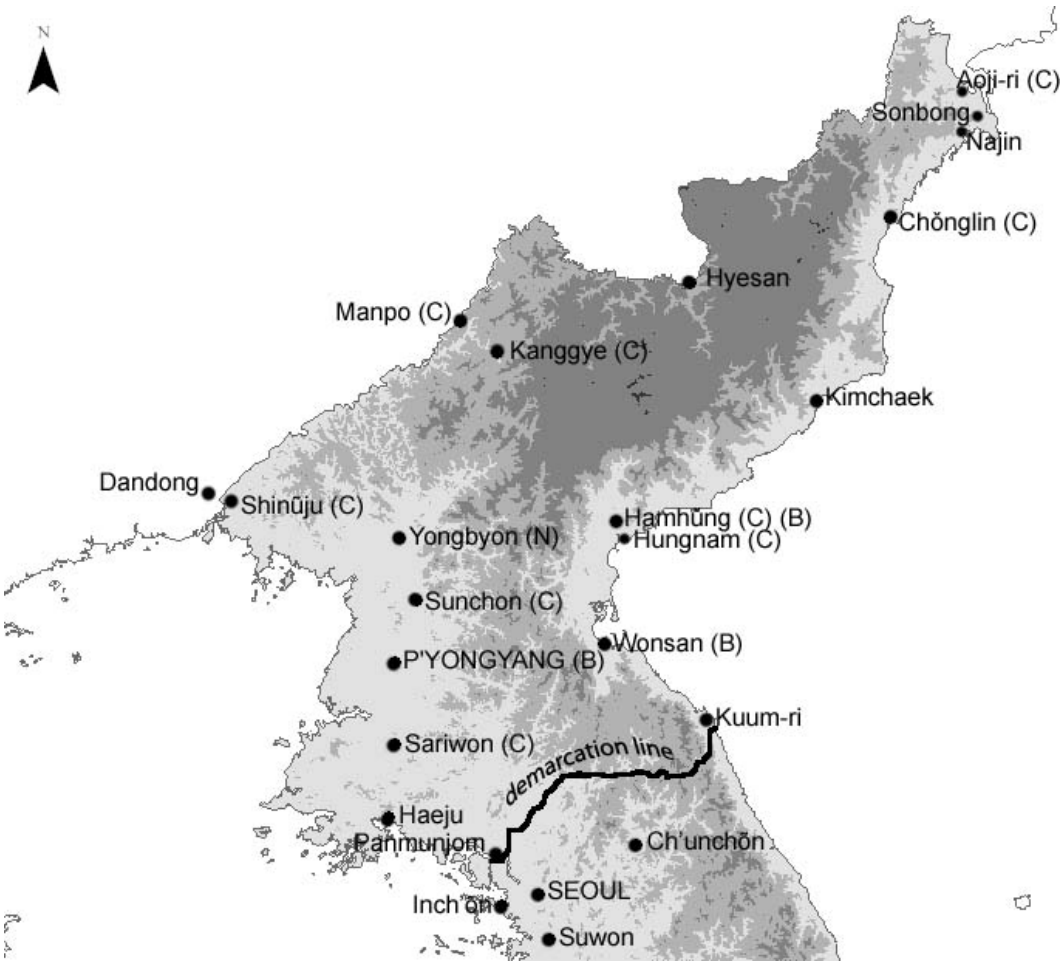
North Korea's Chemical and Biological Weapons Programmes in 2005: Real or Outdated Threats?

Louise Waldenström, Lena Norlander, Gertrud Puu



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North Korea's Chemical and Biological Weapons Programmes in 2005: Real or Outdated Threats?

Abstract

North Korea, as a member of the "Axis of Evil," has been labelled as a state of concern by the U.S. government due to their alleged possession of weapons of mass destruction (WMD). It is well known that North Korea holds advanced missile and nuclear technology, and is suspected to have, according to U.S. and South Korean sources, stockpiles of foremost chemical weapons. This report evaluates why and how North Korea's chemical and biological programmes developed, most likely for different purposes, and how their strategic importance seems to have decreased with the increasing difficulty in obtaining materials used for production and development related to control mechanisms. It also discusses chemical and biological weapons (CBW) lessened significance in regards to North Korea's military defence compared to the nuclear capability. In addition the report maintains the possibility that if Pyongyang would reassess the importance of CBW, it is most likely that North Korea still have stockpiles of chemical weapons for use, and the technology and knowledge to shift dual-use facilities for clandestine production, in both the chemical and biological fields.

Keywords

North Korea, Kim Jong-il, educational system, science and technology, critical indicators, chemical weapons, biological weapons

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Rapportens titel

Nordkoreas kemiska och biologiska vapenprogram: Ett verkligt eller föråldrat hot?

Sammanfattning

Nordkorea utpekades i januari 2002 av president Bush som en av ondskans axelmakter, dvs. en stat som stöder terrorism, bl.a. pga. landets påstådda innehav av massförstörelsevapen. Det är väl känt att Nordkorea är i besittning av avancerad missil och kärnenergiteknik och misstänks att ha, enligt amerikanska och sydkoreanska källor, lager av främst kemiska vapen. Denna rapport värderar varför och hur Nordkoreas kemiska och biologiska program har utvecklats, troligen av olika anledningar, och hur deras strategiska vikt verkar ha minskat med den ökande svårigheten att komma över material för produktion och utveckling pga. exportkontroll. Den diskuterar likaså hur kemiska och biologiska vapen har minskat i värde i Nordkoreas militära strategi, jämfört med kärnvapenkapaciteten. Rapporten hävdar att möjligheten finns att om Pyongyang skulle omvärdera vikten av kemiska och biologiska vapen är det stor sannolikhet att Nordkorea fortfarande har lager av användbara kemiska vapen, samt tekniken och kunskapen att skifta ”dual-use”-anläggningar till hemlig produktion, inom både det kemiska och det biologiska området.

Nyckelord

Nordkorea, Kim Jong-il, utbildningssystem, forskning och teknik, kritiska indikatorer, kemiska vapen, biologiska vapen

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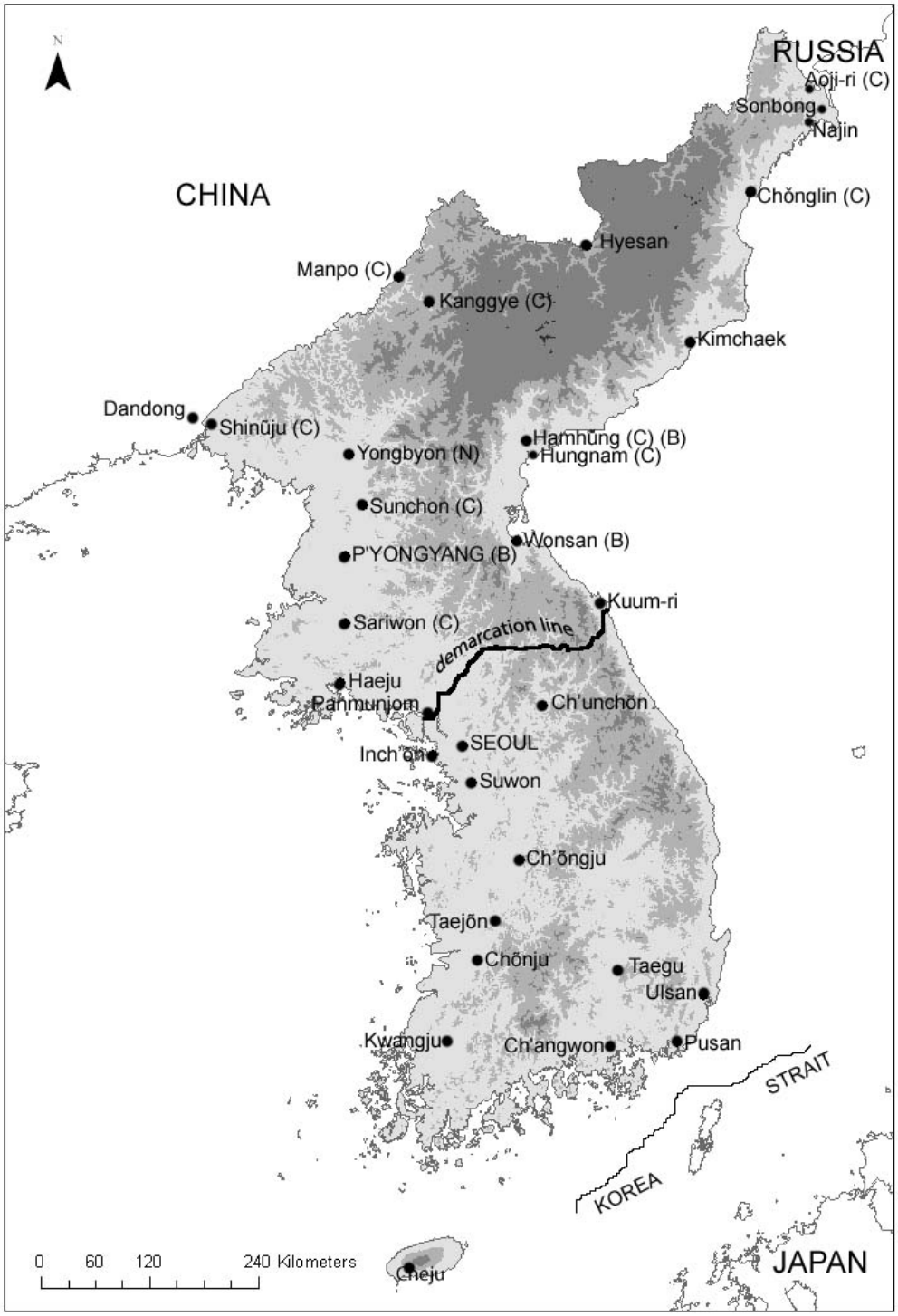

The letters in parentheses, (B) Biological facility, (C) Chemical facility, and (N) Nuclear facility, indicate cities with supposed biological, chemical or nuclear facilities/industry. Even though only one biological facility is indicated in Pyongyang it has to be clarified that there is a concentration of several biological facilities in the Pyongyang area.

1 Introduction

North Korea, as a member of the “Axis of Evil,” has been labelled as a state of concern by the U.S. government due their alleged possession of weapons of mass destruction. It is well known that North Korea holds advanced missile and nuclear technology, and is suspected to have, according to U.S. and South Korean sources, stockpiles of foremost chemical weapons. This report will look at what kind of threat North Korea’s suspected chemical and biological weapons (CBW) programmes actually poses, is it real or outdated? The investigation has been conducted by looking at different indicators in regard to North Korean chemical and biological capabilities, such as educational level, science and technology and motivations and incentives for CBW development. However, it is crucial to keep in mind that the material used in this report, due to an almost absolute lack of North Korean sources, is to a great extent based on international, foremost U.S. and South Korean, material, so a certain bias has to be taken into consideration.

The perceived threat from weapons of mass destruction in North Korea stems back to memories from the Korean War, and allegations of American use from Pyongyang, Moscow and Beijing. The interest in developing chemical and biological weapons began in the mid 1950’s, and continued at least to the end of the 1980’s or beginning of the 1990’s, while missile and nuclear development most likely remained. North Korea is a state where the military has always been of utmost importance, and at present the nation is ruled under a military-first policy. Thus the national priority has long been to maintain a strong conventional army. However, the North Korean military power lost its dominance over the combined U.S. and South Korean forces in the 1970’s, and therefore the Pyongyang leadership most likely implemented an asymmetric strategy in where chemical and biological weapons could be used to narrow the gap in regard to the conventional disadvantage.

However, in the altered international arena that developed after the end of the Cold War, international conventions such as the Biological and Toxin Weapons Convention (BTWC), the Chemical Weapons Convention (CWC) and other control mechanisms as the Geneva Protocol, the Australia Group (AG) and the Proliferation Security Initiative (PSI) have clearly made the incentives for biological and chemical weapons development less attractive, and primarily more difficult. In regard to the biological field, by signing of the BTWC, North Korea has committed itself not to develop, produce or use biological weapons. Concerning chemical weapons, North Korea signed the Geneva Protocol in 1989, in which prohibition is only limited to first use, and has so far declined to join the more comprehensive CWC.

This report will evaluate why and how North Korea’s chemical and biological programmes developed, most likely for different purposes, and how their strategic importance seems to have decreased with the increasing difficulty in obtaining materials used for production and development related to control mechanisms. It will also discuss chemical and biological weapons lessened significance in regards to North Korea’s military defence contrast nuclear capability. In addition the report maintains the possibility that if Pyongyang would reassess the importance of CBW, it is most likely that North Korea still have stockpiles of chemical weapons for use, and the technology and knowledge to shift dual-use facilities for clandestine production, in both the chemical and biological fields.

2 North Korea

The Korean nation dates back as far as to the year 918. In 1910 the Korean Peninsula was occupied by Japan and became a part of the Japanese Empire. The Korean population was forbidden to use their own language and had to take Japanese names. The occupation ended in 1945 after the Japanese surrender. In order to handle the capitulation of the Japanese troops, the U.S. and the Soviet Union decided to divide the peninsula into two parts along the 38th parallel. Soviet troops took charge of the northern half of the nation and American forces of the southern part. After refusal from the north, occupied by the Soviet Union, to hold joint UN elections, elections were only carried out in the south. As a result, two separate states, South and North Korea were declared independently in 1948.

Moscow chose Kim Il-sung as the leader of North Korea, much related to the time he had spent in the Soviet Union. In 1950 North Korea attacked South Korea in an attempt to unify the nation. The war ended with an armistice in 1953, after UN and Chinese intervention. The armistice is still valid since no peace agreement has been signed. The division at the 38th parallel remains, and is noticeable by the Demilitarized Zone (DMZ), which is 240 km long and 40 km wide. It is the most heavily guarded border in the world, with North Korea's positioning of almost one million men in the adjacent area.

Under his almost five decade long reign, Kim Il-sung founded and developed his own *Juche* ideology, which became prevalent in all spheres of North Korea in the 1960's. *Juche*, meaning self-reliance, has coloured North Korean actions in ideology, economics, political and foremost military matters until present day. When Kim Il-sung died in 1994, he was succeeded, after a four year long mourning period, by his oldest son Kim Jong-il in 1998. Kim Jong-il has made North Korea a more noticeable military state, and has implemented the guiding strategy *Kangsung Taeguk*[1], based on a military-first (*Songun*[2]) policy.

The elevated status of the military became apparent when Kim Jong-il made himself Chairman of the National Defence Commission, which is the highest office of the state. After the Bush Administration labelled North Korea a member of the "Axis of Evil," together with Iran and Iraq in 2002, Pyongyang's military emphasis has become more visible, closely connected to the deterioration of relations with Washington.[3] In 2003 North Korea withdrew from the Non-proliferation Treaty (NPT) and reactivated the Yongbyon reactor, which had been sealed since the signing of the Agreed Framework in 1994. In February 2005, North Korea declared that they are in possession of nuclear weapons to be used for deterrence and defensive purposes.

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1 A strong development and a powerful state ideologically, militarily and economically

2 Army-centered politics

3 For an in depth look at North Korea's relations with the U.S. from 1994 to 2004 from a North Korean perspective see Waldenström, Louise, *North Korea's Juche Ideology and its Implications on Pyongyang's Relations with Washington 1994-2004. A North Korean Perspective*, (FOI: Umeå, 2005) FOI-R-1578-SE

3 North Korea's Educational System

After the liberation from Japanese occupation in August 1945, the North Korean educational system, modelled on that of the Soviet Union, was established and aimed at making the North "the land of education." In 1946 illiteracy[4] was widespread and less than 20 % of the Korean population had gone beyond elementary school.[5] In 1949, as a means to improve the nation's literacy, Kim Il-sung decided to return to the original phonetic Korean alphabet. In 1950 primary education became compulsory, but was delayed until 1956 due to the outbreak of the Korean War. In 1958 North Korea implemented a seven-year compulsory primary and secondary education; in 1967 it was extended to nine years, and in 1975 to eleven years.[6]

The North Korean educational system has undergone several changes since its implementation until today. These alterations can be divided into six different stages: 1) Introduction of socialist education and founding era for compulsory elementary school education (1945-1950); 2) Rehabilitation after the Korean War and the era of compulsory elementary education (1950-1958); 3) Emphasis on technical education and compulsory middle school education (1958-1967); 4) An era of practicing nine years of compulsory technical education and establishment of the *Yu-ll* (the only one) ideology (1966-1972); 5) An era of a total of eleven years[7] compulsory education (1972-1985); and 6) Popularization of higher education (after 1985),[8] which includes changing trends such as; the reinforcement of political ideology, emphasis on science and technology, stress on computers and foreign languages, the introduction of optional courses, the cultivation of higher education, and the growth of education for adults.[9]

According to the 1998 revised *Kimilsung* Constitution:

> The state shall give precedence to public education and the training of cadres for the nation and combine general education with technical education, and education with productive labour.
>
> The state shall develop universal compulsory 11-year education which includes a compulsory one-year preschool education at a high level in accordance with the trend of modern science and technology and the practical requirements of social construction.

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4 According to North Korean sources most adults, around 2.3 million, were illiterate at the time of liberation.

5 Hunter, Helen-Louise, *Kim Il-song's North Korea.* (Westport: Praeger Publishers, 1999) 207

6 *North Korea a country study,* Library of Congress, (Washington: U.S. Government Printing Office, 1994) 92

7 One year of kindergarten (age 5 to 6), four years of primary school (people's school) (age 6 to 10), six years of secondary school (age 10 to 16)

8 Min, Moosuk & Ahn, Jehee, *A Study of Education for Women in North Korea.* Women's Studies Forum, Vol.18, 2001. 3-5

9 Cho, Myung-chul, *Realities of the North Korea's Education of the Market Economy and Measures for Cooperation*,URL<http://gkc.kdischool.ac.kr/inter_korean/papers/download.asp?pr_file=Education%20of%20Market%20Economy.pdf.>

11 *DPRK's Socialist Constitution (Full Text) September* 17, 1998. URL <http://210.145.168.243/pk/061st_issue/98091708.htm>

> The state shall train competent technicians and experts by enhancing the regular educational system as well as different form of study while working, and by improving the scientific and theoretical levels of technical education and education on social science and basic science. [11]

An important component of the North Korean educational system is the emphasis on technical education in order to re-establish the economy, foremost after the Korean War. In the North one can state that the word "intellectual" is interchangeable with "technician," and "their concept of an intellectual is a highly skilled technician."[12]

While technical education has been emphasized since the foundation of the state, ideological education became prevalent from the mid 1960's. The goal of the North Korean educational system is not to search for truth, but to teach the student to obey *Juche* ideology. Kim Jong-il stated that ideological education must be more emphasized in the nation's schools than academic education. He called for the intensification of mandatory ideological study and discussion sessions for adult workers. Kim Jong-il also instructed that North Korea "must put screens around us in order to prevent any pagan ideologies other than *Juche* from infiltrating into our society"[13] and after the fall of the Soviet bloc, subjects concerning the history of the former Eastern Europe nations and the Soviet Union were deleted from senior high school textbooks.[14]

The North Korean educational system consists of an eleven year compulsory system, higher education, special education and adult education. In addition, "since 1980 North Korea has fostered first advanced middle schools and science and engineering colleges for the development of science and technology at intermediate and advanced levels."[15] By implementing a junior high school course at the first advanced middle schools, the Pyongyang leadership has been able to foster an early selection of technicians and scientists.[16] The higher education includes colleges, universities, specialized senior schools and special colleges. The most prestigious university in North Korea is the *Kim Il Sung* University, and it is the only institution in the nation that offers Bachelor's, Master's and Doctoral degrees in various majors.

Special education is reserved for children of the power elite and for gifted students[17] in order to foster foremost scientists and technological experts, but also linguists. The schools for gifted students were scarce until the 1990's when they increased due to Kim Jong-il's

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12 Hunter, Helen-Louise, *Kim Il-song's North Korea*. 207

13 Choi, Eun-soo, *North Korea's Educational Policy*. December 1996, URL <http://www.fortunecity.com/meltingpot/champion/65/dprk_edu.htm>

14 Ibid.

15 Cho, Myung-chul, *Realities of the North Korea's Education of the Market Economy and Measures for Cooperation*,URL<http://gkc.kdischool.ac.kr/inter_korean/papers/download.asp?pr_file=Education%20of%20Market%20Economy.pdf.>

16 Ibid.

17 North Korea has instituted a system of selecting outstanding students from general and advanced middle schools and promoting special schools. From the early 1990's, each advanced middle school formed special classes with outstanding students that focused on mathematics, foreign languages, physics and chemistry. From 2001, under the direction of Kim Jong-il, the first advanced middle schools of Pyongyang and each province started to operate a special class for the brightest students in mathematics and biology. Cho, Myung-chul, *Realities of the North Korea's Education of the Market Economy and Measures for Cooperation*, URL<http://gkc.kdischool.ac.kr/inter_korean/papers/download.asp?pr_file=Education%20of%20Market%20Economy.pdf.>

1980's implementation of a system for early selection and systematic education of brilliant students.[18] Schools for gifted students receive up to date educational material and computers. Adult education was established in order to educate its working population, and it includes factory, farm and fishery colleges in where the workers are taught new skills and techniques, or to become engineers. In line with the expansion of the educational system the number of schools and universities has increased accordingly. Elementary schools – increased from 1,472 schools in 1945 to 4,810 in 1999; middle and high school – increased from 50 schools in 1945 to 4,840 in 1999; and universities – increased from 6 schools in 1945 to 280 in 1999.[19]

The focus on technical education can be detected in the amount of colleges and universities that seem specialized within that certain field such as; *Kimchaek* University of Technology, which is the highest ranked college of science and technology. Korea National Defence College, which "provides instruction on the production, operation procedures and launching of missiles;"[20] the *Hamhung* University of Chemical Industry, founded in 1947, was North Korea's first higher educational institute in the field of science and technology, and it is used as a training ground for chemists and engineers. The National Defence College Nuclear Engineering Department has been linked to the training of military specialist, but is unconfirmed.[21] North Korea's top scientists are trained at *Pyongsong* College of Science, and after graduation many of them are placed at *Yongbyon* Nuclear Research Centre or at the nuclear facilities at *Packch'on-kun.*[22] The Physics College is an educational facility for the training of technicians that will operate nuclear reactors, reprocessing facilities and fuel fabrication plants. Additionally, many of the nuclear engineers with Doctoral degrees are trained as post graduate fellows or research associates in a variety of former eastern block institutions, such as the *Dubna* Institute in the former Soviet Union.[23]

North Korea also has several colleges with special emphasis as for example: *Chongjin* Mining and Metallurgy College, *Wonsan* Agricultural College, *Shinuiju* Light Industry College, *Sariwon* College of *Koryo* Pharmacy and *Hamhung* Hydrographical and Power College. In addition there are several colleges with unique nature and curricula such as the *Yalu* River College, which "trains espionage agents sent to the South,"[24] Pyongyang College of Technology, also referred to as the State Security Agency Political College that "produces prospective leaders of the intelligence agency." [25] The Automation College was

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18 Ibid.

19 Min, Moosuk & Ahn, Jehee, *A Study of Education for Women in North Korea.* 3,6

20 *North Korea Profile: Nuclear, Biological and Chemical.* February 2005, URL <http://www.nti.org/e_research/profiles/NK/index_38.html >

21 Ibid.

22 Ibid.

23 Song, Yo-taik, *Collaboration Between North and South Korea on Nuclear Energy for Peaceful Purposes,* Technology Centre for Nuclear Control (KAERI) and Centre for Unification Data and Resources (KINU).

24 *Central Regional Colleges and Universities.* NKchosun.com, May 23, 2002. URL <http:/nk.chosun.com/English/news/news.html?ACT=detail&linkv=10&res_id=6226>

25 Ibid.

established “for the purpose of turning out manpower needed for waging electronic information warfare.”[26]

Even though ideological and technical education is considered the core of the North Korean educational system, the importance of linguistics has increased, especially after the fall of the Soviet bloc. Additionally “the pressing need to know foreign languages and to learn foreign technology led Kim Jong-il to stress the teaching of foreign languages at all levels.”[27] Before 1978 Russian was the mandatory second language taught in North Korean schools, but after 1978 both Russian and English became compulsory and intense efforts were put on foreign linguistics. North Korean students were sent to foreign language institutes in Iraq, Yugoslavia, Japan and Guyana.[28] With the disintegration of the Soviet Union, English replaced Russian as the first foreign language, with Chinese and Japanese increasing in importance as second foreign languages. In universities and colleges English is mandatory (three to four hours a week), while Russian, Chinese, German, French and Japanese are optional (two hours a week).[29] One can detect the importance of English education in the North Korean system, especially after Kim Jong-il asked the U.S. Secretary of State Madeline Albright to send native speakers to the North in October 2000.[33] Thus in order for North Korea to keep its educational focus on enhancing modern science and technology, knowledge of foreign languages, foremost English, are crucial tools in attaining this goal.

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26 Ibid.

27 Hunter, Helen-Louise, *Kim Il-song’s North Korea.* 212

28 Ibid.

29 Cho, Myung-chul, *Realities of the North Korea’s Education of the Market Economy and Measures for Cooperation*,URL<http://gkc.kdischool.ac.kr/inter_korean/papers/download.asp?pr_file=Education%20of%20Market%20Economy.pdf.>

33 Fouser, Robert J. *English Education in North Korea: A Peak into the Unknown.* URL <http://yuldo.net/asian-eng/abstracts/seminar-23-fouser.pdf >

4 Science and Technology

In regard to North Korea's emphasis on science and technology, the 1998 *Kimilsung* Constitution states the following:

> The state shall establish *Juche* in scientific research, introduce advanced science and technology in every possible way, open up new areas of science and technology and raise the country's science and technology to the world level.
>
> The State shall draw up a proper plan for scientific research work; consolidate creative cooperation between scientists, specialists and producer masses.[34]

Since the late 1950's, North Korea's research focus in relation to science and technology, has been linked to problems concerning production technology. Until the 1990's most research within science and technology was focused on the national infrastructure, and the development of advanced science and technology was negligible. [35] However, after the official succession of Kim Jong-il in 1998, North Korea "shifted from its long-held policy orientation toward production technology and is now seeking a balance between technological support for production and research into advanced technology."[36] This can be detected in the economic development plans implemented for the enhancement of the science and technology sector. The first five-year plan for science and technology development (1998-2002) had three main concentrations: rebuilding the national economy through technology, improving public welfare, and developing basic and advanced sciences. The second plan was implemented in 2003 and will run through 2007, with an emphasis on "electronic engineering, bioengineering, thermal engineering, and development of new materials."[37] The plan consists of three main areas: seventeen initiatives related to the national economy, five initiatives in advanced technology[38], and other miscellaneous initiatives, i.e. public welfare. The budget for the current five-year plan is estimated to approximately 70-100 million euros, about 15-20 million euros/year. [39]

The increased focus on science and technology can be noticed in the Joint New Year's editorials published by the North Korean leadership. The editorial is a way for the leadership to present the strategy proposed for the coming year, and contains slogans implemented for the cause of making North Korea a strong and prosperous state. In 2000 the first signs could be noticed in the importance put on the improvement of the nation's science and technology sector. It stated:

> We should step up the general march this year, firmly maintaining the line of giving great importance to ideology, arms and science and technology. Ideology, arms and science and technology are the three main pillars for the building of a powerful nation…

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34 *DPRK's Socialist Constitution (Full Text) September* 17, 1998. URL < http:// 210.145.168.243/pk/061st_issue/98091708.htm>

35 *North Korea Development Report 2003/2004*. Korea Institute for International Economic Policy (KIIEP), Seoul, South Korea. 267

36 Ibid. 267

37 Ibid. 267

38 The initiatives for basic and advanced science are IT, bioengineering, new energy, new materials and marine/aerospace science.

39 *North Korea Development Report 2003/2004,* 275

> The idea of attaching great importance to science should be held fast to.
>
> It is the fixed stand of the WPK to construct socialism in reliance upon science.
>
> We should put the *Juche* based science and technology on the world's level in the shortest possible time and settle urgent scientific and technological problems in the building of a powerful nation.[40]

In 2004 the focus was heightened after the implementation of the second plan.

> It is necessary to make a leaping advance on the front of economy and science. …"Let's make rapid progress in the economy and science and technology and thus increase the national power in every way!"
>
> The economy and science and technology in the *Songun* [military-first] era should be as modern and viable as to materially and technologically guarantee the overall national power with the military muscle as the core and enable the people to live as well as others.
>
> We must put all fields of science and technology in the country on the world's advanced level as early as possible with preserving will and patriotic enthusiasm…[41]

In North Korea science and technology is overseen by the Academy of Sciences, which was established in 1948. In 1994 its function was strengthened when it was integrated with ministry affiliated research institutes and renamed the National Academy of Sciences. In 1998 it was merged with the National Science and Technological Committee. In 2001, another major restructuring was carried out concerning research institutes affiliated with the National Academy of Sciences.[42] In addition, the former chairman of the Academy of Sciences became Kim Jong-il's director of Science of Education, which "is expected to further strengthen the role of the National Academy of Sciences in North Korean R&D efforts."[43] Institutes that are under the direction of the National Academy of Sciences include: Industrial Microbiology Institute, Institute of Chemistry, *Hamhung* Branch, Institute of Chemistry, *Kanggye* Branch, Institute of Chemistry, *Shinuiju* Branch, and the *Pyongsong* College of Science.

In order to improve the nation's standard of science and technology, the North Korean leadership understands the urgent need of international cooperation, and "North Korea is increasingly expanding opportunities for its home-grown experts to study abroad to become familiar with the latest scientific and technological developments."[44] As previously stated, the importance of English education has increased in order to comprehend foreign journals, and what is being said at international conferences on related subjects. After the fall of the Communist bloc, North Koreans studying science and technology abroad diminished, but the numbers have increased since 1998. "Twenty years ago [i.e.in 1979] North Korean

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40 *Joint New Year editorial published,* January 1, 2004, URL <www.kcna.co.jp/item/2000/200001/news01/01.htm>

41 Ibid.

42 Under the restructuring initiative 42 research institutes in the Eunjung District in Pyongyang under the direct control of the National Academy of Sciences and 11 research institutes under the branch of the Academy of Electronics and Automation were incorporated into the Eunjung Branch of the Academy of Sciences. In addition were 20 research institutes either closed or absorbed.

43 *North Korea Development Report 2003/2004,* 270-271

44 *North Korea's Adoption of the Latest Science and Technology This Year,* December 14, 2004. Ministry of Unification, Seoul, South Korea URL <www.unikorea.go.kr/en/northkorea>

scientists and professors were excellent because they studied in the USSR, East Germany and Romania."[45] These nations were also the ones with who North Korea had the most scientific collaborations. This can be detected in papers published in international journals by North Korean scientists, 36 papers with North Korean authors since 1981, where 16 were written in the 1990's.[46] In North Korea there are around ten to twelve journals that could be considered scholarly. "The journals are in the fields of chemistry, physics, geography and the other natural sciences, linguistics, history and archaeology."[47] Very few of these periodicals are available outside North Korea, and none in translation. Thus "the worldwide familiarity with North Korean academic studies must be considered virtually nil."[48]

However, since 2000, North Korea has been making attempts to initiate collaboration with Korean scientists and engineers living abroad, in foremost China, Japan, the U.S., and is expanding the cooperation in regard to science and technology with South Korea.[49] Pyongyang is also expanding exchange programmes for engineers and scientists with foreign nations. In addition, North Korea sends about 300 students per year to China, and has recently (2003/2004) resumed its exchange programme with Russia, which had been suspended since the fall of the Soviet Union. The collaboration with former Communist nations in Eastern Europe has also been re-established.[50] North Korea is also collaborating with developing nations and has "begun collecting relevant information by dispatching science and technology attachés to several developing countries."[51]

The defence industry in North Korea is probably the most important in regard to science and technology, i.e. missile and nuclear development, and it is also the most secretive. However, it is apparent that the North has an advanced nuclear research programme since the leadership has announced that it possesses nuclear weapons. Research related to the defence industry is most likely dependent of foreign assistance, as with Syria in regard to ballistic missiles, and with China, Iran, and Pakistan concerning nuclear activities. Additionally, on September 1, 2004, Syria and North Korea signed the "North Korea-Syria Agreement on Cooperation in Trade, Science and Technology," and in October 2004 North Korea and China signed an agreement on cooperation in marine science and technologies. The North's special interest in China's development regarding science and technology can be detected in the visits that Kim Jong-il made in May 2000 and January 2001. Russia is also a state that has been implicated regarding the transfer of science and technology to North Korea, and on June 20, 2004 "Russia and North Korea entered into 2005-2007 North Korea-Russia cooperation on technological cooperation." [52] In August the same year a Russian delegation also visited the *Kimcheak* Institute of Technology. At the 4th Pyongyang

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45 Baker, Michael. *North Korea: Joint Projects Allow a Peak Into an Impoverished System*, September 10, 1999. Science Magazine URL <www.sciencemag.org/cgi/content/full/285/5434/1637>

46 Ibid.

47 Hunter, Helen-Louise, *Kim Il-song's North Korea*, 217

48 Ibid.

49 *North Korea's Adoption of the Latest Science and Technology This Year*, URL <www.unikorea.go.kr/en/northkorea>

50 *North Korea Development Report 2003/2004*, 277

51 Ibid. 278

52 *North Korea's Adoption of the Latest Science and Technology This Year*, URL <www.unikorea.go.kr/en/northkorea>

International Science and Technology Book Fair, a Russian delegate expressed "belief that the DPRK would proudly rank among the scientific and technological powers, [and that] the Russians would make a noticeable contribution to boosting scientific and technological exchange and cooperation"[53] with the North.

Even though North Korea has put an emphasis on the development of science and technology since the inauguration of the Kim Jong-il leadership, the research capability is still low compared to Western standards. Since the main focus has been on production technology since the foundation of the state, basic and advanced science has been neglected up until 1998. Thus North Korean research institutes lack capability to develop advanced technologies, and the lack of fuel and energy also influence the rate of progress. North Korea is in desperate need of R&D investment and international collaboration in order to move forward in the field of science and technology. However, the chemical industry seem to possess a considerable level of research capability as it serves as the backbone of North Korea's light industry. This can also be detected in the numbers of chemical research institutes.

53 *Russian Figure on Optimistic Prospect of DPRK's Science and Technology*, September 17, 2004. URL <www.kcna.co.jp/item/2004/200409/news09/18.htm>

5 Chemical and Biological Weapons: Classification and Characteristics

The concept "Weapons of Mass Destruction" was coined as early as in 1937, to describe massive aerial bombardment with conventional bombs. Since then, the meaning of the phrase has changed several times. For example, missiles were for some time included in different compilations of WMD. Today, and in this report, we restrict WMD to three categories: *nuclear (including radiological) weapons, biological weapons and chemical weapons.* WMD are designed to kill or harm large numbers of people, indiscriminately. Some types of WMD can have more of a psychological effect than be of any greater military value in an armed conflict.[54]

It is common, and in many contexts very confusing, to put biological and chemical together into one category, BC weapons. It can be even worse – which we have seen several times in articles concerning North Korea - when the acronym is interpreted as "biochemical". There is, by definition in for example convention texts, no such type of weapon.

Biological and chemical weapons have some properties in common. One – shared also by radiological weapons - is that the weapon effect takes place after the agent has entered into the human body, by inhalation, ingestion, drinking or via the skin or eyes.

Some general properties for each category are:

Biological	**Chemical**
Bacteria, virus	Chemical
Living organisms	Molecules
Can reproduce	Can not reproduce
Natural origin – exist in nature	Synthetic – must be made by humans
Always solid – not volatile	Generally volatile
Dissemination as solid aerosol; dry or in a wet preparation	As liquid aerosol or gas

Examples of biological warfare agents are bacteria such as *Bacillus anthracis* (anthrax), *Yersinia pestis* (plague) and *Francisella tularensis* (tularaemia). Some viruses such as Encephalitis virus (encephalitis), hemorrhagic virus (hemorrhagic fever) and *Variola* virus (smallpox) are also regarded as potential warfare agents.

Examples of chemical warfare agents are nerve agents, which represent the most advanced group. It includes agents such as sarin, tabun, soman, and VX.

[54] A good discussion, and many cross references, can be found at URL <http://encyclopedia.lockergnome.com/s/b/Weapons_of_mass_destruction>

Mustard gas is another example, which was made and used already during World War I. It is rather simple to produce, compared to the nerve agents. Phosgene is a chemical with industrial applications, which also was used as a chemical warfare agent during World War I.

6 Chemical and Biological Weapons: Historical Context

The development of chemical and biological weapons programmes in North Korea began in the aftermath of the Korean War. Biological and chemical experiments in regard to warfare were not new to the North Korean leadership, since the atrocities committed by the Japanese occupational forces were still prevalent. The chemical weapons (CW) programme was implemented earlier than the biological, with the assistance of foremost the Soviet Union. In 1953, shortly after the signing of the Korean War armistice, North Korea established a chemical department within its armed forces (the Korean People's Army, KPA). The underlying reason was "that in a future war, chemical and biological weapons would play a pivotal role in mitigating the UN's conventional power, a priceless lesson from their defeat in the Korean War."[55]

After the Korean War, North Korea was heavily dependent on Soviet military assistance and aid to rebuild the nation, and the same dependence can be linked to its focus on CW development and its implementation into the North Korean military strategy. In the 1950's KPA's training and purchases of protective equipment was for that reason done in close cooperation with the Soviet Union. North Korea also received chemical agents from Moscow in order to begin their own indigenous research. It is apparent that "the 1950's was the period when almost all the requirements for chemical (biological) warfare were introduced from the Soviet Union."[56] However, in the 1960's North Korea, under the leadership of Kim Il-sung, began to develop a programme based on their own model, which became evident with Kim's declaration of the *chemicalization* of North Korea's military strategy.

The declaration was fourfold and included: "(a) the strengthening of chemical warfare knowledge, (b) taking countermeasures for the possible U.S. chemical attack, (c) the need to provide the front areas with chemical defence facilities, and (d) the mass production of protective gear and equipment so as to have them distributed among the North Korean people."[57] The result of the declaration was that North Korea, in the 1960's, initiated a development of national resources for the production of chemical weapons. In 1979 it had attained defensive capacity. In the 1980's North Korea implemented an offensive chemical and biological warfare strategy, and the offensive posturing could be noticed in a speech Kim Il-sung made to the Party's Military Committee in 1980.

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55 Ahn, S.W., *Analysis and Countermeasure: North Korea's chemical/biological warfare capability,* Research Report, National Defence University, Seoul, 1988, quoted in *North Korea's Weapons of Mass Destruction: Problems and Prospects,* Ed. Kim, Kyoung-soo, (New Jersey: Hollym International Cooperation, 2004) 81

56 Lee, Y.C., *North Korea's chemical weapons' threat and our countermeasures,* Research Report, National Defence University, Seoul, 1986, quoted in *North Korea's Weapons of Mass Destruction: Problems and Prospects,* 82

57 Shin, S.T., "Threats Underlying North Korea's Weapons of Mass Destruction," *East Asian Review,* Vol.10, No.3 (Autumn 1998), 68-69,quoted in *North Korea's Weapons of Mass Destruction: Problems and Prospects,* 82-83

> The Academy of Defence Science has recently reported to me that we succeeded in producing poisonous gas and bacterial weapons through our own efforts supported by the Soviet scientists in this field. Our Ministry of People's Armed Forces had a group of Special Operations Forces test those new products in the Middle East combat field. The result of the field test was that enemy soldiers suffered from losing their eye sights, respiratory diseases, burning skins and mental aberrations, instead of deaths directly occurring from the weapons' use. Under the circumstances two or three enemy soldiers should be falling behind as to take care of one injured fellow soldier. Therefore, it is much more effective to blind enemy soldiers or to make them insane rather than simply kill them in the battlefield. This successful production of chemical weapons is really a great achievement done by the Academy of Defence Science.[58]

By the end of the decade, in 1989, North Korea supposedly reached chemical offensive capability.

In regard to the development of the biological weapons (BW) programme, it seems to have been implemented at the time when North Korea began to develop their own model of CW, in the 1960's. It is clear that even though biological weapons were part of North Korean military strategy, they received less attention and funds than the prioritized chemical and nuclear programmes. Another difference is that, as previously stated, the Soviet Union assisted North Korea with the CW programme, but on the biological side it is uncertain if any assistance was given due to the secrecy of the ongoing Soviet programme. Reports stating assistance from China have to be taken lightly since there seems to be little evidence of an existing offensive Chinese BW programme at this time. The fact that China at present day maintains that it has never had an offensive biological programme also has to be taken into consideration. However, even though China might not have been directly involved in the development of North Korea's offensive BW programme, it can not be excluded that Beijing aided Pyongyang with supplies of germs, bacteria and viruses.

In the 1960's the Central Bacterial Weapons Institute was established, connected to the Academy of Defence Science, where research was conducted on venomous toxin, extracted from the Vietnamese cobra, which North Korea had received from China. In 1968 the biological research intensified and "venomous insects, and various germs and bacteria of contagious diseases such as anthrax, pest, cholera" was brought into North Korea, most likely from China, in order to engage in full-scale research.[59] In addition, since 1975 North Korea has sent around ten microbiologists per year to China for training in the field of vaccine research. By the mid-1980's it is assumed that a basic infrastructure in regards of research and development within BW had been established. The lesser attention given to the BW programme is most likely related to North Korea's limitations within the field of biotechnology. In addition, the fact that the usage of such weapons could easily backfire on North Korean forces due to the difficulty in keeping control of the weapon once deployed, and the technological challenges related to effective delivery by using warheads, are also crucial to take into account.[60]

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58 Lee, Y.C., *North Korea's chemical weapons' threat and our countermeasures,* Research Report, National Defence University, Seoul, 1986, quoted in *North Korea's Weapons of Mass Destruction: Problems and Prospects,* 83-84

59 Kim, Kyong-soo, "North Korea's Chemical and Biological Weapons' Threat" in *North Korea's Weapons of Mass Destruction: Problems and Prospects,* 84

60 Ibid. 85

7 Motivations and Incentives for Chemical and Biological Weapons

When looking at North Korea's chemical and biological weapons programmes it is crucial to comprehend the motivation and incentives behind the pursuit of these programmes. One can state that there are two main factors that influenced North Korea's motivation and incentives in regard to chemical and biological weapons (CBW), first the military dimension, and secondly the political aspect. As previously stated, the chemical programme was prioritised over the biological, and was implemented after the end of the Korean War. The Korean War was crucial for the North Korean perception of the importance of the military, deterrence and offensive power. In order to distinguish the motivation for CBW one has to look at North Korea's military strategy, national security policy, and the international political developments that have occurred since the 1950's in order to detect how CBW became important incentives in complementation to conventional military power.

The Military Dimension

After the division of the Korean Peninsula, the North Korean military strategy was based on those of the Soviet Union and China. During the decades the strategy has been mixed with other components, such as anti-Japanese sentiments, lessons learned from the Korean War, and *Juche* ideology. The national security policy found in North Korea today is based on two main principles (1) the survival of the nation and its leadership; and (2) reunification of the fatherland under the DPRK's control.[61] In 1962 Kim Il-sung implemented a national military policy referred to as the *Four Military Lines*, which still is the foundation for both the North Korean state and the armed forces. The *Four Military Lines* calls for "the arming of the whole people, the fortification of the entire country, the training of all soldiers as a cadre force, and the modernisation of arms."[62] In 1966, when the development of national resources for the production of chemical weapons was well on its way, Kim urged the importance of adapting modern technology and weapons to North Korean realities.

> …We must strongly fortify the KPA with modern weapons and combat material. We must employ all means to modernize the weapons and make them more powerful based on the successes of ultra-modern science and technology…We must develop and introduce military science and technology in accordance with the reality of our country and correctly incorporate old style weapons along with modern weapons [i.e. chemical and biological].[63]

By the 1970's North Korea had its indigenous chemical weapons programme up and running, and research was developing in the biological field. The motivation behind foremost chemical weapons in North Korean military strategy is that they will be used as a complement to conventional military power; "to demoralize defending forces, reduce their

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61 Bermudez, Joseph S., *The Armed Forces of North Korea*, (London: I.B. Tauris Publishers, 2001) 9

62 Institute of Internal and External Affairs, *Inside North Korea: Three Decades of Duplicity*, Seoul, July 1975, quoted in Bermudez, Joseph S., *The Armed Forces of North Korea*, (London: I.B. Tauris Publishers, 2001) 9

63 Welles, Benjamin, "North Korean Militancy Linked to 1966 Meeting," *New York Times*, 1 February, 1968, 15, cited in Bermudez, Joseph S., *The Armed Forces of North Korea*, 10

effectiveness, and deny use of mobilisation centres, storage areas, and military bases without physically destroying facilities and equipment." [64] The North, influenced by the Soviet military doctrine, early viewed CBW as integral parts in a military offence, but also as deterrence measures.[65] Another motivation behind North Korea's CBW is the asymmetric strategy in where these weapons can be used to compensate and balance the inferiority in regard to the combined numbers of weapons and firepower inhabited by South Korean and U.S. forces.[66]

Kim Il-sung warned that; a "state that has not its own defence power to protect its sovereignty against the internal and external enemies is, in fact, not a fully independent and sovereign state." [67] He called for the armament of the entire nation, putting all its citizens under arms, and emphasised the importance of a purely North Korean defence industry with modern weapons.

Since the end of the Cold War, international events have most certainly had an impact on North Korea's military and asymmetric strategies. The fall of the Soviet Union and normalisation of diplomatic relations between both Russia and China with South Korea, have made North Korea a state in augmented isolation. The death of Kim Il-sung in 1994, and the official succession of Kim Jong-il in 1998, have made North Korea a state in which the military has gained a superior position and increased its political power, especially after the elevation of the National Defence Commission as the nation's highest state body. Kim Il-sung believed that military power was the basis of all power, and Kim Jong-il has officially stated that his power derives from the military. Today North Korea has the fifth largest military force in the world, including CB (N) W capability, with a military manpower availability of 6.1 million.[68] In sum, to North Korea the motivation and incentives behind CBW might be related to the belief that foremost chemical, but to some extent also biological weapons would balance the inferiority of North Korea's conventional weapons vis-à-vis South Korea and the U.S.. Additionally, possession of WMD capability in itself also tends to enhance the nation's prestige among other states in the same international deterrent position as North Korea has found itself.

The Political Aspect

The value of chemical and biological weapons has been learnt from the North Korean certainty of U.S. usage of biological warfare in the Korean War (1950-53), the Iran-Iraq War (1980-88) and the U.S. invasion of Iraq in 2003. In the Korean War, U.S. forces were accused of having used foremost biological weapons, but also to some extent chemical agents against North Korea. These allegations have not been proven, but to Kim Il-sung they were real, and they made him well aware of the power and military advantages linked to such weapons. In 1980, the North Korean leader outlined the importance of CBW; "Today is an era of science, accordingly war should be waged in a scientific way…That is

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64 *North Korea Country Handbook,* Marine Corps Intelligence Activity, U.S. Department of Defence, May 1997.

65 Kim, Kyong-soo, "North Korea's Chemical and Biological Weapons' Threat" in *North Korea's Weapons of Mass Destruction: Problems and Prospects,* 115

66 Ibid. 118

67 Kim, Il-sung, *On Some Problems of our Party's Juche Idea and the Government of the Republic's Internal and External Policies* (Pyongyang: Foreign Languages Publishing House, 1972), 9.

68 *The CIA World Fact Book*, URL <http://www.cia.gov/cia/publications/factbook/geos/kn.html>

the reason why we need to produce CB weapons as many as possible."[69] It is also highly likely that the usage of chemical weapons in the Iran-Iraq War, and the lack of international reaction, made North Korea continue the development of its CW programme. Moreover, at that time there was no convention forbidding the development of CW. However, the BW programme was presumably reduced after the signing of BTWC in 1987. By then North Korea might have succeeded in developing a few biological agents for offensive use, but BW use was less attractive under the prevailing circumstances.

North Korea was allied with Iran during the Iran-Iraq war, and supplied SCUD missiles to Teheran. Thus the North Korean military was closely involved in wartime developments, and became well aware of that the chemical warfare conducted by Iraq came to be a decisive factor in forcing Iran to agree to a truce. It is highly likely that the lessons learned from this war reinforced the belief that "the role of chemical weapons in counterbalancing the enemy's conventional arms superiority"[70] is crucial, and the need for C(B)W in asymmetric strategy is vital. The U.S. invasion of Iraq in 2003 was also an event that might have influenced North Korean incentives for continued development and emphasis of CW. Even though international inspectors did not find any evidence of newly produced Iraqi WMD, the U.S. decided to invade Iraq and remove Saddam Hussein from power. The U.S. operation most certainly showed the North Korean leadership that Washington could not be trusted in its promises of not interfering in internal affairs, something that is closely linked to the ongoing nuclear dispute between the two states. The fate of Iraq and its leader Saddam Hussein is a scenario that North Korea will fight to the end in order to avoid, with WMD as leverage.

It is often stated that CBW are easier to develop and produce than nuclear weapons since there are extreme difficulties in conducting international inspections, especially since BTWC does not have a control regime, and North Korea is not a member of the CWC. Production equipment for "almost all the chemical and biological agents for weapons' use are of dual-use character, which means that they can also be used for a commercial purpose."[71] In the case of North Korea, who has not signed the CWC, no international inspections can be carried out, and in regard to the BTWC, no control regime has yet been established. North Korea has signed the BTWC and is thus obliged not to develop or use any biological agents in offensive purpose. North Korea has been a passive state party of the convention and has never been engaged in the negotiation meetings.

North Korea recently denied the possession of "a single biological weapon" and emphasised that it is committed to honouring international agreements on the development of biological weapons.[72] Moreover, the state has recently announced that it will enact

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69 Lee, Y.C., *North Korea's chemical weapons' threat and our countermeasures*, Research Report, National Defence University, Seoul, 1986, quoted in *North Korea's Weapons of Mass Destruction: Problems and Prospects*, 112-113

70 Moon, S.M., "North Korea-a big chemical weapons state," *Arms Control on the Korean Peninsula*, Seoul Quarterly, Vol.15 (Dec.1994) cited in *North Korea's Weapons of Mass Destruction: Problems and Prospects*, 113

71 Kim, Kyong-soo, "North Korea's Chemical and Biological Weapons' Threat" in *North Korea's Weapons of Mass Destruction: Problems and Prospects*, 115

72 *Pyongyang Denies Having Biological Arms*, The Korea Times, September 12, 2005 URL <http://times.hankooki.com/service/print/Print.php?po=times.hankooki.com/lpage/nation/200509/kt2005091219480411990.htm>

"comprehensive laws to control production, exports and imports of certain chemical and biological substances" in compliance with the principles of the BTWC.[73] This measure reflects that North Korea seriously wants to take its responsibility as a state party of the convention. Several states, for instance China, have strengthened their export control measures in recent years.

In conclusion one can state that the underlying motivations and incentives behind North Korea's CBW programmes are based on the North Korean self-reliant thinking, and the belief that no foreign power will ever again invade and control the northern part of the Korean Peninsula. Motivation stems from memories of Japanese occupation, reliance to the Soviet Union and China, and foremost the outcome of the Korean War. Kim Il-sung realized the need to establish a strong military power, not dependent of foreign assistance, and implemented a military doctrine heavily reliant on modern weapons and unconventional warfare options. CBW gives North Korea a leverage against great powers, and principally asymmetric strategy vis-à-vis the combined forces of South Korea and the U.S.. Incentives are also based on the "cheap" production costs of such weapons, compared to nuclear weapons, and the prestige a state obtains with CBW possession.

[73] *Korea to create stricter biochemical laws.* JongAng Daily, 13 June, 2005.

8 Critical Indicators for Weapons of Mass Destruction Programmes

When looking at South Korean and U.S. sources, the threat from North Korea's weapons of mass destruction is very realistic. However, does North Korea possess the critical indicators, i.e. leadership, political outlook and resources, needed for offensive weapons programmes?

The North Korean leadership can be viewed as family dynasty, but also as a one-man autocracy. The power of the Kim leadership in North Korea is absolute, and since the succession of Kim Jong-il in 1998 there have been visible signs of increased military influence in the decision making. This is foremost detectable by the National Defence Commission becoming the highest state office in the nation, with Kim Jong-il as Chairman, and the implementation of a military-first (*Songun)* policy, which emphasizes the importance of the military and military power. The military-first policy is propagated to enhance the status of the military since it is the only plausible means that provides assurances for regime survival as "the military provides deterrence, defence, and a massive offensive threat, as well as leverage in international negotiations."[74] Additionally the policy is crucial for North Korean security, outranking a powerful economy and science and technology. According to the Pyongyang leadership; "if the barrel of a gun was weak, a country would be eventually swallowed by outside forces, no matter how powerful its economic might may be and no matter how advanced its science and technology may be."[75]

The military-first policy was further enhanced in 2002, after George W. Bush's "Axis of Evil" statement, and explained by the North Korean leadership as, "the core of army-based politics is the army, and its main principle is to give priority to military affairs."[76] Military-first politics are heralded and assured to guarantee independent politics, the core of *Juche*. Military power and a strong military defence are becoming increasingly important, and according to Kim Jong-il "independence cannot be defended without a strong military power."[77] The importance of the military-first policy can be detected in North Korean defence expenditure of the gross domestic product (GDP), which is expected to be between 25 to 34 %.[78] Even though the numbers are not consistent, one can still detect a trend of an enlarged percentage of the GDP being used for defence purposes, even though the defence budget[79] has decreased since 1998. This can be compared to Russian figures allocated

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74 *Democratic Peoples Republic of Korea*, Global Security Organization, URL <www.globalsecurity.org/military/world/dprk/intro.htm>

75 *PRK 'Military First' Doctrinal Declaration*, The DPRK Briefing Book: Policy Area: Military, February 23, 2003. URL <www.nautilus.org/DPRKBriefingBook/military/militaryfirst.html>

76 *Rodong Sinmun on army-based policy*, The Korean Central News Agency, January 27, 2002. URL <www.kcna.co.jp/item/2002/200201/news01/27.htm>

77 *Army-based policy, DPRK's mode of politics*, The Korean Central News Agency, November 13, 2002. URL <www.kcna.co.jp/item/2002/200211/news11/13.htm>

78 GDP = the total market values of goods and services produced within North Korea in a given year. GDP includes only goods and services produced in North Korea, regardless of the producer's nationality.

79 The defence budget for the fiscal year 2002 was estimated to US$ 3.2 billion, but some estimates also range it from US$ 4.7 to 5.2 billion. In 1985 the budget was estimated around US$ 7.5 billion. Country Handbook: North Korea, The Library of Congress, May 2005. URL <http://lcweb2.loc.gov/frd/cs/profiles/North_Korea.pdf>

around 2.6 to 2.7 % of the GDP.[80] In addition, China spends between 2.3 and 2.8 %, and the U.S. around 3.9 % of their GDP on defence expenditures.[81]

The political outlook associated with critical indicators for an offensive programme includes factors such as regional WMD dynamics, military strategy, political ambitions, security dilemmas, and alliances and influences, The WMD dynamics in the region have been dominated by China, the former Soviet Union and Russia since the beginning of the Cold War. However, the greatest threat in regard to WMD to face North Korea is the capabilities of the U.S. forces stationed in South Korea, Japan and Taiwan. Since being placed in the Axis of Evil, the relationship with the U.S. has become increasingly hostile, and thus the regeneration of the North Korean nuclear programme. After Pyongyang withdrew from the NPT in 2003 there have been several statements from the North Korean leadership in regard to foremost nuclear capacity.[82] Statements concerning chemical and biological weapons are scarcer.

North Korea's military strategy, which can be said to be a reflection of Pyongyang's national goals, and founded on the socially constructed views unique to the North was, until the mid-1990's, based on reunification of the Korean Peninsula. However, the goal of regime survival seems to have replaced reunification in importance, and with the implementation of the military-first policy, military power and WMD possession have rapidly increased in importance. A military strategy can be threefold; offensive, defensive or deterrent.

1. An offensive doctrine [strategy] endeavours to destroy an enemy's military forces and disarm it.
2. A defensive doctrine [strategy] seeks to deny an enemy's military objectives.
3. A deterrent doctrine [strategy] aims to punish an aggressor, raising the cost of aggression to an unacceptable level and prompting it to not pursue attack.[83]

The North Korean strategy has evolved since 1948 and can be viewed as both offensive and defensive. The essence of the North's strategy can be regarded as offensive and "designed to provide a military option to achieve reunification by force employing surprise, overwhelming firepower, and speed."[84] The offensive posture is demonstrated by the organization and deployment of the armed forces, which with its 6.1 million manpower availability ranks fifth in the world.[85] WMD can also be viewed as an integral part of an offensive strategy, especially in regard to chemical weapons, while nuclear weapons might be considered for more deterrent purposes. The defensive posture can be detected in the protective flanks of the coastline and the stationing of around one million men in the

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80 *Russian Military Budget,* Global Security Organization, URL <http://www.globalsecurity.org/military/world/russia/mo-budget.htm>

81 *China's Military Spending up to 2.8% of GDP – RAND,* Taiwan Security Organization, May 20, 2005. URL <http://taiwansecurity.org/AP/2005/AP-200505.htm>

82 See *Special Report on the North Korean Nuclear Weapons Statement,* Monterey Institute of International Studies, February 11, 2005, and *Text of North Korea's Statement of NPT Withdrawal,* January 10, 2005. URL <http://cns.miis.edu/reserach/korea/npstate.htm>

83 Mayer, Charles C. *National Security to Nationalist Myth: Why Iran Wants Nuclear Weapons.* Thesis, Naval Postgraduate School, Monterey, California. September 2004. 17

84 Hodge, Homer. *North Korea's Military Strategy,* The DPRK Briefing Book, Policy Area: Military, Spring 2003. URL <www.nautilus.org/DPRKBriefingBook/military/DPRKMilitaryStrategy.html>

85 *The CIA World Fact Book,* URL <http://www.cia.gov/cia/publications/factbook/geos/kn.html>

adjacent area of the Demilitarized Zone (DMZ). However, even though the Pyongyang leadership has "deployed forces to protect its coasts, airfields, and especially the North Korean capital of Pyongyang, the overall deployment of forces and, particularly, forward deployment of large numbers of long-range artillery underscore the offensive nature of its strategy."[86] Thus, in sum one can state that North Korea's military strategy "advocates offence as the most effective means of defence,"[87] and WMD are an integral part of both offensive and defensive posturing.

In regard to security dilemmas, North Korea does not disregard past experiences, such as the Japanese occupation, the division of the Korean Peninsula by the U.S. and the Soviet Union, the Korean War, and the international events that occurred in the early years of the Cold War. Since the end of the Korean War, the U.S. has been perceived as the nation's main threat, and North Korean security needs and security alliances have been based on this perception.[88] As a result "North Korea has sought to strengthen its military capabilities by forming security alliances and by allocating a tremendous amount of resources to the military sector,"[89] including WMD research and development. Pyongyang has security alliances with both Moscow[90] and Beijing, and it is important to keep in mind that North Korea is the only nation that China has a military assistance agreement with in case of war. The North Korea/China Friendship and Mutual Assistance Treaty has been valid since 1961. The relationship with the former Soviet Union was influential in regard to military assistance and development, and also in regard to nuclear and ballistic missile technology. It is also believed that the Soviet Union assisted North Korea in its chemical weapons programme since much of the North's military strategy, including its special weapons doctrine, is based on the Soviet model.

In the resource field one can most definitely state that North Korea is importing equipment, agents and know-how in foremost the nuclear and ballistic missile fields, but also some in the chemical field.[91] North Korea has also established an indigenous programme for ballistic missile development, with assistance from foremost the former Soviet Union and China. The chemical industry in North Korea is more advanced than the biological field, and could be used in offensive purposes, see chapters 9 and 10. The research and development concerning primarily the nuclear and ballistic missile programmes, has had a high-priority since the 1950's, and there are several non-declared facilities that most likely are correlated to this research. In sum it can be argued that North Korea does possess the

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86 Hodge, Homer. *North Korea's Military Strategy,* URL <www.nautilus.org/DPRKBriefingBook/military/DPRKMilitaryStrategy.html>

87 Ibid.

88 See Waldenström, Louise, *North Korea's Juche Ideology and its Implications on Pyongyang's Relations with Washington 1994-2004: A North Korean perspective,* (Umeå: February 2005) FOI-R-1578-SE

89 Pinkston, Daniel, A. *North Korean Motivations for Developing Nuclear Weapons,* Monterey Institute of International Studies, URL <http://cns.miis.edu/research/korea/dprkmotv.pdf >

90 In 2000 the new Russian – North Korean cooperation treaty replaced the old 1961 Mutual Defence Treaty. Unlike the 1961 treaty, the new one does not include an article about military assistance in case of a war. Russia is thus less obligated to North Korea than was the Soviet Union. Mikheev, Vasily. *Russian Policy Towards North Korea,* The Centre for Strategic and International Studies, September 22, 2000. URL <www.csis.org/pacfor/pac0038.html>

91 See *Nuclear Imports.* Nuclear Threat Initiative URL <www.nti.org/e_reserach/profiles/NK/Nuclear/47.html> *Missile Imports* URL <www.nti.org/e_reserach/profiles/NK/Missile/66.html> *Chemical Imports.* URL <www.nti.org/e_reserach/profiles/NK/Chemical/53.html>

critical indicators for an offensive WMD programme, especially in regard to the nuclear, ballistic missile and chemical fields. Concerning the biological programme it is doubtful that it is advanced enough for offensive use.

9 Capabilities in the Chemical Field

The Chemical Warfare Programme

Overview

It is extremely difficult to obtain reliable information about North Korean possession of chemical weapons, or in fact anything with any connections to chemical warfare. Information available in open sources mostly has its origin in testimonies from defectors, which furthermore seldom is first hand information. Such information has been analyzed by foremost all South Korean and U.S. intelligence and other organisations. Officially, South Korea regularly reports that there are three to four research facilities, at least eight facilities for production and six or seven for storage found in North Korea. The amount of stored chemical weapons might be as high as from 2 500 to 5 000 tons. Many types of agents are available, sometimes as many as 19 are mentioned. The list includes everything from tear gases to advanced nerve agents. North Korea also possesses a great variety of suitable delivery systems, with emphasis on artillery systems. The assessments, presented for example at several web sites, can differ quite a lot in details.

Still the general view, shared also by the authors, is that North Korea has developed and produced chemical weapons, has (had) them in stockpile and can produce more, if needed. The question marks are about the situation today, concerning for example, how modern is the arsenal; how much has deteriorated; are the munitions renewed; can nerve agents be produced today?

Here, “common views” will be presented, analyzed and discussed, and the CW issues, in the context of the development of the economy in general, and of the chemical industries in particular, will be put forward.

Industry and economy in North Korea

The basis for industrial activities was laid during 1910-1945, when Japan occupied and administered the, then unsplit, country.[92] Japan made investments mainly in the Northern part of Korea. After WW II and the Korean War (1950-1953), North Korea could rapidly rebuild its heavy industry, with support from China and the former Soviet Union. The annual growth rate was amazingly high for several years, exceeding South Korea’s until the late 1960s.

North Korea attempted to modernize its industry in the 1970s, but the success and outcomes of these efforts were not as good as the regime had hoped. The country got economic problems and its debts to other countries steadily increased. Still, development continued but came to an abrupt end in the beginning of 1990’s, when the Soviet Union and other parts of the communist world collapsed. The decline, starting in 1991, continued for several years but growth rates have begun to strive upwards again, and the government has taken many measures to try to improve the situation.[93]

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92 *Other Industry* URL <http:// www.globalsecurity.org/wmd/world/dprk/industry.htm>

93 Yoshikawa, Y. (2004) *The Prospect of Economic Reform in North Korea*. Available at URL <http://www.nautilus.org/DPRKBriefingBook/transition/200312NKecon.html>

Among the heavy industries, iron mining and steel production are of outermost importance. The chemical industry was already from the start built upon domestic resources, mainly anthracite coal. North Korea used to be very dependent on oil imports for the petrochemical industries, mainly from the former Soviet Union and to some extent also from China. With the collapse of the USSR, there was a drastic reduction in import volumes. Today, not more than about 0.32 million tons of oil[94] passes through the few refineries annually. Factories for petrochemical products have reduced their production in proportion.

North Korea has two oil refineries,[95] and together they have an annual capacity of 3.5 million tons. One – the *Suengri* Chemical Factory - is located in the northeast, close to the Russian and Chinese borders. It was built about 30 years ago, with Soviet support, and has a final capacity of two million tons. The idea was that the USSR would supply the raw material, but there has been almost no activity at the factory during the last decade, and is probably now inoperable. The other refinery, *Bonghwa* Chemical Factory, was built simultaneously but with Chinese support. It is a bit smaller and located close to the Chinese border in the northwest. China still exports oil to North Korea, giving some work for the facility but far from its capacity. The refineries are located in North Korea's two free economic trade zones.

Recent economic reforms

Many reforms and changes, including price and wage adjustments, devaluation and a farm reform, have taken place since 2002.[96] There is a partial open-door policy in business, striving towards foreign investments in North Korea. Free economic trade zones (FETZ) are one tool in this policy. Already in 1991, a first attempt was made, in the northeast part of the country, in the *Rajin-Sonbong* area close to the Russian border. While one can still find nice advertisements for this area,[97] facts point at a complete failure. One of many reasons could be that the economy still was of a socialistic planning type.[98] In September 2002, there was a decision to set up a new FETZ in the *Sinuiju* area and permit great freedom in economics and legislation.[99] The region will have its own independent administration, legislation and justice system. For example, it can issue its own passports. This arrangement is planned for 50 years.

Whether the *Sinuiju* area really will develop in this direction is still an open question. Its development is dependent on cooperation with China and also with South Korea, which both seem to be reluctant. China has actively worked against the idea,[100] one of the reasons could be that the North Korean area will compete with the neighbouring Chinese *Dandong* area, with similar types of light industries.

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94 The figure can be compared to the annual import of crude oil to Sweden, about 23 million tons. World consumption is 3 500 million tons

95 Jung, W.J. **(**2001**)** *North Koreas Petrochemical Industry***.** KOTRA, 21 January**,** 2001.

96 Yoshikawa, Y. (2004) *The Prospect of Economic Reform in North Korea*. Available at URL <http://www.nautilus.org/DPRKBriefingBook/transition/200312NKecon.html>

97 *Rajin-Sonbong Region* URL <http://210.145.168.243/pk/095th_issue/99051905.htm>

98 Yoshikawa, Y. (2004) *The Prospect of Economic Reform in North Korea*. Available at URL <http://www.nautilus.org/DPRKBriefingBook/transition/200312NKecon.html>

99 *DPRK to set up Sinuiju special economic district*. People daily (English version) September 23, 2002 URL <http://english.peopledaily.com.cn/200209/23/eng20020923_103689.shtlm>

100 *North Korea Development Report 2003-2004*, 219

Still, there is much activity in both the Chinese and the North Korean provinces in this area and also across the border. The sincerity in contacts between the provinces was illuminated after the train accident in *Ryongchon*, close to *Sinuiju*, in April 2004.[101] People living across the border in the Chinese town of *Dandong* went into North Korea to try to help family members and other injured and homeless people.[102]

Two recent events, in 2003, in the region concern import to North Korea of a controlled chemical, sodium cyanide. This chemical has many civilian applications, for example in gold and silver processing after mining. It is a precursor[103] for the nerve agent tabun and can also be used for preparing highly toxic hydrogen cyanide. A South Korean businessman exported, without permission from the government, 107 tons to a Chinese company in *Dandong*, which re-exported the item to North Korea. There was also an unsuccessful attempt to obtain 33 tons from Germany.

North Korea as actor in illicit drug trade

North Korea is well-known for doing business in clandestine[104] areas such as trafficking in illegal drugs and weapons (foremost missiles) in order to increase the nation's income. It cannot be excluded that the free trade zones might facilitate export and import of items which are under international surveillance, including precursors for chemical warfare agents and other material related to weapons of mass destruction. Because of the similarities in producing and trading such compounds and illegal drugs, it is crucial to give a short survey of North Korea as actor in drug trade.

A striking parallel is that North Korea is not a party to any of the international narcotics control treaties. The numerous incidents on drug smuggling during the latest decades, in which personnel from embassies and similar representations abroad has often been involved, might reflect a direct official involvement in this traffic. The narcotics are mainly of two types: heroin by tradition and methamphetamine of increasing importance.[105,106] In April 2003, a vessel belonging to a North Korean enterprise was seized by Australian federal police. The vessel had apparently delivered 125 kg heroin to Australian criminals. In June the same year, there was another incident, involving methamphetamine. A Chinese vessel was seized by South Korean police when arriving to the harbour Pusan in South Korea. The vessel had, among other things, a cargo container with 50 kg

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101 *Ryongchon* is a station along the main railway between Beijing and Pyongyang. The blast was however not at the main line but inside the railroad yard. The official version for the cause of the massive explosion was an electric contact, caused by unawareness, between a wagon with ammonium nitrate and a wagon with fuel. Some sources claim that two fuel containing wagons collided. According to some other sources, one wagon contained a delivery for Syria, with SCUD D missiles, warheads with chemical or biological agents and fuel propellants. The explosion resulted in a 15 meter deep crater and had effects within a radius of 2 km. 8 000 people were made homeless, the number of lethalities was estimated to about 150 and the number of injured around 1300.

102 *Several Stories on NK Train Accidents*, URL <http://www.freenorthkorea.net/archives/freenorthkorea/001209.html>

103 Starting material for the production of, for example, CW agents.

104 Conducted with or marked by hidden aims or methods.

105 Hwang, B. (2003) *Curtailing North Korea's Illicit Activities*, Available at URL <http://www.nautilus.org/DPRKBriefingBook/terrorism/bg1679.html>

106 *International Narcotics Control Strategy Report*, Bureau for International Narcotics and Law Enforcement Affairs, State Dept., March 2004. Available at URL <http://www.nautilus.org/DPRKBriefingBook/terrorism/NarcoticsReportonDPRK.html>

methamphetamine, which probably had been packed in China, transported by railway to North Korea to the port of *Rajin*[107] in the free economic trade zone *Rajin-Sonbong* and transferred to the vessel.[108]

The two cases mentioned above give no indication about production in North Korea. However, the assessment is that North Korea does produce these street drugs.[109] The annual production capacity of raw opium has been estimated to around 50 tons. The capacity in pharmaceutical laboratories to process the raw material into heroin is estimated to be even greater, 100 tons. Synthesis of methamphetamine in large scale and mainly for the Japanese market, started around 1996 and the capacity is estimated to be 10-15 tons of high quality product per year.

Background and official statements in the chemical warfare (CW) area

It is reasonable to assume that North Korea started a defensive programme directly after the Korean War, in 1954.[110] The interest for offensive CW research and development could also have had an early start. It is well established that Kim Il-sung proclaimed his "Declaration of *Chemicalization*" in 1961. A sizeable chemical industry was established and probably included a planning for production of chemical weapons, with the assistance of the Soviet Union. However, progress was slow and in 1979 North Korea had only reached defensive capability according to U.S. intelligence. It would take almost another decade for establishing a considerable offensive capability. It should be noted that the reach of offensive capacity coincided with the beginning of the general decline in economy and production.

North Korea used to deny the possession of chemical weapons, for example during the period when South Korea tried to get North Korea to sign the chemical weapon convention (i.e. 1989-1993).[111] The attitude might have changed recently. For example, in October 2002 Kang Sok-ju (first vice minister of foreign affairs) admitted to the possession of "weapons more powerful than nuclear weapons". The expression was interpreted as BC-weapons by the U.S..[112]

As their master in chemical weapons issues – the Soviet Union – used to do, North Korea, at least until the end of the 1990's, seems to have looked upon chemical weapons as integral parts in the military system. Even though CW seem to have lost some strategic

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107 Sometimes (for example in the Nautilus documents) Rajin is named Najin See URL <http://www.statois.com/ukp.html> for alternate names of North Korean provinces and areas

108 *International Narcotics Control Strategy Report*, Bureau for International Narcotics and Law Enforcement Affairs, State Dept., March 2004. Available at URL <http://www.nautilus.org/DPRKBriefingBook/terrorism/NarcoticsReportonDPRK.html>

109 Rafael F. Perl, *Drug Trafficking and North Korea: Issues for U.S. Policy,* CRS Report for Congress, December 2003. Available at URL <http://www.nautilus.org/DPRKBriefingBook/terrorism>

110 *North Korea's Chemical and Biological Programmes*, In North Korea's Weapons Programmes: A Net Assessment. The International Institute for Strategic Studies, London, UK. 49

111 Ibid. 53

112 *North Korea reportedly admits to biological, chemical weapons* BBC Monitoring Asia Pacific November 5, 2002.

importance, compared to nuclear weapons, the Pyongyang leadership might still find it advantageous to exaggerate their capacities and capabilities.

Agent list according to South Korean sources	
Blister agents:	Mustard
	Lewisite
	Phosgene oxime
Choking agents:	Phosgene
	Diphosgene
Nerve agents:	Sarin
	Tabun
	Soman
	VX, VE, VG, VM
Blood agents:	Cyanogen chloride
	Hydrogen cyanide
Incapacitant:	BZ
Vomiting agents:	Adamsite
	Diphenylchloroarsine
Tear gases:	Chloroacetophenone (CN)
	Chlorobenzylidene malononitrile (CS)

It is reasonable to interpret this list, not as a list of weaponized agents, but rather as a comprehensive list of agents, in which North Korea has shown an interest beyond the research level. Many of the agents are today regarded as obsolete.

In the choice of agents for large scale production and weaponization, several criteria should be applicable. The availability of raw materials/precursors could be regarded as the most important one. Due to all import restrictions, one could claim that today, availability is synonymous to domestic availability. The status of production facilities is another factor. The stability of the final product upon storage could also be a very important factor, especially if there are restrictions – such as shortage of precursors - for renewal of the stockpiles.

An assessment, shared by others,[113] is that mustard and phosgene are the most probable agents. Sarin is the most interesting among nerve agents, followed by VX or VM. It would not be a surprise if North Korea – like many other countries – has production of a riot control agent, probably a tear gas, which is not covered by CWC.

[113] *Chemical Overview*, URL <http://www.nti.org/e-research/profiles/NK/Chemical/print/index.prt>

Facilities

In regard to locations for facilities used for research, production and storage, various sources and documents are in disagreement, especially for the presumed production sites.[114] Noticeable is that no sources or documents contain a facility or an area for testing activities.[115]

The choice of source in this report is the list from a recent survey on economic development in North Korea,[116] which includes a chapter on the defence industry.

Suggested locations for production are *Anju*, *Aoji*, *Chongjin*, *Hamhung*, *Kanggye*, *Manpo*, *Sinuiju*, *Sunchon*. In open sources, there are no indications on locations exclusively designed for the production of chemical warfare agents. If any production takes place today, it seems to be done at industrial complexes for mainly civilian products. This does not exclude the possibility that there are specific factories, for CW agents, within these complexes.

There are good reasons to assume that the production of mustard gas (and also phosgene) could take place in facilities producing poly(vinyl alcohol) and the fibre "Vinalon".[117, 118]

The *Hamhung* area is the biggest and most important chemical industrial area, where industries like April 25th Vinalon Factory, which among other things produces herbicides, fertilizers, pesticides is located. *Hungnam* Fertilizer is a big complex and has sulphuric acid, ammonium sulphate, phosphate and urea on its production programme. This chemical factory was recently modernized.[119] *Hamhung* Chemical Factory has similar products.

Aoji and *Chongjin* are both located in the north-eastern part of the country. Methane, methanol, ammonia and many other chemicals derivable from oil and coal are made at the *Aoji-ri* Chemical Complex. *Chongjin* Chemical Fibre Complex does not only produce synthetic fibres but also formalin, phenols and pesticides.

Kanggye and *Manpo* are also located far from the capital, to the northwest and rather close to the Chinese border. Ammonia and sulphuric acid are among the products produced at the *Manpo* Chemical Factory.

Anju and *Sunchon* are both located rather close to and north of the capital Pyongyang. In *Anju*, the *Namhung* Youth Chemical Complex is situated, the only petrochemical facility in North Korea.[120] It has a total annual production capacity of 550 000 ton chemicals,

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114 The interested reader is encouraged to read a good discussion at the website of Global Security, *Chemical Weapons*, URL <http://globalsecurity.org/wmd/world/dprk/cw-fac.htm>

115 Ibid.

116 *North Korea Development Report 2003-2004*, 180

117 Croddy, E. (2003) *Vinalon, The DPRK, and chemical weapons precursors*, Nuclear Threat Initiative, URL <www.nti.org/e_research/e3_23b.html>

118 This is a product which at the beginning of the North Korean chemical development was of great pride - today it must be regarded is a rather old-fashioned synthetic product.

119 *North Korea Development Report 2003-2004*, 91

120 Jung, W.J. *North Koreas Petrochemical Industry***,** KOTRA 21 January, 2001.

including such products as ammonia, ethylene, fertilizers and fibres.[121] Another, even bigger complex, consisting of about 50 factories, is found in *Sunchon* Vinalon Complex. In contrast to most of the facilities mentioned, this was established rather recently (around 1990) and might not be fully running yet.

The *Sinuiju* area can be viewed as the most interesting today (see the section on free trade zones). Among many other factories the *Sinuiju* Chemical Fibre Complex is located in the area, which has products such as chlorine, calcium cyanamide and synthetic fibre. The area also contains the only (or at least the most important) oil refinery in the country, *Bonghwa* Chemical Factory.[122] It is assumed that naphtha produced here is transported to *Anju* (see above) in a pipeline.

From this survey, one dare to conclude that mustard gas and some other simple agents such as phosgene could be produced at many of the mentioned facilities. At the same time, it is not obvious where – if anywhere - nerve agents might be produced today.

Research in chemistry can take place at many locations. The source mentioned in this survey suggests *Hungnam* (close to *Hamhung*), *Kanggye* and *Sinuiju*.

Stockpiling is suggested to take place in the southern part of North Korea, in *Sanumri, Whangchon, Sariwon, Samsadong, Wangjaebong* and *Shinanshangri*.

Amounts in storage and capacity for production

The official standpoint from South Korea is that North Korea is estimated to have between 2 500 and 5 000 tons of chemical weapons in stockpile. In later years, somewhat lower figures (2 500 to 4 000 tons) have been presented. Much lower estimates of 180-250 tons can also be found.[123] As a comparison, Libya had only 23 tons of agents in storage and Iraq produced about 3 800 tons during the period 1981-91. Thus, if figures of North Korean possession are correct, they make North Korea the third biggest (after Russia and the U.S.) holder of chemical weapons, bigger than Iraq ever was.

Similarly, the figures for production capacity differ quite a lot. Due to problems in the chemical industries during the latest decade, the annual production could have varied substantially, but might, according to some analysts, on the average have been as high as 8 000 tons.[124,125] If needed, the capacity could, according to these sources, be raised to 20–30 000 tons, approaching an amount equal to the total Russian or U.S. declared amount.

Needs versus capacity and capability

If it is assumed that North Korea, during the golden ages in the late 1980's and early –mid 1990's, produced a couple of thousand of tons of high quality agents, the need for new production might be very limited. High quality agents have a very long shelf life due to the

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121 *North Korea's Chemical and Biological programmes*, 50

122 Jung, W.J. *North Koreas Petrochemical Industry***,** KOTRA 21 January, 2001

123 *Chemical Weapons Programme*, URL <www.globalsecurity.org/wmd/world/dprk/cw.htm>

124 Ibid.

125 Bermudez, J. S. and Richardson, S. A. (2001) Chapter 3 *The North Korean View of the Development and Production of Strategic Weapons Systems* in Sokolski, H. D.(ed) "Planning for a Peaceful Korea", available at
URL <http://permanent.access.gpo.gov/websites/armymil/www.carlisle.army.mil/ssi/pdffiles/00062.pdf>

inherent stability. If we also suppose that very limited amounts are used for large scale test – (i.e. the lack of a test area or facility noted above does reflect that tests are not performed regularly) – we can conclude that the stockpiles are virtually untouched from year to year. There could be several types of munitions.

However, if it is supposed that North Korea has a problem with the stability, then replacement should be needed.[126] Impurities are the usual cause for inferior stability, and nerve agents are – as Iraq experienced frequently - especially sensitive. One cannot take it for granted that North Korea is able to replace deteriorated weapons with the same type of agent. With all of today's import restrictions, self-sufficiency in all necessary precursors and other chemicals and materials might be necessary for a reliable production. As previously discussed, on the one hand, North Korea probably still has good prerequisites for producing mustard and phosgene, but on the other, supplies of nerve agent precursors might, be too limited to permit a renewing of these stockpiles.

An obvious consequence would be that while the total volume of the stockpile can be maintained, there is a successive qualitative impairment, when nerve agents are replaced by less potent agents. Two statements made by U.S. Commanders in recent years can be interpreted in this context, although they might look contradictory:

> Statements by Commanders in Chief United Nations Command/Combined Forces Command and Commander, U.S. Forces Korea, before the Congress Senate Armed Services Committee:
> General Thomas A. Schwartz 5 March 2002:
> "We assess that North Korea has very large chemical stockpiles and is self-sufficient in the production of chemical components for first generation chemical agents"[127]
> General Leon J. Laporte 31 March 2004:
> "North Korea has an assessed significant chemical agent stockpile that includes blood, blister, choking, and nerve agents."

This report's assessment is that North Korea still has a stockpile of old nerve agents, but this stockpile is shrinking due to deterioration and difficulties in renewing, as the availability of phosphorus-containing precursors might be restricted.

Two recent attempts – one successful and one unsuccessful - in importing controlled phosphorus-containing chemicals can be interpreted as indicative of North Korea's limited capacity in the phosphorus chemistry. In August 2003, Taiwan seized a cargo containing 159 barrels of phosphorus pentasulphide from a North Korean vessel.[128] This chemical can be used for producing insecticides, but also for the production of nerve agents. The second attempt, from 2002, was more related to Pyongyang's nuclear ambitions.[129] North Korean authorities had contact with several chemical firms in China to obtain tributyl phosphate, a chemical used in processing uranium (but it can also be used as a simulant in chemical

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126 In the document mentioned above *Chemical Weapons Programme* URL <www.globalsecurity.org/wmd/world/dprk/cw.htm>, it is argued that North Korea uses half of its annual new production (0.5 × 8 000 tons= 4 000 tons) for replacement of deteriorating stockpiles. That would mean that almost everything is replaced each year!

127 First generation means WW I agents, such as phosgene and mustard.

128 *US praises Taiwan for seizure of chemicals aboard North Korean freighter* BBC Monitoring Asia Pacific, August 13, 2003.

129 *N. Korea seeks aid from China on nukes; Attempts to buy fuel component* The Washington Times, December 9, 2002.

warfare training etc). North Korea seemed to have been successful in obtaining 20 tons of the chemical from a Chinese company located in the seaport *Dalian*, not far from the North Korean border.[130] One could argue that if North Korea is unable to produce this rather simple phosphorus compound, it would have even greater difficulties with the production of nerve agents.

While there can hardly be any doubts that North Korea has well-educated personnel in both research and production technology, there are uncertainties regarding the status of relevant chemical industries. It should be noted that the chemical industries mentioned above (Facilities) are characterized by annual production capacity. This is a figure which can be very dissimilar compared to the real production volume. The drop in the economy during the 1990's had great effects on the chemical industry. Lack of energy and raw materials - prior to 1990 imported mainly from the Soviet Union and China – have also had severe effects. As a result, the domestic production of fertilizers (NPK) has declined during these years to less than 10 % of the required amount. In 2004, the production was only about 56 000 tons,[131] and many factories are assumed to be more or less abandoned.

According to a recent UN Report, eight factories for nitrogen based fertilizers are running.[132] However, no phosphate factory is included in the report. Still, the volumes of any demand on chemical warfare agents are much smaller than on civilian chemicals. Even if the regime – which puts military needs ahead of civilian - requires as much as 1 000 tons of agents annually to substitute deteriorating stockpiles, it should not be any problems, again provided that precursors are available.

Chemical troops/Chemical defence

Chemical warfare and defence seem to be integrated in the North Korean military system. Chemical defence battalions are incorporated into larger force units.[133] Approximately 1 % of the forces are composed of chemical warfare personnel,[134] which corresponds to 9 900 up to 13 000 people.[135] The nuclear and chemical defence are since 1981 placed in the same organization – the Anti-Nuclear and Anti-Chemical Defence Bureau.

The defence forces are well equipped and trained; apart from personal protection, such as mask and simple suits, the troops have decontamination systems and detection kits and systems. Available information on protective equipments points to a great similarity with older Russian material. North Korea finds both military and civilian CW protection important; not only the armed forces, but also civilians are trained in simulated chemical attacks. The aim is to equip all troops with full protective gear, but the physical protection

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130 *China ships North Korea ingredient for nuclear arms* The Washington Times, December 17, 2002.

131 *Special Report FAO/WFP Crop and Food Supply Assessment mission to the Democratic People's Republic of Korea,* Nov 2004 Available at URL <http://www.fao.org>

132 *Fertilizer Production Capacity in Developing Asia*,2001. Published by a special organization within UN, Fertilizer Advisory Development and Information Network for Asia and the Pacific, FADINAP. Available at URL <http://www.fadinap.org>

133 *North Korea's Chemical and Biological Programmes*, 56

134 Bermudez, J. S. and Richardson, S. A. (2001) Chapter 3 *The North Korean View of the Development and Production of Strategic Weapons Systems* in Sokolski, H. D.(ed) "Planning for a Peaceful Korea", available at URL <http://permanent.access.gpo.gov/websites/armymil/www.carlisle.army.mil/ssi/pdffiles/00062.pdf>

135 *Chemical Directorate,* URL <http://www.globalsecurity.org/wmd/world/dprk/chemical.htm>

for civilians seems to rely mainly on collective protection,[136] perhaps in underground systems. It is possible that the ambition is to complement the civilian protection with protective masks.

North Korea and international agreements in the CW area

The Geneva Protocol from 1925 is an agreement in which the contracting parties accept a prohibition of "the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices" and also "agree to extend this prohibition to the use of bacteriological methods of warfare."[137] In practice, the prohibition is limited to "first use" and to other contracting parties. Both North Korea and South Korea signed this protocol as late as in 1989. By then, the work on the much more comprehensive Chemical Weapons Convention (CWC) was close to come to an end. South Korea tried to put pressure on North Korea to take part in the negotiations and, when the convention was opened for signature in January 1993, also to follow South Korea's example and join it. North Korea did not, and the regime denied any possession in a formal statement.[138]

North Korea continues to show a total lack of interest in CWC-related issues. For example, Pyongyang does not take part as an observer in OPCW[139] activities. One could claim that North Korea actually has nothing to gain from joining the convention – apart from appraisal from the world community. One should remember that the convention is rather far-reaching as regards to the obligations for the state parties. Not only must stockpiles and production facilities be declared and destroyed, but the convention also demands openness in permitting inspections, and in declaring dual use facilities and capacities. Such obligations could be regarded as extremely intrusive for a closed society. A reasonable guess is that any attempt to encourage North Korea to join the CWC must be tied to economic advantages, such as help in re-creating the chemical industry.

Prisoners as human guinea pigs for chemical warfare agents?

Defectors have for decades, since the 1970s, accused the North Korean leadership for gassing political prisoners and their families. Due to a BBC documentary, these alleged crimes got much attention in the spring of 2004. What kinds of agents used, and for what purpose, are very unclear from the reports, nor is the information regarding the location for the assaults entirely dependable. However, some testimonies concerning Camp 22, which is said to be located in *Hyeryong* in the north *Hamgyong* province, i.e. in the north-eastern part, is according to a human rights source[140]for families of the condemned, and one out of five concentration camps in use. A second location is said to be close to *Hamhung*, in *Hungnam* province (see above, Facilities). The closest camp in this region is no 15, in *Yodok*, which is both for the condemned and their relatives.

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136 Ibid.

137 Available at for example URL <http://fas-www.harvard.edu/~hsp/1925.html>

138 *North Korea's Chemical and Biological Programmes,* 49

139 Organisation for the Prohibition of Chemical Weapons

140 Jhe, S., Choi, E., Suh, J., Lee, K. and Kim, S. *White Paper on Human Rights in North Korea*, (Seoul: Korea Institute for National Unification, 2000)

The South Korean government claims, and many analysts agree, that it is hard to control the reliability and authenticity in these allegations. South Korea takes no action, nor does any other nation – at least not until any more convincing data appear.

10 Biological Capabilities

The Biological Warfare Programme

Background

North Korea acceded to the Biological and Toxin Weapons Convention (BTWC) in 1987. Despite this fact, North Korea is accused of carrying an offensive biological programme. In general, the biological warfare issue concerning North Korea has not received the same degree of attention as that of nuclear or chemical warfare. It is, however, plausible to suppose that North Korea has had a programme for the development of biological weapons as well as means of protection against biological weapons.

In the 1960s, previous to the BTWC, which came into force in 1975, several states had national programmes of offensive character. For instance the Soviet Union and China, two of the states in North Korea's neighbourhood and also states with influence on North Korea, early had an interest in the development of biological weapons and both states are assumed to have continued the programmes for decades. It is, however, believed that neither the former Soviet Union nor China has provided any direct assistance in the development of BW in North Korea.

A review of the literature on offensive programmes reveals that analysts all over the world agree on the fact that North Korea has been involved in offensive biological activities for decades. There is, however, very limited information available to prove it. A few defectors have brought information and intelligence organisations have produced lists with production and test facilities and data on possible agents. A critical survey of the published information shows, however, that the material is meagre. The same allegations are repeated from year to year, but there are very few reliable sources and no details of a programme.

Taken together the political situation, historical parallels and North Korea's particular situation, it is highly likely that the BW research in North Korea began in the early 1960s and that it continued into the 1990's despite the adherence to the convention.

Accusations of biological weapon production

There have been repeated accusations on offensive activities and large scale production of biological weapons in North Korea.[141] Most of these accusations originate from South Korea. The South Korean defence minister Kim Dong-Shin, for instance, estimated in 2001 that at least ten different agents were developed as weapons. [142] The US agrees (2001) but has a more cautious attitude: "The U.S. believes that North Korea has a dedicated, national level effort to achieve a BW capability and that has developed and produced and may have weaponised BW agents in violation of the convention".[143] These statements are similar to a number of others originating from various sources and times. For instance, in a Russian foreign intelligence report 1993, North Korea was claimed to perform military biological

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141 Bermudez, J.S. *Exposing the North Korean BW Arsenal,* Jane's Int Rev, August 1998, 29

142 *North Korea has up to 5000 tonnes of biochemical weapons,* Agence France Press, November 20, 2001.

143 *US says Iraq, N. Korea building biological weapons,* J. Bolton at the Geneva Conference 2001. Media Corporation of Singapore, November 20, 2001.

research at several institutes and universities.[144] In addition, it was claimed that facilities for tests of biological agents were located at North Korean islands, as was the case in the former Soviet Union.[145] The present and dominating hypothesis is that North Korea had a programme for the development of biological weapons and that it mainly has been focused on a few organisms. Presumably the North Korean biological programme also contained a defensive part, which focused on protection means such as methods for identification and prophylaxis (vaccine). The defensive research could be expected to have included a large number of infectious agents. In addition, education and training of military personal in protection against BW is supposed to have been organised in the defensive part of the programme. When it comes to the present situation, there is doubtfulness of the status of the programme. In order to make an analysis of the potential programme, the available information is scrutinised. The analysis includes an assessment also of the capability such as technology and industry.

Assuming that North Korea has a biological programme with a defensive as well as an offensive branch, it could be expected to find several facilities subordinate to the National Defence Commission where research and development are performed. In addition to medical military academies and in institutes exclusively designed for the purpose, civilian institutes and universities may have compartments involved in the biological programme. There is, however, no proof for a large-scale programme with production facilities exclusively intended for biological weapons. A more acceptable organisation would be facilities of dual-use character, i.e. industries for production of pharmaceutical products, connected to the biological programme. Considering the almost total lack of information from North Korea and the limited transparency into internal affairs, the risk for disclosure of a programme is minimal.

If it is assumed that North Korea had a biological programme with an offensive profile from the 1960s at least to the end of the 1980's, the state should have build a substantial know-how and an infrastructure for the production of biological warfare agents. By using the information from the Soviet Union biological programme[146] as a frame for the assessment of the North Korean programme, it is believed that a Korean programme - of a more limited scale than the gigantic Russian biological programme – could have been successful. It could be expected that the offensive activities initially were focused on various infectious agents with the intent to gain a general know-how, but that a few agents were selected for weaponization.

A review of the literature shows that about twenty different research institutes and industries have been alleged for connections to the offensive programme. Three suspected production sites have been specified in the allegations. It is of interest to investigate the information available on the various sites with presumed offensive connections. It appears that the information is brief and there are few specifications of sources, research activities, production profiles etc. Most information is gained from various Western analytical institutes and intelligence assessment while basic sources such as scientific publications originating from North Korea or national web-sites are rare. According to Western data

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144 Russian Foreign Intelligence Report 1993. *Proliferation of Weapons of Mass Destruction.*

145 The Soviet Union BW programme involved a field test facility at the *Vozrozhdeniye* (Rebirth) Island in the Aral Sea. At this facility large-scale aerosol dissemination tests were performed with various BW agents.

146 Alibek, K. *Biohazard*. (London: Random House UK Ltd., 1999)

bases there is an extreme scarcity of scientific publications from North Korea and hence, on material to make an objective judgement of the capacity for BW development, i.e. technology and research on BW agents. Reports from clinical medical facilities usually give a common view of infectious diseases´ status and vaccine coverage in a country of interest, including biological warfare agents.

In the following section an overview on sites which have been mentioned in connection with a biological programme is presented.

Facilities

Three separate branches have been accused to be involved in offensive work: the Central People's Committee, the Korean Worker's Party (Central Committee) and the National Defence Commission.[147] Almost twenty sites which are suspected in connection with offensive activities have been named in various publications. A tentative organisation tableau is presented with the various sites and an overview of the possible role in an offensive programme based on the presumed activities.

There is information on at least four research facilities organised under the Central People's Committee Academy of Science:

- Central Germ Research Laboratory
- Institute of Microbiological Diseases
- Kim Il-Sung University Medical College (1st, 2nd, 3rd Institute of Bacteriology)
- Pyongyang Medical College.

These civilian research sites of the Academy of Science are assumed to be involved in research and academic education, but there is no information available on the character of the research. They presumably conduct common research in the medical area, but may also have a role in supplying know-how (scientist or knowledge) to a biological programme of defensive as well as offensive character.

The Worker's Party Central Committee is asserted to be heading a separate research facility, the Central Biology Institute. In similarity to most of the North Korean institutes nothing is known about the activities of this institute. It may support a biological programme with know-how. Research with offensive purpose may be performed under cover.

Other facilities are believed to be subordinate to the National Defence Commission. The suggested organisation structure is the following:

1. Academy of Defence Science

- Bacteriological Institute
- Medical Research Institute (Nat'l. Defence Research Institute and Medical Academy)

The Bacteriological Institute and the Medical Research Institute under the Academy of Defence Science could be expected to perform research activities for the development of

147 Bermudez, J. S. *Exposing the North Korean BW Arsenal*, 29

means of protection of military personal to natural infectious diseases as well as biological warfare agents. The research is reported to be focused on the causative agents of anthrax, botulism, bubonic plague, cholera, hemorrhagic fever, smallpox, typhoid fever, typhus and yellow fever.[148] These diseases have been of medical importance in North Korea and, with the exception of smallpox[149], they are all expected to appear frequently. As a result clinical isolates (strains) from these diseases should be found in clinical and research laboratories. It should be logical to have activities going on for the development of vaccines, means of treatment and identification methods. Partially, such research could, of course, also have an offensive purpose. For instance, the mapping of pathogenic[150] properties useful for vaccine development might be used for the optimising of a biological agent and animal tests of the efficiency of a vaccine might in parallel be used also for the test of aerosolised agent. There is, however, no information available to support this hypothesis.

2. The 3rd/5th General Machinery Industrial Bureau

- February 25th Factory
- Field test facilities on island(s) in the Western Sea

North Koreas biological programme is believed to be managed separately from the general defence industry.[151] One site, however, is subordinate to the General Machinery Industrial Bureau. It is the February 25th Plant, which is assumed to have the capacity for germ production.[152] This is one of the sites which have been indicated for offensive activities by the South Korean officials. It is, however, hard to believe that North Korea with its stretched economy and inability even to produce the required vaccines for its populations (see below), would have an active factory for the production of biological weapons. A more attractive explanation is that this site is used for legal production of for instance organisms for the agricultural sector. In addition it may be a resting capacity in case North Korea would like to activate a production of biological weapons.

In a 1993 report of the Russian intelligence service it is stated that biological weapons have been tested on North Korean islands located along the western coast.[153] There is no more information available to support this accusation. Access to areas for field trials is, however, a prerequisite for the successful weaponization of biological agents.

3. Ministry of People's Armed Forces

- Armed Forces Medical College
- Medical Officers School
- Joint Research Institute
- Military Preventive Medical Unit

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148 Ibid, *Biological Capabilities*, URL <www.nti.org/e_research rofiles/NK/Biological/print/56.prt>.February 25, 2005.

149 Smallpox is an eradicated disease and stocks of the virus are supposed to be present only in the US and in Russia. Countries which have had strains originating from a domestic outbreak are supposed to have destroyed these.

150 Properties which are essential in the infectious process.

151 *North Korea Development Report 2003/04*, 180

152 *No. 25 Plant*, URL <http://www.nti.org/db/profiles/dprk/bio/fac/NKB_F_febr25_GO.html>

153 Russian Foreign Intelligence Service Report *Proliferation of Weapons of Mass Destruction*. 1993.

- *Onjong-ni* Biological Research Facilities.

It seems plausible that the Armed Forces Medical College and the Medical Officers School mainly are involved in education of military medical personal. They could also be expected to have education in protection against biological warfare agents such as detection, identification, and decontamination. Another unit which may have a more applied and technical function is the Military Prevention Medical Unit, also subordinated to the Ministry of People's Armed Forces. These three facilities seem to have a natural role in a biological defence programme.

According to a defector, Choe Ju Hwal, a former sergeant in the North Korean People's Army, the Joint Research Institute is responsible for the development of biological weapons.[154] This institute is subordinate to the Ministry of People's Armed Forces and it is a hot candidate for offensive activities, but there is no detailed information available. Another facility for biological research, which is reported to be located in Onjong-ni, is described to have research, development and testing of biological warfare agents. [155] It is claimed to have an underground location and to contain animal test facilities.

There are also some additional civilian facilities which have been mentioned in the various allegations of offensive activities. Two of these sites have epidemiological focus, the Sanitary Quarantine Institute (or National Sanitary and Anti-Epidemic Centre) and the *Paekma* Epidemic Control Centre.[156] These facilities are subordinate to the Ministry of Public Health. The Sanitary Quarantine Centre[157] has the responsibility of the nationwide sanitation, immunisation to various infectious diseases, hygienic care of children, prevent parasites and perform quarantine against infectious diseases from abroad. The Hemorrhagic Fever Laboratory is established under this facility.[158] Hemorrhagic fevers are common in East Asia and North Korea needs a laboratory capacity for proper diagnosis of the diseases.

Biotechnology and production capacity

North Korea is supposed to have a basic biotechnological infrastructure on a level corresponding to other Asian countries, such as China. In this respect, scientific contacts and exchange with China and Russia or the former Soviet Union is believed to have forced the previous development, for instance in the pharmaceutical sector. The lack of public information, however, makes it difficult to make any reliable judgement of the know-how in biotechnology. The economic draw-back in the 1990's is believed to have influenced the development in biotechnology negatively.

One hypothesis is that North Korea relies on the capability to produce BW agents in dual purpose facilities when requested. Thus, in addition to the previously mentioned biological sites, a number of biotechnology facilities have been described.[159] According to the

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154 Ibid.

155 *Onjong-ri Biological Warfare (BW) Agent Testing Facility*, URL <http://www.nti.org/db/profiles/dprk/bio/fac/NKB_F_onjong_GO.html>

156 *Biological Facilities*, URL <http://www.nti.org/e_research/profiles/NK/Biological/print/57.prt>

157 *National Sanitary and Anti-Epidemic Centre*, URL <http://www.nti.org/db/profiles/dprk/bio/fac/NKB_F_cntqua_GO.html>

158 *North Korea's Chemical and Biological Programmes*, 58

159 Ibid.

description they all have production capability in the pharmaceutical area. Some of the facilities may play a role in the biological protection programme, i.e. for production of vaccines or drugs. With the purpose to make a judgement of the potential capacity for production of biological warfare agents, biotechnology industry has been reviewed.

- *Aeguk* Compound Microbe Centre: development and production of microbial-based fertiliser supplements. It supplies microbial stocks to the North Korea's 120 fertiliser factories and it could in parallel be responsible for storing seed stocks of BW agents.

- *Aeguk* Preventive Medicine Production Factory: ten laboratories with development and production of vaccines and medicines. For instance, a recombinant hepatitis B vaccine has been developed and produced in yeast. The facility is presumed to have the capacity also for the large production scale production of biological warfare agents if requested.

- Branch Academy of Cell and Gene Engineering: research on cellular biology and genetic engineering, for instance of human growth hormone, snake-venom derived anti-coagulants, genetically modified crops and vaccines. It is also manufacturing restriction endonucleases. This facility has a perfectly legal activity reflecting an established biotechnology infrastructure.

- *Kyong-t´ae* Endocrinology Institute: diagnosis and treatment of various diseases. Comprises three laboratories, one is the Generic Engineering Laboratory. There is doubt if this institute could have any active role in a BW programme more than as a possible common source of scientist with a proper experience.

- Industrial Microbiology Institute: development and production of microbial cultures for feed supplements, medicines and vaccines. The institute is located in *P´yongsong* City in the South *P´yongan* Province and it is subordinate to the Academy of Sciences. It has been confirmed that vaccines to diphtheria, hemorrhagic fevers and Japanese B encephalitis have been produced at this site.[160] This institute seems to have the appropriate infrastructure for a BW site or a support for such a site.

- Industrial Medical Institute: research and development of prophylactic treatment focused on industrial diseases. The institute is located in *Hamhung* city of South *Hamgyong* Province.[161] It does not have an apparent profile of an offensive institute but could eventually support a programme.

- *Munchon* Agar Plant: production of agar for growth media. The assessed production is 200 tons a year (1992). It has been calculated that this plant theoretically can support the production of about 1000 tons of bacteria each year. It is supposed to support legal purposes and to be a mobilisation site. North Korea is presumed to have a sufficient indigenous production of growth media which could support a mobilised production.

- Pharmaceutical Institute of the Academy of Medical Sciences: research and development of medicaments, for instance nutritive supplement such as amino acid

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160 *Industrial Microbiology Institute*,
URL <http://www.nti.org/db/profiles/dprk/bio/fac/NKB_F_indmic_GO.html> May 3, 2005.

161 *Industrial Medical Institute under Academy of Medical Science*,
URL <http://www.globalsecurity.org/wmd/library/news/dprk/2004/04/dprk-040428-kcna05.htm>

derived from industrial by-products. The products of this institute may be important for North Korea's independence concerning growth media for microorganisms and cells.

- Synthetic Pharmaceutical Division at *Hamhung* Clinical Medicine Institute: research and development of medicaments and clinical diagnostics, for instance test of antibiotic susceptibility. This institute is most possible a perfectly civilian site with an important role in the public health system and eventually also for a defensive programme.

- *Taedonggang* Reagent Company: research and development of vaccines (hepatitis B vaccine) and diagnostics. By analogy with the previous institute this company is believed to have a legal role in the public health system. It could, of course, contribute to the technology infrastructure concerning protection measures to biological weapons.

In spite of the lack of detailed information on these sites, some conclusions may anyhow be drawn from it. North Korea has the technical ability for genetic engineering; this is reflected by the construction of a recombinant vaccine to hepatitis B, human growth hormone and genetically modified crops. Moreover, the techniques have been used in various cell systems. Apparently North Korea has the basic know-how for production of recombinant products of various origins as well as industrial scale production. Science Magazine reported in 2004 that an American journalist was invited to North Korea where he met scientists in various branches and for instance the successful cloning of a rabbit was demonstrated.[162] If this is true it verifies the general picture of competent scientists, which have gain know-how in the biotechnological area and its various techniques, such as genetic engineering. It could, however, be suspected that there are only a few successful examples of applications of the technical breakthrough, because of the stretched economy.

The country also produces micro organisms for agriculture, indicating know-how in selection and/or construction of such organisms. Presumably efforts have been spent on means to increase the yields from farming in order to feed the population.

According to NTI North Korea has a microencapsulating technique to protect its biological agents.[163] Microencapsulating is a commonly used in pharmaceutical industry in purpose to protect biological and chemical substances. Similarly, it is a possible technique for protection of bacteria and viruses intended for use in weapons. It is usually associated to a high technology offensive programme and there are doubts about the extent to which North Korea has a biotechnology infrastructure to support an offensive programme.

North Korea is very likely to have an indigenous manufacturing capacity for much of the material and equipment required in research and development. Considering the isolation and strained economic situation of North Korea, the country has been forced to support itself with similar products, which are used in large quantities in biological laboratories. For instance there is information on an agar production facility, the *Munchon* Agar Plant, which has a production capability of several tons. The production of restriction endonucleases is performed at the Branch Academy of Cell and Gene Engineering. Restriction endonucleases are necessary tools in genetic engineering, but there is no

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[162] Neureiter, N.P. *Talking with North Korea*, Science (2004) 305, 1677; Stone, R. *North Korea: Visiting the Hermit Kingdom*, Science (2004) 305, 1696.

[163] NTI, Nuclear Threat Initiative, an organisation working to reduce the global threats from WMD. URL <www.nti.org>

information on the type of enzymes or production capacity. It can, however, be questioned if North Korea has been able to support the indigenous laboratories in the last decade.

North Korea is believed to have a partly indigenous production of equipment for laboratory work and industry. For instance it has been reported that the Industrial Microbiology Institute produces its own equipment such as reactors, fermenters and driers.[164] Equipment is also reported to be imported from Japan. There is some information on advanced biotech-related equipment which has been manufactured from abroad, such as a peptide sequencer originating from an American firm.[165]

Vaccines and therapeutics

For the purpose of assessing the supply of means of protection against biological warfare agents it is of interest to gain access to national information on vaccines, drugs and infectious disease in North Korea. There is, however, no such information available. Alternative sources of information are the UN, WHO and various other NGOs which have been welcomed in North Korea since 1995. A UN agency was established in Pyongyang in 2001.[166] Gro Harlem Brundtland, Director General of the WHO, called in 2001 the North Korean government to allocate more funds to the public health care, which at the time accounted for only 3 % of the national budget.

Considering the accusations for offensive research on several agents, it is of special interest to scrutinise the status of the agents commonly mentioned as BW agents, as well as antibiotics, antiviral substances and identification methods for these agents in North Korea.

North Korea has built up a public-health system, which in the 1970-80's was one of the best in the world.[167] The economic decline in the 1990's was followed by a decay of the health sector with an acute shortage of medical and hospital supplies. The precarious situation has been officially admitted by North Korean government representatives at various occasions.[168] Infectious diseases such as tuberculosis and malaria have reappeared as significant public health problems.[169] Diarrhoeal diseases have increased because of deterioration in water and sanitation system. The situation concerning other infectious diseases is most likely the same. Due to the limited access to information resources on modern trends in health and medicine the system is outdated. There is a need of an extensive process of capacity building to improve skills and technology and also the epidemiological surveillance for communicable diseases.

Technical support has been provided by WHO to the tuberculosis control programme, including the necessary anti-tuberculosis drugs. According to the WHO there is also an acute need for improved diagnostic facilities and anti-malaria drugs to fight malaria, which

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164 *Industrial Microbiology Institute*,
URL <http://www.nti.org/db/profiles/dprk/bio/fac/NKB_F_indmic_GO.html> May 3, 2005.

165 *Biological Import and Export Overview*,
URL <http://www.nti.org/e_research/profiles/NK/Biological/print/59.prt> February 25, 2005

166 Watts, J. *Brundtland asks North Korean government to spend more on health*, The Lancet (2001) 358, 1882.

167 *Health-care divide widens in North Korea*, The Lancet (2003) 362, 2072.

168 Ahmad, K. *North Korean government admits that health of children is very poor*, The Lancet (2001) 357, 1684.

169 *WHO Country Cooperation Strategy 2004-2008*. WHO June 2003.

is assessed to be a risk for 40 % of the population. Other organisations have supported vaccinations against hepatitis B, which has emerged as another medical problem in North Korea.

The medical problems reported by WHO reflect that North Korea has a shortage of medicines and supplies at all levels. National production of drugs has largely declined. Traditional Koryo medicines, produced mainly from roots, comprise about 70 % of drugs used in some province hospitals and antibiotics are used only for extreme emergencies.[170] Basic Western drugs are commercially available and some drugs have labels in Russian. North Korea has four pharmaceutical companies which produce Western medicine.[171] The North Korean government has taken a very friendly attitude to Western investments which have been necessary to reach international standards of quality. Chinese medicine is also possible to buy in shops.[172]

The public health system included a vast vaccination programme and the vaccination coverage was almost 100 % before 1994.[173] In the following decade the coverage dropped significantly because of lack of available vaccines. Immunisations and vaccines are high on WHO's agenda for the period 2004-2008. According to UNICEF's 2002 statistics on North Korea the majority of one-year old children was fully vaccinated against tuberculosis (88 %), polio (99 %) and measles (95 %) while 68 % were vaccinated with the DPT3[174] vaccine.[175] In addition, the WHO priorities 2004-2008 also include hepatitis B, intestinal infections and parasitic diseases. According to a North Korean health official, hepatitis B is the second largest public health problem and vaccination is the most effective form of prevention.[176] Apparently North Korea is unable to produce their own version of hepatitis B vaccine, which is claimed to be one of the products of the Industrial Microbiology Institute, *Aeguk* Preventive Medicine Production Factory and *Taedonggang* Reagent Company (see above, Biotechnology and production capacity).

Other infectious diseases, which are endemic in North Korea, are Japanese encephalitis, Dengue fever, Korean hemorrhagic fever, rabies, epidemic typhus, scrub typhus and plague.[177] In 2005 North Korea still had no reported case of SARS, but the health authorities have been frightened of it. The hostile North Korean attitude concerning information on epidemiology changed markedly after the outbreak of SARS in China 2003.

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170 Owen-Davies, J. *North Korea's public health tragedy*, The Lancet (200) 357, 628.

171 *North Korea's Friendly Attitude Towards Foreign Invested Pharmaceutical Companies*, October 12, 2004.
URL <http://crm.kotra.or.kr/main/common_bbs/notice_read_nk.php3?board_id=21&pnum=899646&cnum=0>

172 *North Korea's healthy façade hides dying nation*, The Lancet (2002) 359, 1840.

173 *North Korean government admits that health of children is very poor*, The Lancet (2001) 357, 1684.

174 Diphtheria, tetanus, and pertussis vaccine.

175 *UNICEF At a glance: Korea, Democratic People's Republic of, URL* < www.unicef.org>. May 3, 2005.

176 Goe, L.C., J.A. Linton. *Community-based public health interventions in North Korea: one non-governmental organization's experience with tuberculosis and hepatitis B*, Public Health (2005) 119, 347.

177 *North Korea – Vector Risk Assessment Profile*, The Navy Disease Vector Ecology and Control Centre, URL <http://www-nehc.med.navy.mil/ May 3, 2005>

For instance, North Korean delegates were permitted to attend international conferences on infectious diseases.[178]

In 2005 North Korea was hit by an outbreak of the avian influenza, "the bird flu", which killed thousands of chickens at a Pyongyang farm.[179] North Korea officially informed the FAO[180] regional network of the avian influenza on March 27 and allowed verifying tests.[181] North Korea has claimed that the country is free from the disease, which according to WHO has killed 46 persons in the Far East since 2003. Despite the long history of self-imposed isolation, North Korea has increasingly been cooperating with international agencies over the past decade and in 2004 the country joined an UN network for East Asian countries to cooperate in fighting the avian flu.[182] Considering the present status of the public health system and malnutrition, an outbreak of this influenza among humans would be fatal for the North Korean population.

North Korean scientists have been interested in questions concerning the activation or stimulation of the immune system. They are for instance reported to have succeeded in developing immunoregulators from bacterial cell walls and one product was in clinical trials in the 1990's.[183] This immunoregulator won a gold medal at an international exhibition in 1993.[184]

In conclusion, the described situation reflects the incapability for domestic production of basic drugs and vaccines. Moreover, the assessment is that development in the pharmaceutical sector has been hampered by the strained economical situation. Thus, North Korea is heavily depending on aid for production of pharmaceutical products. In addition, it could be expected that the majority of national vaccines are of old generation design, the recombinant hepatitis B vaccine being an exception. Presumably, the same situation is true also for vaccines to biological warfare agents, such as the anthrax agent. North Korea has a similar dependence on international aid in order to produce the necessary drugs for public health diseases of concern. It is no reason to suspect that drugs for treatment of infectious diseases caused by biological warfare agents are more easily available. In order to adjust to international standards of quality the domestic pharmaceutical industry has to improve the product quality.

Biological warfare agents

Several infectious agents have been mentioned in the context of a North Korean offensive programme.[185] These are all agents which are present or have caused outbreaks in North Korea, see above. Endemic organisms could be expected to be in focus for research in

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178 Watts, J. *UN highlights North Korea in appeal for aid*, The Lancet (2003) 362, 1814.

179 *Bird flu hits North Korea*, Agence France Presse, March 15, 2005. URL <http://news.inq7net/common/print.php?index=3&story_id=30600&site_id=22>

180 FAO, The United Nations Food and Agricultural Organization.

181 Normile, D. *North Korea collaborates to fight bird flu*, Science (2005) 308, 175

182 Ibid.

183 *Industrial Microbiology Institute*, URL <http://www.nti.org/db/profiles/dprk/bio/fac/NKB_F_indmic_GO.html> May 3, 2005.

184 *The 23rd Geneva International Exhibition of Inventions, New Techniques and Products*, April 1993.

185 *Biological Capabilities*, URL <http://www.nti.org/e_research/profiles/NK/Biological/print/56.prt.> May 3, 2005.

universities and medical colleges. Hence, information of microbiological legal research could have been misinterpreted as offensive activities. Hemorrhagic fever viruses, encephalitis viruses and yellow fever virus should normally be found in outbreaks. A Korean hemorrhagic fever vaccine has been developed and it is produced at the Industrial Microbiology Institute.[186] This institute is reported also to produce a Japanese encephalitis vaccine, indicating that both these diseases have been and are a problem in North Korea.

The smallpox virus is the exception – smallpox is an eradicated disease and should not be found in North Korea. A possibility that can not be excluded is that North Korea has isolated smallpox virus from the epidemics of the 1960s and 1970s. The accusations have not been verified in any part and hence this piece of information is impossible to dismiss. It could, however, be suspected that smallpox is included in a suggested biological warfare list because of the great international concern of the virus.

Botulism, the disease caused by the toxin of the bacterium *Clostridium botulinus*, is a normal contribution to the public health problems of many states in Asia and Africa. It is expected to be a problem in North Korea and thus in research focus. The toxin has also for decades been one of the main agents on biological weapons lists.

In accordance to the previous discussion, the conclusion is that there are acceptable explanations to the interest for many "biological warfare agents". A North Korean offensive programme may as well have focused on some of these agents such as botulinus toxin, anthrax bacteria and encephalitis virus. These agents are all classical representatives of offensive activities.

Scientific and Technical capacity in areas with connection to BW

The North Korean scientists are expected to be well educated, but due to economical problems research can be expected to have "starved" for years. The overall picture is that in the decades previous to 1990's genetic engineering and biomedical technology emerged within North Korea. This predication may be verified by the ability to utilise genetic engineering on cells of various origin for applications in medicine as well as agriculture. However, due to the isolation of the state and its scientists and the economic shortcomings the development in the 1990's is expected to have partially declined. Moreover, considering the explosive development in the biotechnology area, North Korea will need years to catch up with the international development.

The achievements in biotechnology have been of benefit for the pharmaceutical industry all over the world, including North Korea. The report reflects that the country has many facilities which could be used for production of biological warfare agents. It is, however, an open question if North Korea at present has a capacity for indigenous production of either pharmaceutical products or biological warfare agents.

Delivery systems

The development of delivery systems for biological agents is depending on the strategy of the country. Biological agents may be used both as strategic and tactical weapons. Nothing is known about the strategy of North Korea concerning biological weapons, but it is

[186] *Industrial Microbiology Institute*,
URL <http://www.nti.org/db/profiles/dprk/bio/fac/NKB_F_indmic_GO.html> May 3, 2005.

assumed that they could be of interest as strategic weapons. It follows that know-how from the chemical programme may have been used for dissemination tests of biological agents. It is assumed that if the country had an offensive programme for decades, it has some weapon system for short-range delivery of biological agents. However, it is doubted that North Korea possesses any advanced system for long distance delivery. This assumption is based on the fact that most states with offensive biological programmes – even technically advanced states – have had utmost problems with the dissemination of biological agents.

11 South Korean Perception of the North Korean Chemical and Biological Threat

In countries which experience WMD threats from neighbouring countries one expect to find a high level of physical protection and other countermeasures, provided the country is not too poor to afford this. The most obvious example is Israel, a country in which both military personnel and civilians have access to the most modern equipment, and are trained in how to use protective masks and how to behave. Sweden used to be another example in regard to the protection of civilians, especially during the USSR era.

South Korean rhetoric claims that North Korea has a CW potential, which today – if true - must be regarded as the leading available one in the world.[187] Are preparations and protection in South Korea at a level corresponding to the oratory?

One should have in mind that prior to 1997 and its ratification of the CWC, South Korea had a possibility to retaliate any attack with chemical weapons. South Korea had one CW production facility and might have hundreds of tons of CW munitions, including nerve agents. These stockpiles are now under destruction. Any countermeasure of today is thus of defensive character.

There is a small but well-developed defensive NBC-equipment industry in South Korea.[188] Items produced are: light-weight decontamination equipment for military and civil defence, a reconnaissance vehicle, and NBC filters for collective protection. For personal protection, *Samgong* Industrial Company manufactures both NBC protective clothing (suits, gloves, and boots) and protective masks including a hood and mask for civilian defence. Obviously the U.S. and South Korean military forces are very well equipped and trained for unconventional and especially chemical warfare.

However, that does not seem to be the case for the civilian population.[189,190] There are some exceptions, due to actions of the U.S. Force Korea, which has announced that all Department of Defence employees and their families will get protective masks.[191] Whether civilian masks should be distributed to all citizens seems to be an issue under discussion. As the pre-warning time for Seoul is only a couple of minutes, the masks must be available at homes and workplaces to be effective countermeasures against any North Korean missile attack with CBW. South Korean authorities seem to hesitate, partly because of the cost. A contributing factor could be that a protective mask in every man's possession means that police forces loose one weapon in any riot control action, i.e. tear gases. Fire brigades are equipped with some protective materials like decontamination systems and breathing aids, the emphasis being on chemical defence.

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187 U.S. and Russia both still have bigger stockpiles, but as these are declared to OPCW and are under destruction, they are not available for use, unless the country withdraws from the convention.

188 *Jane's Nuclear, Biological and Chemical Defence* 2002-2003

189 *North Korea Advisory Group, Report to the Speaker, U.S. House of Representatives*, November 1999. Available at URL <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB87/nk21.pdf >

190 *North Korea Chemical Profile*,
URL <http://www.nti.org/db/profiles/dprk/chem/over/NKC_OGo_bg.html

191 *Chemex*, URL <http://globalsecurity.org/military/ops/chemex.htm>

In addition, joint military exercises conducted by the U.S. forces and the South Korean military, for example Foal Eagle[192], include preparedness against weapons of mass destruction. The exercises are defensive in nature and contain nuclear, biological and chemical decontamination drills, along with hospital exercises focusing on mass-casualty scenarios.[193]

The preparedness in civilian defence in South Korea is thus surprisingly low for both chemical and biological attacks.

[192] Foal Eagle is a counter-infiltration exercise that has been conducted annually since 1961. It is purely for defensive purposes, which tests the ability of South Korea to defend itself, assisted by the U.S. armed forces. It is primarily a rear-area exercise in which troops defend against invading forces, hostile Special Forces and commando attacks, or sabotage operations on critical rear-area targets. "Foal Eagle," *Global Security Organization*, URL < www.globalsecurity.org/military/ops/foal-eagle.htm>

[193] Lea, Jim, *Foal Eagle 2000 to feature about 25,000 troops*, Stars and Stripes, October 12, 2000. URL <www.pstripes.com/ed101200e.html>

12 Discussion

The threat from weapons of mass destruction has been a firm conviction in North Korea from the very beginning of the state's existence. The background might be related to the experiences from the Korean War, which were interpreted as attacks with biological or chemical weapons. This interpretation was heavily supported – if not invented – by the Soviet Union and China. The belief that North Korea's main adversaries, i.e. the U.S. and South Korea, would not hesitate to use biological and chemical weapons in inevitable future armed conflicts was taken for granted. Thus, North Korea early decided to develop CBW in the mid-1950. The importance of non-conventional weapons can also be detected in North Korea's military doctrine, emphasized by Kim Il-sung in the 1960's, with the proclamation of *chemicalization*. Continued adherence can be distinguished by Pyongyang's firm devotion to its military-first policy, in where weapons of mass destruction play an integral part. It is most likely that North Korea's development of CBW was for different purposes. Chemical weapons have long been regarded as integral for offensive military purposes, while biological weapons might have been produced for strategic reasons. Today one can assume that the value and necessity of CBW has decreased due to the missile and nuclear capability that North Korea is believed to hold. However, the pure belief that Pyongyang possesses these weapons, as is the view in the U.S. and South Korea, can in itself be seen as an asymmetric strategy by the leadership in order to avoid confrontation and, reduce North Korea's inferiority in regard to conventional military power.

It is assumed that North Korea's research efforts were initially concentrated on defensive countermeasures. In the late 1950s, and in the following decades, the chemical and biological programmes also involved offensive research and development. With help from the communist regimes in the Soviet Union and China, and in a flourishing economy, North Korea was successful for a long period. In the beginning of this period the annual growth rate was as high as 12 %, and industries, not the least chemical ones, were growing and expanding. Hundreds or thousands of tons of chemical warfare agents, including nerve agents and mustard gas, were produced and stockpiled. On the biological side, North Korea is assumed to have succeeded in developing a few "classical agents" such as the anthrax agent. The biological programme was most likely on a low technical level and the benefits from for instance gene technology was not utilised. On the conditions that the North Korean offensive programme was terminated – accidentally or finally – late in the 1980's, the country has no stockpiles of BW with retained activity.

North Korea is, and has been, very sparing in acts and rhetoric concerning its present attitude in CBW issues, especially when compared to the nuclear question. However, there are some steps taken that could be interpreted as signs of a more modern view on CB weapons and an adaptation to an altered international arena. North Korea signed both the Biological and Toxin Weapons Convention and the Geneva Protocol from 1925 in the late 1980´s, and these measures are assessed to reflect that the country has changed its view on BW. The weapons are no longer thought to be an integral part of the military capacity – if they ever were. Furthermore, North Korea has recently declared that it will enact comprehensive laws to control production, exports and imports of certain chemical and biological substances (see Chapter 7). The BTWC was signed in 1987 – 15 years after the convention was open for signature and after the signature from South Korea. The Geneva

Protocol, which primarily was a protocol intended for banning chemical weapons but also include BW, was signed by both states in 1989.

Of course it is highly unsatisfactory that North Korea is one of the few remaining states which is not a state party of the chemical weapons convention. There could be many reasons why the threshold for signing the CWC seems to be much higher compared to the threshold for joining the BTWC or the Geneva Protocol. One explanation is obvious: North Korea does not want to loose a weapon which might be useful in a future armed conflict (less probable) or which might be useful in negotiations (more probable). Another explanation could be that North Korea realises that by joining the convention, which would mean a destruction programme, is a very costly business; a lesson that North Korea has learnt from Russia. Coupled with this economic aspect, one should look at the political aspects as mentioned earlier - North Korea might find the control mechanisms of the CWC too intrusive. These two last-mentioned aspects are exclusively related to the chemical weapons convention. However, if North Korea was to return to the NPT, as was indicated in the September 19, 2005 statement[194], chemical weapons would increase in military and political importance.

Nevertheless, even non-signatory states are, thanks to the unexpectedly high success rate of the convention, subject to important limitations set forth by the convention. For example, North Korea used to be very dependent on the Soviet Union and China, regarding expertise and material, in the development and production of chemical weapons. These friendly neighbours are not only state parties but also serious in their efforts to follow the convention, which excludes any assistance. North Korea could thus, even if there was a political incentive for a continuation of the efforts in the CBW area, pragmatically find it not worthwhile. The problems for North Korea in attaining material for their WMD programmes have accelerated due to the Proliferation Security Initiative (PSI). The initiative, launched in 2003, might not have seen much success so far, but one of the chemical seizures mentioned earlier was PSI related.

Thus, at present it can be assumed that it is very difficult for North Korea to develop and produce biological or chemical weapons due to constraints in the economy, infrastructure and the alleged inferior status of the industries concerned, as discussed in Chapters 9 and 10. In the case that North Korea should reappraise the value of BW or CW, it could of course easily shift a dual-use facility for clandestine production. Many reports contain allegations that North Korea has several such industries which are used for the production of BW agents. According to the arguments presented in this report, these facilities have, with a few exceptions, at present not the capacity for any large-scale legal production. The exceptions are facilities which have received international assistance and support for the production of essential medicines such as antibiotics. In the chemical field the assessment is that North Korea mainly rely on old declining stocks, but should have no problems in renewing these, at least not World War I agents like mustard and phosgene. Hence, North

[194] A joint statement was issued at the six-party talks held in Beijing; Joint Statement of the Fourth Round of the Six-Party Talks Beijing, 19 September 2005. The first part of the statement included a commitment from the DPRK to abandoning all nuclear weapons and existing nuclear programs and returning, at an early date, to the Treaty on the Non-Proliferation of Nuclear Weapons and to IAEA safeguards. For the full statement see *Joint Statement Released at Six-Party Talks*, Korean Central News Agency, September 20, 2005. URL< http://www.kcna.co.jp/index-e.htm >

Korea maintains a chemical capability that quantitatively might be the same as it has been for the past two decades, but which loses in quality.

Is there still a political conviction in North Korea that biological and chemical weapons are of outermost importance for defence? It is hard to believe that the leading and educated classes today find it probable that the U.S. or South Korea would ever use these types of weapons, the chemical ones furthermore being under destruction. Thus, the old qualification for CB defence, in a wide meaning, has disappeared. Still, the regime might find it prosperous to give other signals, both to the population and to the surrounding world.

North Korea is much more successful in the nuclear and in the missile areas. This fact probably influences the present view on biological and chemical weapons. A nuclear weapon is of course much more powerful and threatening than any biological or chemical weapon. The nuclear aspects, although not covered in this report, do contribute to the conclusion that North Korea's chemical and biological programmes are more outdated than real threats in 2005.

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Phone: +46 90 10 66 00
Fax: +46 90 10 68 00

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