및 대응방안" ["The North Korean Chemical Weapons Threat and Proposed Countermeasures"], op. cit.; 東北亞 軍事力 [2004-2005 North East Asia Military Power], KIDA (Seoul, 2005), p. 175.

⁶⁶ For example, the "North Korea Country Handbook" prepared by U.S. Marine Corps intelligence in May 1997 concluded that North Korea would use chemical weapons in the initial stage of a hypothetical attack against South Korea. See, "US handbook says North Korea would use chemical weapons", Kyodo News Service, in BBC Worldwide Monitoring, 11 November 1999.

⁶⁷ Jim Garamone, "Commander assesses North Korea's conventional threat", American Forces Press Service, 26 August 2005.

⁶⁸ Crisis Group interview, Seoul, 30 October 2008.

CWC any time soon, since that convention requires the verifiable destruction of CW stocks. Military leaders are also very unlikely to accept a CW disarmament process, both because they would consider it a sign of weakness and because it would reveal information about the country's military capabilities and posture.

5. Command and control

As noted above, the National Defence Commission's control of all military assets would shift to the Supreme Commander of the Korean People's Army (SCKPA) in time of war. The threshold is presumably much lower for using chemical than nuclear weapons. Kim Jong-il, as SCKPA, would have to approve CW use, but the munitions are already at storage facilities, and custody has been transferred to the KPA.⁶⁹ The Chief of the General Staff would consult with the SCKPA and request authorisation to use CW, which could happen under two scenarios.

In the first, the DPRK could use CW in a first strike against the ROK, with the approval of the NDC and its chairman (again Kim). Such a plan would be extremely risky and almost certainly would fail, but the argument for it would be that war was inevitable and the KPA would be more likely to succeed if it attacked first. Since the conventional military balance does not favour the KPA, asymmetric capabilities, including CW, could be necessary to avoid defeat.

The General Staff Department's Nuclear Chemical Defence Bureau (NCDB) would have to deploy defensive measures before the KPA could launch a CW attack. Gas masks and protective suits would have to be distributed, and monitoring and detection equipment would have to be deployed to ensure that KPA troops avoided or at least minimised self-contamination.⁷⁰ As CW units prepared for an assault, the NCDB would deliver munitions to combat units. The defensive and offensive preparations would be observable from outside North Korea, and the resulting warning time would nullify some of the first-strike advantages.⁷¹ Of course, this scenario would include the mobilisation of other military resources in addition to CW munitions, so it would be impossible for the KPA to launch such a strike without the South having at least a few days' warning.

⁶⁹ Internal government memorandum made available to Crisis Group.

⁷⁰ Ibid.

⁷¹ ROK intelligence can detect KPA artillery preparations in forward areas, but U.S. intelligence is much better at detecting ballistic missile launch preparations in rear areas. Crisis Group interview, Seoul, 30 October 2008.

In the second scenario, the KPA could use CW to retaliate against the ROK and/or U.S. forces in Korea after a conflict had already begun and conventional means had proven insufficient to avoid defeat. The Chief of the General Staff would consult with Kim Jong-il and request permission.⁷² In this scenario, however, command, control and communications networks might already be seriously degraded, and CW units in the field might be unable to receive instructions and authorisation. In the 1990s, the DPRK began to install fibre-optic networks in an effort to upgrade the telecommunications system and improve the military's command, control and communications.⁷³ However, the system is vulnerable to attack, and KPA policy regarding delegation of authority to use CW to field commanders is unknown.

6. Exports

North Korea has been accused of exporting CW, as well as having assisted others with developing the munitions. In February 1997, then Israeli Foreign Minister David Levi charged it was supplying Syria with chemical weapons.⁷⁴ A September 2003 report asserted that the North has been suspected of transshipping chemical weapons through Georgia.⁷⁵ On 26 July 2007, an explosion occurred at a Syrian military facility when engineers reportedly were attempting to load

⁷² In early February 2009, General Yi Yŏng-ho (Ri Yong Ho) replaced Kim Kyŏk-sik as Chief of the General staff. Kim Yŏng-ch'un replaced Kim Il-ch'ŏl as Minister of the People's Armed Forces at the same time. Kim Hyun, "N. Korea shakes up military: report", Yonhap News Agency, 11 February 2009.

⁷³ "North Korean Smart Book", U.S. Forces Korea, Camp Garry Owen, March 2001, pp. 4-11. One indication of North Korea's backwardness in telecommunications technology is that Seoul agreed in 2007 to help it strengthen its telecommunications network in order to improve the military hotline between the two sides, but the assistance has been delayed after Lee Myung-bak was elected president and relations deteriorated. Despite the deep freeze in relations, North Korea asked again for assistance to upgrade the hotline during military talks in October 2008. Arguably, the transfer of South Korean telecommunications equipment and technology for the inter-Korean military hotline could be applied more broadly to the North Korean military. Byun Duk-kun, "Pyongyang blasts Seoul over anti-communist leaflets", Yonhap News Agency, 27 October 2008.

⁷⁴ "북한 - 중국, 시리아에 화학무기 제공" ["North Korea - China supply Syria with chemical weapons"], *The Chosun Ilbo*, 4 February 1997.

⁷⁵ "Georgian officials say country may be used to transport chemical weapons", Mze TV (Tbilisi), in BBC Monitoring International Reports, 28 September 2003.

a CW warhead onto a Scud-C missile.⁷⁶ Initial reports claimed that Syrian and Iranian engineers were killed in the blast, but in September 2008, Japan's *Sankei Shimbun* reported that three North Korean military personnel also died in the accident.⁷⁷ The Reform Party in Syria, an opposition group, claimed in July 2008 that North Korea in cooperation with Syria supplied Lebanese Hizbollah with mustard gas and nerve gas for delivery on its short-range missiles.⁷⁸ All these accusations are unconfirmed, but the threat of North Korean exports will remain as long as there is a demand for these weapons.

The KWP's Second Economic Committee operates the Yong'aksan General Trading Company, the Korea Mining Development Corporation (KOMID), the Yŏn'yu Company and other affiliates and front companies for managing arms exports. Yong'aksan and KOMID are under U.S. economic sanctions, for allegedly selling missiles and other proliferation activities, but there is no open source evidence linking North Korea with CW exports. However, transfers of CW precursors, agents and technologies are not that difficult to conceal, and Pyongyang has a well-established network for illicit arms sales.

C. BIOLOGICAL WEAPONS

The DPRK acceded to the Biological and Toxin Weapons Convention (BTWC) in March 1987, but many analysts believe it violates its commitments by maintaining a secret BW development program and possible stocks of weaponised agents. In January 1989, it acceded to the 1925 Geneva Protocol, which bans the use of biological as well as chemical weapons.⁷⁹ Verification of BTWC compliance is extremely difficult under any circumstances due to the dual-use nature of biotechnology and the problem in differentiating between offensive and defensive BW research programs. Furthermore, BW facilities do not require much space, so are easy to conceal. Given Pyongyang's violation of its nuclear safeguards commitments as well as its

general attitude towards arms control, it is reasonable to suspect that it would also violate BTWC commitments.

The North's motivations for a BW program also stem from the Korean War experience, but the objectives and doctrine are less clear than for the nuclear and CW programs. Likewise, the blurring of biological technologies into the realm of public health makes it hard to assess the program. Nevertheless, Pyongyang almost certainly is interested in BW technologies, at least for bio-defence purposes. The open source literature includes several references to the 1960s as the beginning of the BW program.⁸⁰ However, most recent assessments of that program have been revised downward; many analysts and policymakers now doubt Pyongyang's capabilities and intentions in bio-warfare.

1. History of the program

During the Korean War, North Korea was involved in operations to discredit the U.S. and other UN Forces that had intervened to support the ROK. In the winter of 1951-1952, its health minister travelled to Shenyang in China to obtain a sample of plague bacilli that was later injected into two North Korean criminals who had been sentenced to death. Their tissue samples were then provided to international investigators as part of a hoax to prove the U.S. used biological weapons in the Korean War.⁸¹ The accusations generally were accepted at the time but have subsequently been discredited. Nevertheless, the case indicates Pyongyang's awareness and interest in BW during the war, and the DPRK still insists that the U.S. used such weapons during the conflict.⁸²

A South Korean source claimed that the DPRK began to obtain BW technology in the 1950s from China, Vietnam, Ethiopia, and Middle Eastern countries in order to develop an independent production capability.⁸³ However, the technology from these sources must

⁷⁶ James Hider and Michael Evans, "Blast at secret Syrian missile site kills dozens", *The Times* (London), 20 September 2007; "July Blast in Syria linked to chemical arms, report says", *The Los Angeles Times*, 20 September 2007.

⁷⁷ *Sankei Shimbun*, 12 September 2008, in "Japan: 'source' says reprocessing facility for Syrian plutonium built in Iran", OSC Document ID: JPP20080912034001.

⁷⁸ "Hizbollah acquires CW", *Middle East Newline*, 14 July 2008, in OSC Document ID: GMP20080714738001.

⁷⁹ The text of the protocol is available at "Inventory of International Nonproliferation Organizations and Regimes", The James Martin Center for Nonproliferation Studies, 2002, <http://cns.miis.edu/inventory/pdfs/aptgenev.pdf>.

⁸⁰ "Adherence to and Compliance with Arms Control, Non-proliferation, and Disarmament Agreements and Commitments", U.S. Department of State, Bureau of Verification and Compliance, 30 August 2005, www.state.gov/t/vci/tls/rpt/51977.htm; Im Hong-gŭn, op. cit.; Pak Tong-sam, op. cit.

⁸¹ Bruce B. Auster, "Unmasking an old lie", *U.S. News & World Report*, 16 November 1998.

⁸² "Biochemical warfare of U.S. imperialism is inhuman crime", KCNA, 29 January 2008.

⁸³ 신성택 [Sin Sŏng-t'aek], "북한의 생물학무기 위협 및 대응방안" ["The North Korean Biological Weapons Threat and Proposed Countermeasures"], Chapter 4 in *북한의 대량살상무기별 위협분석 및 대응책연구* [Analysis of

have been rudimentary at best. In 1992, South Korea's Agency for National Security Planning (renamed the National Intelligence Service in 1999) reported to the National Assembly that in the early 1960s, Kim Il-sung directed the Academy of Defence Sciences (since renamed the Second Natural Science Academy) to develop biological weapons. The academy established a testing centre and reportedly acquired *Bacillus anthracis* (anthrax), *Yersinia pestis* (plague) and *Vibrio cholerae* (cholera) from Japan in 1968.⁸⁴

In the 1970s, the DPRK reportedly established a large "germ research institute" in Sŏngch'ŏn-kun, South P'yŏng'an Province, and in 1980 it established the Central Biology Research Institute, as well as a military bio-defence unit and the No. 25 Factory in Chŏngju, North P'yŏng'an Province. The factory reportedly was to produce thirteen types of biological agents, including *Bacillus anthracis*, *Yersinia pestis* and *Vibrio cholerae*.⁸⁵ According to a 1994 DIA report cited in *The New York Times*, the North acquired the smallpox virus from the Soviet Union in the late 1980s and began working on weaponisation of it in the early 1990s.⁸⁶ In 1999, *The New York Times* reported that North Korean soldiers had been vaccinated against the smallpox virus, indicating the DPRK could be considering its use as a biological weapon.⁸⁷ However, that newspaper's reporting on suspected Iraqi WMD later proved to be inaccurate, and many assertions regarding the North's BW program have not been confirmed.

2. Capabilities and inventory

In years past, the literature commonly assumed that the DPRK had an offensive BW capability, but recent assessments have weakened many of the claims. For example, in 1997, General John Tilelli, Commander, U.S. Forces Korea, testified that the North "deploys a large stock of chemical and *perhaps* biological weapons" (emphasis added).⁸⁸ In March 2000, the U.S. Defense Department declared that North Korea had

been pursuing BW research and development since the 1960s, but that its biotechnology infrastructure was "rudimentary by Western standards".⁸⁹ In 2003, the CIA reported that "North Korea is believed to possess a munitions production infrastructure that would have allowed it to weaponise BW agents and may have some such weapons available for use".⁹⁰ The 2006 CIA assessment was nearly identical except it judged North Korea's "biotechnology infrastructure to be rudimentary but that it could support the production of various BW agents".⁹¹

In August 2005, General Leon LaPorte, Commander, U.S. Forces Korea, said he did not believe the DPRK had been able to weaponise biological agents, but "we know they have worked that and are experimenting".⁹² General Bell, who replaced LaPorte in 2006, told the U.S. Senate Armed Services Committee in March of that year that "some reports suggest that Pyongyang may have a biological weapons research program".⁹³

The South Korean government believes that North Korea does not possess weaponised BW agents, only samples of the agents. The North maintains at least three possible BW production facilities and seven BW or BW-related research centres. The production facilities include: the No. 25 Factory in Chŏngju, the Central Biological Weapons Research Institute in Pyongyang and a plant in the City of Munch'ŏn, Kang'wŏn Province.⁹⁴ The ROK assumes the North has acquired samples of the smallpox (variola) virus, but again this has not been confirmed.⁹⁵ If Pyongyang planned to use smallpox as a weapon, KPA soldiers and civilians would have to be vaccinated, which would be expen-

North Korean WMD Threats and Research on Policy Measures] (Seoul: KIDA, December 2000).

⁸⁴ 임은순 [Im Ūn-sun], "최소경비로 최대 살상 선택/북한 생화학무기 실태" ["Choosing the 'greatest casualties for the lowest cost': facts on North Korea's biological weapons"], *The Kyunghyang Shinmun*, 24 October 1992; Pak Tong-sam, op. cit.

⁸⁵ 임은순 [Im Ūn-sun], *The Kyunghyang Shinmun*, op. cit.

⁸⁶ William J. Broad and Judith Miller, "Government report says 3 nations hide stocks of smallpox", *The New York Times*, 13 June 1999.

⁸⁷ Ibid.

⁸⁸ John H. Tilelli, prepared statement before the Senate Armed Services Committee, 18 March 1997.

⁸⁹ "N. Korea maintaining chemical arms program: Pentagon report", Kyodo News Service, Japan Economic Newswire, 24 March 2000.

⁹⁰ "Attachment A: Unclassified Report", CIA, op. cit.

⁹¹ "Unclassified Report", CIA, op. cit.

⁹² Jim Garamone, "Commander assesses", op. cit.

⁹³ B.B. Bell, statement, 2006, op. cit.

⁹⁴ Internal government documents made available to Crisis Group. Theoretically, large quantities of biological weapons can be produced in days, but the planning and preparation for BW use on a large scale would probably take several weeks.

⁹⁵ Crisis Group interviews, Seoul. The last known case of smallpox was in 1978. All countries except Russia and the U.S. have reported they do not possess the variola virus, but the World Health Organisation has not been able to confirm this. Russia and the U.S. maintain samples in heavily guarded laboratories in case they are needed to treat a recurrence of the disease. Intelligence agencies in Russia, South Korea, and the U.S. assess that the DPRK has samples of the virus, but the U.S. believes the evidence is "medium quality". Barton Gellman, "4 Nations Thought to Possess Smallpox", *The Washington Post*, 5 November 2002.

sive and risky, since the vaccination campaign would reveal intentions.⁹⁶

The most likely agents for weaponisation are *Bacillus anthracis* (anthrax), *Yersinia pestis* (plague), *Vibrio cholerae* (cholera), and botulinum toxin.⁹⁷ Anthrax is a disease caused by a bacterium common in soil throughout the world. Humans usually contract it through exposure to infected animals or animal products after the animals have ingested the spores. The most common form is cutaneous anthrax, which develops when spores penetrate breaks in the skin, but this is treatable.⁹⁸ Gastrointestinal anthrax is contracted by eating contaminated meat or animal products but requires the ingestion of a large amount of spores and is very rare. Inhalation anthrax, although theoretically treatable, is almost always fatal, because antibiotic treatment is ineffective once symptoms occur.

Anthrax is possibly the best candidate for a biological weapon, because it is lethal but not contagious. In aerosol form, the spores are invisible to the naked eye and odourless. Symptoms appear as soon as two days after exposure and resemble a severe cold or flu at first. Despite the lethality of inhalation anthrax, several factors mitigate against any planned use. The particle size of the aerosol must be fairly precise to cause a pulmonary infection, and environmental factors are also critical. Exposure to prolonged direct sunlight will kill the spores, and wind or rain can also eliminate them. However, there are no practical early devices to detect dispersion of aerosol BW agents.

If North Korea were to use biological weapons, KPA Special Forces or special agents under KWP control would probably disperse the BW in South Korea or Japan, while seeking to escape detection. This might precede a large DPRK military operation such as invasion in order to degrade ROK and U.S. response capacity. In a limited conflict scenario, where it wished to avoid escalation, Pyongyang might have an incentive to use BW, since it would offer plausible deniability. But biological weapons can infect friendly forces and

civilians, and North Korean BW defence and public health systems have no capacity to deal with epidemics. Though some analysts believe the DPRK has armed or would arm its ballistic missiles with BW warheads, this is very unlikely. It would be an inefficient use of expensive missile systems, and the KPA probably does not have the technical capability.

3. Human experiments

North Korea reportedly has used live human beings for experiments with chemical and biological agents, but some analysts question this. For example, Mrs Yi Sun-ok, who defected from the DPRK in December 1995, said children have been taken from their parents for testing chemical and biological weapons.⁹⁹ She also claimed to have witnessed “many prisoners lying on the slope of a hill, bleeding from their mouths, motionless, enveloped by strange fumes and surrounded by scores of guards in gas masks”.¹⁰⁰ In February 2004, a BBC documentary, “Access to Evil”, reported the North has used humans for CBW tests, but the program drew protests from the UK Foreign Office.¹⁰¹ It included testimony from a chemical engineer who had defected from North Korea and claimed to have participated in a chemical experiment that resulted in the death of two prisoners in April 1974.¹⁰²

On 12 February 2004, a South Korean human rights organisation published a document that appeared to have the official stamp of North Korea's State Security Agency and details of a prisoner transfer for CW experiments.¹⁰³ The source reportedly fled North Korea but was arrested in China and repatriated.¹⁰⁴ Inconsistencies were discovered that discredited the

⁹⁶ Crisis Group interview, Seoul, 30 October 2008. There have been no indications that Pyongyang has implemented a smallpox vaccination effort, which would cause serious side effects for small numbers in the population.

⁹⁷ Internal government documents made available to Crisis Group.

⁹⁸ Without antibiotic treatment, about 20 per cent of cutaneous anthrax cases are fatal, but with treatment, fatalities are very rare. Thomas V. Inglesby, Tara O'Toole, Donald A. Henderson, et al., “Anthrax as a Biological Weapon, 2002: Updated Recommendations for Management”, *Journal of the American Medical Association*, 1 May 2002, vol 287, no. 17.

⁹⁹ A. Butcher, “Babies killed in N. Korean weapon trials”, *Courier Mail* (Queensland, Australia), 8 July 1996.

¹⁰⁰ Michael Sheridan, “N Korea inmates ‘used for gas tests’”, *The Australian*, 26 January 2004, p. 13.

¹⁰¹ John Deane, “UK protests over N. Korea's ‘weapons tests on prisoners’”, Press Association, 13 February 2004.

¹⁰² 김범수 [Kim Pöm-su], “나는 북한 화학무기 생체실험에 참여했다” [“I participated in North Korean chemical weapons experiments on live humans”], *미래한국* [Future Korea], 12 June 2004, p. 7.

¹⁰³ Charles Whelan, “North Korean prisoners used for chemical weapons tests: activists”, Agence France-Presse, 12 February 2004; Kim So-young, “N.K. tested gas on prisoners”, *The Korea Herald*, 13 February 2004.

¹⁰⁴ Robin Gedye, “Chinese agents seize N Korean defector: arrest is too late to save secrets of biological killings”, *The Daily Telegraph* (London), 12 February 2004, p. 16; “China arrests man who leaked secret N. Korean gas chamber claims: report”, Agence France-Presse, 11 February 2004.

assertions,¹⁰⁵ and South Korean officials initially were sceptical about the claims.¹⁰⁶ Four of the source's North Korean family members appeared before the DPRK media to declare the document had been fabricated and misused by the foreign media to "attack the fatherland".¹⁰⁷ They probably had no information about the document and could well have been coerced into making their statements, but it is not uncommon for defectors to exaggerate their claims for various reasons, so the document could have been forged. In sum, it is unclear whether the DPRK has conducted CBW experiments on humans since the 1952 case, but it cannot be ruled out.

III. RISKS

A. WEAPONS USE

There are several possible scenarios for the use of DPRK chemical or biological weapons in Korea or elsewhere. While mutual deterrence on the Korean peninsula is robust, it could fail; in the case of transfers to other states or non-state actors, the likelihood of CBW use increases. South Korea's population density and Seoul's proximity to the DMZ make millions of civilians vulnerable to a North Korean attack. As the conventional balance of forces continues to deteriorate for Pyongyang, its leaders might feel they would have to use CW early in a conflict to avoid defeat.

1. Attack: deliberate, accidental, unauthorised

While it is difficult to imagine North Korea using its nuclear weapons in an unprovoked first strike, the literature stresses the generally offensive nature of DPRK military doctrine, and, as has been noted, the threshold for CW use is much lower. The Supreme Commander of the KPA must authorise it, but the KPA has custody of the munitions, which also increases the likelihood of accidental or unauthorised use. The regime might use chemical weapons either while conducting preventive war or as a "doomsday weapon" in the face of imminent defeat in war. Either BW research or efforts to weaponise biological agents could lead to accidental exposure or release in North Korea. Although unlikely, the North might use biological weapons in the first phase of a preventive war.

2. Retaliation, escalation

The Korean peninsula is one of the world's most dangerous flash points. The DPRK has the fourth largest military in the world, with one million active duty personnel, but most of its hardware is obsolete.¹⁰⁸ Escalation and all-out war were avoided during a period of high tension and serious North Korean provocations in the 1960s, but there have been several close calls in the now more than half-century since the end of the Korean War.¹⁰⁹

¹⁰⁵ Bertil Lintner, "North Korea and the poor man's bombs", *The Asia Times Online*, 9 May 2007, www.atimes.com/atimes/Korea/IE09Dg01.html.

¹⁰⁶ Samuel Len, "South Korea doubts report North used human guinea pigs", *International Herald Tribune*, 3 February 2004, p. 5.

¹⁰⁷ "Truth behind false report about 'experiment of chem. weapons on human bodies' in DPRK disclosed", KCNA, 30 March 2004; "《화학무기인체실험》문서들은 허위문건이다—당사자가족 기자회견" ["Chemical weapons experiments on live humans": a press conference with family who say documents are fake"], *ibid.*

¹⁰⁸ Scobell and Sanford, *North Korea's Military Threat*, *op. cit.*; Jae-Jung Suh, "Assessing the Military Balance in Korea", *Asian Perspective*, vol. 28, no. 4, 2004, pp. 63-88.

¹⁰⁹ Notable examples include: the North Korean capture of the *USS Pueblo* in January 1968; the shooting down of a U.S. Air Force reconnaissance plane in April 1969; the axe murders of two U.S. Army personnel at Panmunjom's Joint Security Area in the DMZ in August 1976; the bombing and attempted assassination of former ROK President Chun

Misperception or miscalculation could yet lead to an escalation spiral. Deliberate or accidental incursions during a time of rising tensions might create incentives to strike first. In particular, Pyongyang does not recognise the Northern Limit Line (NLL) – the west sea boundary extending from the DMZ – and the area has seen two deadly battles over the last decade. In June 1999, the ROK navy sank a DPRK naval vessel, and in June 2002 the North sank a South Korean ship in a similar skirmish. In the 2002 case, the South Korean military called off its pursuit of North Korean vessels after electronic intelligence indicated the North had turned on radars for onshore anti-ship missiles.¹¹⁰ If the ROK had attacked the radar and missile sites to protect its ships, the situation could have escalated into a full-scale war, including the possible use of North Korean chemical weapons against the South.

3. Internal use in a power struggle

Political transitions in authoritarian states are often resolved through violence, though some one-party states (such as the former USSR and China) have institutionalised peaceful transition mechanisms. At the time of the DPRK's only power transition, following the death of Kim Il-sung in July 1994, many analysts were surprised at the smooth transfer of authority to Kim Jong-il and the state's resiliency. Many ROK analysts believe Kim Jong-il's "military first" policy has paved the way for another smooth transition, at least in the short run, but if the next leader is unable to deliver economic recovery, internal pressures could create instability or even a military coup. Any struggle for power involving the military could be violent, with at least a possibility of chemical weapons being involved. Indeed, some senior South Korean military analysts believe such weapons are more likely to be employed in an internal power struggle than in a conflict with the South.¹¹¹

B. PROLIFERATION, SALES, TRANSFERS

North Korea's proliferation activities, at least regarding ballistic missiles to the Middle East and Pakistan, are well documented. There is also substantial evidence suggesting the North was assisting Syria to build a nuclear reactor at Dair al-Zor (Al Kibar) before Israel bombed the site in September 2007.¹¹² Given its track record, the relative ease with which such transfers can be concealed and its well-established network, Pyongyang very well could sell chemical munitions or the materials and technology to produce them. However, there is no clear evidence of such exports.

Compared to its neighbours, the DPRK economy is under-developed, with little foreign trade. Economic sanctions have not persuaded Pyongyang to abandon its proliferation activities, and they are particularly ineffective when imposed by countries that have no economic relationship with it. China, North Korea's main trading partner, is unwilling to impose an economic blockade to compel non-proliferation compliance. Food, fuel and humanitarian assistance are also essentially off the table for sanctions from its perspective. The South Korean government under Lee Myung-bak is more willing to apply pressure but not to suspend or block humanitarian assistance.

Ironically, sanctions intended to curtail North Korean proliferation can have the opposite effect. Since few legitimate international business opportunities have been available to Pyongyang, illicit activities have become a major source of foreign exchange needed to balance the chronic current account deficit. The North's comparative advantage is in weapons and little else. Transforming its munitions industry into peaceful civilian enterprises would be difficult and perhaps not possible under the Kim family regime, but disarmament and economic recovery would eventually require reforms that open the economy and provide it access to international markets.

Du-hwan in Burma in October 1982 that killed 21 people, including four ROK cabinet ministers; and the bombing in flight of a Korean Air passenger aircraft in November 1987.

¹¹⁰Robert Whyman and David Watts, "Korean dispute ends in sea battle", *The Times* (London), 16 June 1999; "The naval clash on the Yellow Sea on 29 June 2002 between South and North Korea: the situation and ROK's position", ROK national defence ministry, 1 July 2002; Mark Magnier, "Koreans battle in Yellow Sea", *The Los Angeles Times*, 29 June 2002.

¹¹¹Crisis Group interview, Seoul, 30 October 2008.

¹¹²"Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic", Report by the Director General, IAEA, 19 November 2008; David Albright and Paul Brannan, "The Al Kibar Reactor: Extraordinary Camouflage, Troubling Implications", Institute for Science and International Security Report, 12 May 2008; Bill Gertz and Sara A. Carter, "Intelligence on Syria delayed to avoid fight", *The Washington Times*, 25 April 2008.

C. ARMS RACES

North Korea's WMD programs could trigger arms races in North East Asia or other regions by posing direct security threats or by undermining non-proliferation regimes. The nuclear and missile programs pose the greatest such threat, but the ROK and Japan are unlikely to seek their own WMD capabilities, relying instead on their alliance relationships with the U.S. and bolstering their conventional capabilities. However, these measures could trigger responses from North Korea (or, in some circumstances, also China). South Korea is most threatened by North Korean chemical weapons, but Seoul is in full compliance with its CWC commitments and has destroyed its former CW stocks. It will continue to develop advanced, precision-guided munitions, including cruise missiles, as a counter-strike option for meeting the North Korean CW threat. However, North Korean CW proliferation could help trigger or exacerbate arms races in regions that are already insecure, such as the Middle East.

IV. POSSIBLE RESPONSES

A. NON-PROLIFERATION, COUNTER-PROLIFERATION AND EXPORT CONTROLS

Non-proliferation efforts are necessary but not sufficient for managing the North Korean WMD threat. Non-proliferation requires international cooperation, including among national governments, international organisations and the private sector. An international norm against chemical and biological weapons has emerged. Non-proliferation tools can thus be focused on a few states or the non-state actors that still seek CBW capabilities, but it is very difficult to stop determined proliferators, since the technical barriers for acquiring chemical and biological weapons are not that high.

The discovery of the A.Q. Khan nuclear smuggling network and numerous other cases of WMD-related trafficking have led to the establishment of counter-proliferation mechanisms. In particular, the U.S.-initiated Proliferation Security Initiative (PSI), founded in 2003, is aimed at interdicting WMD shipments before they reach countries of concern or terrorist groups. The PSI began as a coalition of eleven countries but now includes 95. The participants adopted a set of principles in September 2003, but there is no treaty, central authority or secretariat to manage the coalition. Members rely upon domestic and international law to intercept dangerous cargoes. There have been some successes, but excellent intelligence and international coordination are required. The PSI alone is not a full solution to proliferation, but it raises the costs and difficulties for proliferators.¹¹³

South Korea announced its intention to join the PSI as a full member one day after North Korea conducted its second nuclear test on 25 May 2009.¹¹⁴ Seoul's announcement brought a swift rebuke from Pyongyang, which described the South's move as a "declaration of war" and warned that "the DPRK will deal a decisive and merciless retaliatory blow, no matter from

¹¹³ For more on the PSI, see "The Proliferation Security Initiative (PSI) At a Glance", Arms Control Association, fact sheet, October 2007; Wade Boese, "Interdiction Initiative Successes Assessed", *Arms Control Today*, July/August 2008; "Proliferation Security Initiative", The James Martin Center for Nonproliferation Studies, Inventory of International Nonproliferation Organisations and Regimes, <http://cns.miis.edu/inventory/pdfs/psi.pdf>.

¹¹⁴ "S. Korea to join US-led anti-proliferation drill", *The Korea Times*, 26 May 2009.

which place, at any attempt to stop, check and inspect its vessels".¹¹⁵

The Australia Group was established in 1985 to restrict the supply of CW and BW agents and materials.¹¹⁶ While export controls have made it more difficult and costly to acquire illicit materials and technologies, it is hard to monitor the large volume of international trade, and proliferators have been creative in surmounting export controls.

UN Security Council Resolution 1540 (28 April 2004) requires all member states to take "effective measures to prevent the transfer of WMD and their delivery systems to non-state actors". These include accounting and physical security, border security and law enforcement against smuggling, as well as export and trans-shipment controls. The resolution also calls upon states to adopt, strengthen and comply with relevant multilateral treaties.¹¹⁷

Although the UN is able to provide technical assistance to those that request it, member states' resources and commitments are often insufficient, and Resolution 1540 has not been universally implemented.¹¹⁸ It established a committee that has prepared a checklist for implementation and reports to the Security Council. Member states were required to submit an initial report to this body by October 2004, but as of July 2008, 37 countries had failed to do so. Of those 37, only the DPRK is believed to possess WMD.¹¹⁹ While the North has not denounced the resolution and receives 1540 Committee communications, it has not taken any initiative to implement it.¹²⁰

¹¹⁵"CPRK regards S. Korea's full participation in PSI as declaration of war against DPRK", KCNA, 27 May 2009; Jon Herskovitz, "North Korea warns of attack if ships checked", Reuters, 27 May 2009.

¹¹⁶See the Australia Group website, www.australiagroup.net/en/index.html.

¹¹⁷UN Security Council Resolution 1540, 28 April 2004.

¹¹⁸Peter Crail, "Implementing UN Security Council Resolution 1540: A Risk-Based Approach", *The Nonproliferation Review*, vol. 13, no 2, July 2006, pp. 355-399; Wade Boese, "Implications of UN Security Council Resolution 1540: Presentation to the Institute of Nuclear Materials Management Panel Discussion", Arms Control Association, 15 March 2005.

¹¹⁹"Report of the Committee established pursuant to Security Council Resolution 1540 (2004)", UN S/2008/493, 8 July 2008. Available at: www.un.org/sc/1540/committeereports.shtml.

¹²⁰The 1540 Committee was preparing to deliver the checklist to DPRK authorities in the summer of 2008. The DPRK has the authority to release this document to the public or to keep it confidential. Crisis Group email communication,

Export control systems require national legislation, human resources, and cooperation between the private and public sectors, as well as international cooperation. North Korea has no experience in this area, and it could take years to put together an export control regime if Pyongyang decides to abandon its WMD programs.¹²¹ The Kaesŏng Industrial Complex (KIC), an inter-Korean joint economic project in North Korea just five kilometres north of the DMZ, offers a test case for the application of export controls in the DPRK. According to South Korean law (the "Inter-Korea Exchange and Cooperation Act"), ROK firms must receive approval from the unification minister before sending any strategic items into the KIC.

In December 2004, the KIC established export control rules and a committee that reviews and monitors export control compliance for KIC firms, which are required to submit compliance documents to the committee every October.¹²² Prior to investing in the KIC, firms must receive approval from the unification ministry, which delegates the export control review to the Korea Strategic Trade Institute (KOSTI), a semi-private industry association that works with the government and firms on export control compliance and submits the results of the review to the ministry.¹²³ One firm's application for the pilot phase of the project was rejected because it exceeded certain machine tool specifications.¹²⁴

Japan feels most threatened by any nuclear-armed North Korean missiles and believes missile defence offers the only real countermeasure. Distance and geography make it technologically feasible to intercept North Korean missiles, and the Japanese constitution, domestic laws, and national defence policies proscribe the use of offensive military means. However, missile defences are not perfect and North Korean ballistic missiles can strike Japan in about seven minutes, so a successful

1540 Committee member, 20 June 2008. However, with the collapse of the Six-Party Talks, Pyongyang has ignored its non-proliferation obligations under Security Council resolutions.

¹²¹Crisis Group interview, Shim Soung-kun, president, Korea Strategic Trade Institute (KOSTI), Seoul, 25 June 2008.

¹²²*개성공단 5년 [Kaesŏng Industrial Complex: 5 Years]*, ROK Ministry of Unification, Seoul, December, 2007, pp. 120-121.

¹²³In the case of conventional weapons or sensitive items, the ROK conducts an inter-agency review that can include the national defence; knowledge economy; education, science and technology; and other relevant ministries as warranted. However, none of these items is even considered for KIC or inter-Korean trade.

¹²⁴Crisis Group interview, Shim Soung-kun, president, Korea Strategic Trade Institute (KOSTI), Seoul, 25 June 2008.

interception would require immediate detection of the launch and very quick decisions.¹²⁵

B. DETERRENCE AND COUNTER-STRIKE CAPABILITIES

Deterrence and credible precision-strike capabilities will be indispensable until the DPRK abandons its CBW programs. The U.S. plays a prominent role in deterring North Korea through its bilateral military alliance commitments with Seoul and Tokyo. In 1978, the U.S. and South Korea established the Combined Forces Command (CFC) to integrate their military forces on the peninsula in wartime under a U.S. four-star general and a four-star ROK deputy commander.¹²⁶ The CFC is scheduled to be disbanded in April 2012, when Seoul regains wartime operational control of its military.¹²⁷

Since the end of the Korean War, the majority of U.S. ground forces have been deployed close to the DMZ. Because their presence would ensure U.S. involvement, this arrangement was thought to deter a DPRK attack. In recent years, however, the Pentagon has increasingly viewed these troops as vulnerable hostages that reduce U.S. military options. As part of its force transformation policy, U.S. ground forces are being redeployed further away from the DMZ to reduce the American military footprint and move them beyond North Korean artillery range.¹²⁸

At the same time, the U.S. Army has deployed artillery and Army Tactical Missile Systems (ATACMS) with the Second Infantry Division near the DMZ, which has drawn North Korean criticism.¹²⁹ In 2002, South

Korea became the first country to purchase ATACMS missiles from the U.S.¹³⁰ It has also developed and deployed the Hyŏnmu, an upgraded version of the U.S. Nike-Hercules. It has a range of only about 180km, but South Korea has also developed and deployed highly accurate land-attack cruise missiles that can strike targets throughout the North. In October 2006, Seoul established an integrated missile command under the army to manage counter-strike forces.¹³¹

If North Korea refuses to abandon its CBW capabilities, the fallback position for potential adversaries is a mix of nonproliferation, counter-proliferation, deterrence and containment. A preventive military option is unthinkable unless there is clear foreknowledge that the DPRK is about to launch unprovoked military operations against its neighbours, a contingency that is very unlikely, since it would be observable and suicidal for the DPRK.

C. EMERGENCY RESPONSE PLANNING

Mutual deterrence is robust but nonetheless capable of failing on the Korean peninsula. North Korean WMD is most likely to be used, if at all, in an inadvertent conflict and escalation along the DMZ or the NLL in the Yellow Sea, but ROK emergency response agencies must be prepared for any scenario. South Korea has conducted civil defence exercises for decades, but civilians today appear to be more complacent than in the Cold War era. Critics have argued that previous military leaders exaggerated the North Korean military threat as a means to instil fear in the South Korean people and justify authoritarian rule.¹³² On the other hand, conservatives argue that the government delib-

¹²⁵ Crisis Group Asia Briefing N°91, *North Korea's Missile Launch: The Risks of Overreaction*, 31 March 2009.

¹²⁶ "Combined Forces Command: Mission of the ROK/US Combined Forces Command", United States Forces Korea, www.usfk.mil/usfk/cfc.aspx.

¹²⁷ "Combined Forces Command Marks 30th Anniversary", *The Chosun Ilbo*, 7 November 2008; "South Korea to Reclaim Wartime OPCON in April 2012", *The Hankyoreh*, 23 February 2007.

¹²⁸ Chang-hee Nam, "Relocating the U.S. Forces in South Korea: Strained Alliance, Emerging Partnership in the Changing Defense Posture", *Asian Survey*, July/August 2006, vol. 46, no. 4, pp. 615–631; Todd Lopez, "Transformation in Korea", *Army.mil/news*, 29 July 2008, www.army.mil/news/2008/07/29/11313-transformation-in-korea/.

¹²⁹ "6th Battalion, 37th Field Artillery", U.S. Army Second Infantry Division website, www-2id.korea.army.mil/organization/units/fires/6-37fa/; "U.S. moves to deploy new type missiles in South Korea assailed", KCNA, 2 April 2005; "Memorandum of the DPRK government exposing

arms build-up of U.S. and S. Korea", KCNA, 13 September 1997.

¹³⁰ "Briefs – Korea buys ATACMS Block IA", *Jane's International Defence Review*, 18 January 2002.

¹³¹ Daniel A. Pinkston, "South Korea tests 1,000 kilometer-range cruise missile and develops 1,500 kilometer-range version", *WMD Insights*, November 2006, www.wmdinsights.com; Daniel A. Pinkston, "South Korean response to North Korean July missile exercise includes unveiling of new cruise missile", *WMD Insights*, October 2006.

¹³² For example, in 1986 North Korea began constructing a large dam on a tributary to the Han River that runs through Seoul. President Chun du-hwan and others asserted that the dam could be used to flood Seoul. South Korea began to build its own dam – the Peace Dam – south of the DMZ in 1987 to block any such attempt. Construction of the Peace Dam was suspended when it was half finished, but it was finally completed in 2005 at a cost of about \$429 million. Choe Sang-hun, "Peace dam still waits for the flood that never came", *The New York Times*, 28 August 2007.

erately discounted or ignored the North Korean threat during ten years of liberal rule under former Presidents Kim Dae-jung and Roh Moo-hyun. However, the 11 September 2001 terrorist attacks in the U.S. and large natural disasters around the world have increased awareness of the need for emergency response planning.

South Korea enacted its "Basic Disaster and Safety Management Law" in March 2004 and established the National Emergency Management Agency (NEMA) three months later. The agency responds to natural disasters, and its civil defence division is responsible for training. NEMA has signed international cooperation agreements with the UN and the U.S., but a North Korean chemical or biological attack could overwhelm it and other ROK government agencies.¹³³ Nevertheless, preparedness can reduce the number of casualties and help survivors recover.

D. DIPLOMACY, ENGAGEMENT AND ARMS CONTROL

Numerous international institutions specialise in disarmament and confidence building with respect to weapons of mass destruction. However, East Asia does not share Europe's experience of strong multilateral institutions, particularly in the security realm. Some mechanisms are universal and indispensable, such as the Nuclear Non-Proliferation Treaty (NPT), the International Atomic Energy Agency (IAEA) and the CWC, but so far they have been insufficient for dealing with North Korean WMD. This has led to the proliferation of ad hoc instruments over the last two decades: the Agreed Framework; the Four-Party Talks; the Six-Party Talks; inter-Korean summits; inter-Korean ministerial meetings; inter-Korean military talks; and Track II dialogues. No single mechanism can resolve all outstanding issues surrounding North Korean WMD and regional security, so a patchwork of existing and new ones will be necessary if diplomacy is to succeed.

1. CWC

The Chemical Weapons Convention, as noted above, bans the production, possession, transfer and use of chemical weapons and requires member states to declare their chemical weapons stocks and destroy them under monitoring from the Organisation for the Prohibition of Chemical Weapons (OPCW) at the Hague. Parties are also required to declare their civilian chemical industry facilities and allow OPCW inspections to

verify CW are not produced and dual-use precursors are not diverted.¹³⁴

Convincing North Korea to join the CWC will be difficult, since its policymakers view international organisations and arms control regimes as biased instruments of the powerful, who seek to undermine their country. Although North Korean negotiators are well-versed in arms control terminology and treaties, they view them as means to enable the strong to impose their will on Pyongyang.¹³⁵ Leaders feel they need their panoply of weapons as protection against a more powerful and hostile world and even say that their nuclear weapons provide security and stability for the Korean peninsula and all North East Asia.¹³⁶ Their power-oriented view of international relations is suspicious of arms control and restraint.

If North Korea verifiably terminates its nuclear weapons program, that could be a sign it feels secure enough to surrender its missiles and CW stockpile as well. The destruction of chemical weapons is dangerous and costly, however, so it will need assistance. If Pyongyang accedes to the CWC, the OPCW could offer technical and financial assistance. Given its experience with CW destruction, Seoul could also help, though the South Korean government has concluded a confidentiality agreement with the OPCW and will neither confirm nor deny that it ever had a CW program. Nevertheless, the OPCW has designated a South Korean Agency for Defence Development chemical laboratory in Taejon as an accredited site to conduct testing and sampling in technical support or offsite CWC inspections and CW destruction. The lab is mobile and can assess environmental samples for CW contamination.¹³⁷

¹³³ For more information on NEMA, see its website at: <http://eng.nema.go.kr/>.

¹³⁴ "The Chemical Weapons Convention (CWC) at a Glance", Arms Control Association, fact sheet, October 2008, www.armscontrol.org/factsheets/cwcglance; "Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Chemical Weapons Convention)", OPCW, updated 18 November 2008, www.opcw.org/chemical-weapons-convention/; for documents related to OPCW support for implementation, see its website, www.opcw.org/documents-reports/browse-by-topic/implementation-support/.

¹³⁵ For example, former South Korean Vice Defence Minister Park Yong-ok, who participated in several rounds of inter-Korean arms control talks in the early 1990s, described the North Koreans as very suspicious of arms control and unwilling to compromise. Crisis Group interview, Seoul, 31 October 2008.

¹³⁶ "Service persons and Pyongyangites hail successful Nuclear Test", KCNA, 20 October 2006.

¹³⁷ "Report of the Organisation on the Implementation of the Convention (1 January-31 December 1998)", OPCW, 2 July 1999; Crisis Group email communication, Dr Kim Il-

Regional or bilateral cooperation could be applied to supplement weapons disarmament under the CWC. Two areas must be addressed if the DPRK agrees to abandon its chemical weapons: CW destruction and chemical industry conversion and compliance with peaceful use obligations. International inspectors from the OPCW would have to verify the destruction, but the ROK could assist with the actual destruction of the weapons given its own experience. South Korea's Samyang Chemical Company destroyed the ROK's CW stockpile under a contract from the national defence ministry.¹³⁸ However, South Korea's CW stockpile apparently consisted of binary nerve agent munitions, which are easier to handle and destroy than the unitary munitions that are believed to make up North Korea's arsenal.¹³⁹ Therefore, the ROK's technical ability to assist the DPRK might be limited.

If the DPRK were to collapse, most of its chemical plants and infrastructure would be shut down because they are obsolete. However, if Pyongyang were to sign the CWC, the factories would be subject to OPCW inspections. In the ROK, the Korea Specialty Chemical Industry Association (KSCIA) works with the OPCW to implement inspections. Theoretically it could perform this function after Korean unification, but it has no current plans for handling the North's chemical industry and CWC compliance.¹⁴⁰

While the OPCW must be the main actor in assisting North Korea to comply with CWC commitments, China and Japan could provide training and education for North Koreans to show how they have cooperated in north-eastern China to destroy CW munitions abandoned by the Japanese military at the end of World War II. Beijing and Tokyo could provide examples of best practices and the handling of unanticipated difficulties in working together to destroy CW as the case might apply to North Korea.¹⁴¹

2. BTWC

The Biological and Toxin Weapons Convention (BTWC) prohibits development, production, stockpiling, and transfer of biological agents and toxins of "types and quantities that have no justification for prophylactic, protective or other peaceful purposes". Parties are required to "destroy or divert to peaceful uses any agents, toxins, weapons, equipment, and their means of delivery".¹⁴² However, the treaty has been criticised for weak verification mechanisms. Parties consult to address compliance and verification issues, but many are not transparent about their programs. It is difficult to distinguish offensive BW programs from defensive ones, and many states wish to shelter national biotech firms and their proprietary information from inspection. Parties can report suspected violators to the Security Council, but this has never been done.

While North Korea's BW threat probably has been exaggerated, any illicit pathogens or toxins and related equipment in its possession should be destroyed. Since BW pathogens and toxins exist in very small quantities, and production facilities are small and easy to conceal, disarmament in this area will require extensive cooperation.

DPRK officials and scientists would have to disclose facilities, technologies, materials and equipment. This will be difficult for Pyongyang and likely require initial confidence-building measures as well as a quid pro quo to improve the DPRK's security and make it possible to transfer personnel into peaceful pursuits. Given the ROK's developed biotech industry and common language and culture, Seoul could provide training in peaceful bio-safety and bio-security procedures to North Korean scientists and technicians.

North-South public health cooperation is another potential confidence-building measure that could be linked to BW. For example, South Korea has been supplying medicine and equipment to deal with the re-emergence of malaria in the DPRK, even as relations have deteriorated significantly.¹⁴³ Prevention or eradication

hyun, Chemical Analysis Laboratory, CB Department, ROK Agency for Defence Development, 16 January 2008.

¹³⁸ Crisis Group telephone interview, 17 January 2008.

¹³⁹ Internal document made available to Crisis Group.

¹⁴⁰ Crisis Group email interview, Cho Jin-ho, Korea Specialty Chemical Industry Association, Seoul, 18 January 2008.

¹⁴¹ On some of the difficulties in CW destruction in north-eastern China, see Shari Oliver, Stephanie Lieggi and Amanda Moodie, "Program to clean-up abandoned chemical weapons in China moves sluggishly", *WMD Insights*, June 2008, www.wmdinsights.com/125/125_EA1_ProgramToCleanUp.htm.

¹⁴² "The Biological Weapons Convention (BWC) At A Glance", Arms Control Association, fact sheet, July 2008, www.armscontrol.org/factsheets/bwc. The convention website is at www.opbw.org/. "Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (BTWC)", The James Martin Center for Non-proliferation Studies, Inventory of International Nonproliferation Organisations and Regimes, updated 18 April 2008, <http://cns.miis.edu/inventory/pdfs/btwc.pdf>.

¹⁴³ Frank Konings, "The Korean War against Malaria", *The Far Eastern Economic Review*, July 2008, www.feer.com/

of avian flu is another area that could benefit from inter-Korean cooperation, and such cooperation in further public health areas could likewise help build confidence and transparency.

3. Six-Party Talks

The Six-Party Talks were established in August 2003 to seek a diplomatic solution to North Korea's nuclear program. As noted above, China, the DPRK, Japan, the ROK, Russia, and the U.S. signed a "Statement of Principles" on 19 September 2005, whereby Pyongyang agreed to abandon that program in exchange for a package of security assurances and economic and political incentives. The six parties have formed five working groups to address the various objectives: denuclearisation of the Korean peninsula; economic and energy cooperation; establishment of a North East Asian Peace and Security mechanism; normalisation of DPRK-U.S. relations; and normalisation of DPRK-Japan relations.¹⁴⁴ While North Korea declared in April 2009 that it would never again participate in the Six-Party Talks, the process holds out some hope in the longer run of evolving into a mechanism for addressing North East Asian security issues more generally, including the issue of WMD disarmament.

4. G-8 Global Partnership

The G-8 Global Partnership against the Spread of Weapons and Materials of Mass Destruction (Global Partnership) was established in June 2002 at the G-8 Summit in Kananaskis, Canada with the objective of raising \$20 billion over ten years to eliminate WMD threats through dismantlement and the employment of weapons scientists in peaceful pursuits. The U.S. has pledged to provide at least \$10 billion, and other industrialised countries have joined the effort. Until now, efforts have focused on the former Soviet Union, but the partnership is looking to apply the program to WMD programs in other countries, including the DPRK.¹⁴⁵ Canada has taken a strong interest in the

initiative and could approach North Korea and propose participation as a way to help Pyongyang meet its obligations in the Six-Party process.

international-relations/2008/july/Korean-War-Against-Malaria.

¹⁴⁴ For detail on the Six-Party Talks, see Crisis Group Report, *North Korea: Getting Back to Talks*, op. cit.

¹⁴⁵ "G-8 Leaders Agree to Fund Threat Reduction Programs", *Arms Control Today*, July/August 2002, www.armscontrol.org/act/2002_07-08/g8jul_aug02; "Global Partnership against the Spread of Weapons and Materials of Mass Destruction ("10 Plus 10 over 10 Program")", The James Martin Center for Nonproliferation, Inventory of International Nonproliferation Organisations and Regimes, updated 19 October 2007, <http://cns.miis.edu/inventory/pdfs/g8.pdf>.

V. CONCLUSION

North Korea's chemical and biological weapons programs pose serious security threats that require immediate and sustained international efforts to eliminate them. The Six-Party Talks have focused on the nuclear weapons program, and although the participants are committed to establishing a peace mechanism in North East Asia, they are not addressing either the chemical or the biological programs. While the North projects a menacing image, it faces challenges of food, energy and economic insecurity and a deteriorating conventional arms balance. These present opportunities for issue linkages, even a grand security bargain, but the negotiations will be daunting.

Pyongyang's chemical weapons arsenal is sufficient to cause huge civilian casualties in South Korea. The evidence of the arsenal seems irrefutable, but Pyongyang denies the existence of any chemical or biological weapons programs. North Korean media proclaim the DPRK is threatened by non-existent South Korean and U.S. chemical and biological weapons. This indoctrination extends to KPA soldiers in the form of CW defence training, even though Seoul signed the CWC and has destroyed its CW stocks.

The North Korean nuclear threat is the most urgent regional security issue, but if progress is made on rolling back Pyongyang's nuclear ambitions, there could be opportunities to construct a cooperative diplomatic solution for chemical weapons and the suspected biological weapons program. Serious diplomatic efforts must continue to address all North Korean WMD capabilities, but the international community must also be prepared for a number of other contingencies including a deliberate, accidental, or unauthorised chemi-

cal or biological attack or incident; chemical or biological retaliation following a military clash and escalation; and arms races.

Effective responses require planning and policy coordination among international agencies and national governments, but also NGOs. There are a number of international institutions for dealing with the complex and extensive North Korean WMD issue including the Six-Party Talks; the G-8 Global Partnership against the Spread of Weapons and Materials of Mass Destruction; the Chemical Weapons Convention; and the Biological and Toxin Weapons Convention. However, these mechanisms are not sufficient for addressing all issues, and new regional mechanisms focusing on other sources of insecurity will be necessary.

If North Korea credibly commits to abandon its nuclear program in the Six-Party Talks, diplomatic efforts should quickly move towards a multi-faceted approach to establish a WMD-free Korean Peninsula and a cooperative security mechanism for the region. Issue linkage addressing North Korean insecurities will be necessary to obtain Pyongyang's cooperation for WMD disarmament. Addressing the North's legitimate security concerns should not be viewed as appeasement as long as it is linked to progress in such WMD disarmament.

Every possible diplomatic effort must be made to achieve North Korean WMD disarmament, and diplomatic solutions will hopefully be available to establish a WMD-free Korean Peninsula. But as insurance against diplomacy failing, the international community must maintain robust deterrence and containment against the several North Korean threats.

Seoul/Brussels, 18 June 2009

APPENDIX A MAP OF NORTH KOREA



APPENDIX B

MAP OF NORTH KOREAN CHEMICAL WEAPONS (CW) SITES



APPENDIX C

GLOSSARY OF ABBREVIATIONS AND TERMS

ATACMS	Army Tactical Missile Systems.	MRL	Multiple rocket launcher.
BTWC	Biological and Toxin Weapons Convention, opened for signature in 1972 and entered into force in 1975. It prohibits the development, production and use of biological and toxin weapons.	NCDB	[North Korean] Nuclear and Chemical Defence Bureau, under the General Staff Department of the Ministry of the People's Armed Forces.
CBW	Chemical and biological weapons.	NDC	National Defence Commission, highest military authority in the DPRK, chaired by the SCKPA, at present Kim Jong-il.
CFC	Combined Forces Command, established in 1978 by the U.S. and South Korea to integrate their military forces under a U.S. four-star general and a ROK four-star deputy commander in time of war. Scheduled to be disbanded in April 2012.	NEMA	South Korean National Emergency Management Agency, established in 2004 to respond to natural disasters; its civil defence division is responsible for training.
CIA	(U.S.) Central Intelligence Agency.	NLL	Northern Limit Line, the west sea boundary extending from the MDL. It is not recognised by Pyongyang and has been the site of two deadly sea battles over the last decade.
CMC	Central Military Committee, under the (North) Korean Workers' Party Central Committee. The CWC is mostly inactive but would probably oversee the mobilisation of the North's reserves in time of war.	NPT	Treaty on the Non-proliferation of Nuclear Weapons.
CW	Chemical weapons.	OPCW	Organisation for the Prohibition of Chemical Weapons; secretariat of the CWC.
CWC	Chemical Weapons Convention, opened for signature in 1993 and entered into force in 1997. It bans the production and possession of chemical weapons.	PSI	Proliferation Security Initiative. U.S.-inspired and founded in 2003, it is aimed at interdicting WMD shipments before they reach countries of concern or terrorist groups.
DIA	(U.S.) Defense Intelligence Agency.	ROK	Republic of Korea.
DMZ	Demilitarised zone, the four-km wide buffer zone dividing the two Koreas, with two km on each side of the Military Demarcation Line (MDL)	SCKPA	Supreme Commander of the (North) Korean People's Army, at present Kim Jong-il.
DPRK	Democratic People's Republic Korea.	SEC	Second Economic Committee, under the CMC's munitions industry department and responsible for the procurement, production, import and export of weapons.
FROG	Free rocket over ground.	WMD	Weapons of mass destruction.
IAEA	International Atomic Energy Agency.		
KCNA	[North] Korean Central News Agency.		
KIC	Kaesŏng Industrial Complex, an inter-Korean joint economic project in North Korea five km north of the DMZ.		
KOMID	Korea Mining Development Corporation. Operated by the North's Second Economic Committee, it is under U.S. sanctions.		
KOSTI	Korea Strategic Trade Institute, a semi-private industry association delegated by the ROK government to work with the government and firms on export control compliance.		
KPA	[North] Korean People's Army.		
KSCIA	[South] Korea Specialty Chemical Industry Association, works with the OPCW in the ROK to implement inspections		
KWP	[North] Korean Workers' Party.		
MDL	Military Demarcation Line, divides the two Koreas and represents the line of contact when the Korean War Armistice was signed on 27 July 1953.		

APPENDIX D
DPRK CW AGENTS

Nerve Agents	Blister Agents	Blood Agents	Choking Agents	Riot Control, Vomiting Agents
Tabun (GA) Sarin (GB) Soman (GD) VX VE	Lewisite (HD) Mustard agent (L, H)	Hydrogen chloride (AC) Cyanogen chloride (CK)	Phosgene (CG) Diphosgene (DP)	Adamsite (DM) Vomiting agent (DA) Chloropicrin (PS) Tear gas (CN)s Tear gas (CS)

APPENDIX E

ARMS CONTROL AND EXPORT CONTROL REGIMES

Technology	International Regime	Monitoring Secretariat	Export Control Regime	Remarks
Nuclear	NPT	IAEA	NSG, Zangger Committee	–
Missile	MTCR / ICOC	–	MTCR / ICOC	No secretariat enforcement
Chemical	CWC	OPCW	Australia Group	–
Biological	BTWC	–	Australia Group	Weak enforcement
Conventional Arms	CCWC / Wassenaar Arrangement	–	Wassenaar Arrangement	–

APPENDIX F

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