

The North Korea  
Instability  
Project

# Overview of North Korea's NBC Infrastructure

Joseph S. Bermudez, Jr.  
June 2017

**Joseph S. Bermudez Jr.** is an internationally recognized analyst, award winning author and lecturer on North Korean defense and intelligence affairs and ballistic missile development in the Third World. He is concurrently Chief Analytics Officer and co-founder of AllSource Analysis, Inc., Founder and CEO of KPA Associates, LLC and has served as: senior all-source analyst for DigitalGlobe's Analysis Center; senior analyst, consultant and author for IHS Markit (formerly the Jane's Information Group); the publisher and editor of KPA Journal; and other related positions.

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## Executive Summary

During the past 40+ years North Korea has consistently pursued expanding its nuclear, biological and chemical (NBC) programs with impressive single-mindedness and determination, and fully in line with its national philosophy of *juche* (self-sufficiency). Available information indicates that North Korea: possesses—or will soon possess—operational nuclear weapons and continues to develop such weapons; possesses an ongoing offensive biological weapons research program, may possess an inventory of these weapons and continues to conduct research into new capabilities; and possesses a longstanding chemical weapons program with a militarily significant inventory of such weapons, and continues to conduct research into more advanced chemical weapons.

To achieve its current level of technology and proficiency, North Korea has overcome numerous and significant obstacles to develop extensive diversified infrastructures to conduct NBC research and development, testing and weapons production. An understanding of these infrastructures is essential in mitigating NBC weapons usage during periods of instability, preventing onward proliferation and in planning and conducting operations to locate, secure and eliminate NBC capabilities when the need arises. Any such operations will face considerable challenges as North Korea has deliberately built its NBC infrastructures in extreme secrecy; undertaken camouflage, concealment and deception operations to mask the NBC infrastructure; made extensive use of legitimate defensive or civilian industrial and research infrastructures; and has dispersed NBC facilities throughout the country. It is therefore highly probable that there are significant elements of the NBC programs and their infrastructures that are simply unknown outside the North Korean government.

## Overview of North Korea's NBC Infrastructure

### I. North Korea's NBC Infrastructure

In its simplest form, all power and decision-making within North Korea ultimately resides with Kim Jong Un who is simultaneously Chairman of the State Administrative Commission<sup>1</sup>, Chairman of the Korean Workers' Party (KWP) and Supreme Commander of the Korean People's Army (KPA). For the nuclear, chemical and biological warfare (NBC) programs, it then passes down through three intertwined and synergistic chains-of-command—the Supreme People's Assembly (SPA), KWP Central Committee and KPA. Additionally, the Guard Command and Ministry of State Security have responsibilities for overall security within the NBC infrastructure and the Guard Command likely has a weapons custodial responsibility.

The Munitions Industry Department is subordinate to both the KWP's Central Military Committee and Executive Policy Bureau. This organization exercises overall responsibility for the policy planning, research, development, financing, production and distribution of all weapons, military equipment and related technologies.<sup>2</sup> Additionally, in coordination with other components of the KWP, it is ultimately responsible for the majority of foreign arms acquisitions and sales (e.g., ballistic missiles, NBC, etc.). The Munitions Industry Department accomplishes its responsibilities through two primary organizations—the Second Economic Committee and the Academy of National Defense Sciences.<sup>3</sup> In its broadest sense, the Second Economic Committee is responsible for production and the Academy of National Defense Sciences for research.

The Second Economic Committee is reportedly composed of the First through Seventh Machine Industry Bureaus, General Bureau, External Economic Affairs Bureau and Materials Company.<sup>4</sup> These bureaus are each responsible for a specific group of weapon systems and coordinate their activities with their counterpart bureaus within the KPA (e.g., the Third Machine Industry Bureau works with the Artillery Command, etc.) and the Academy of National Defense Sciences. Each bureau exercises day-to-day control over its subordinate facilities and organizations through a network of branch offices located throughout the country. NBC and ballistic missile development

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1 The State Affairs Commission is the highest decision making body in the North Korean government as of 2016.

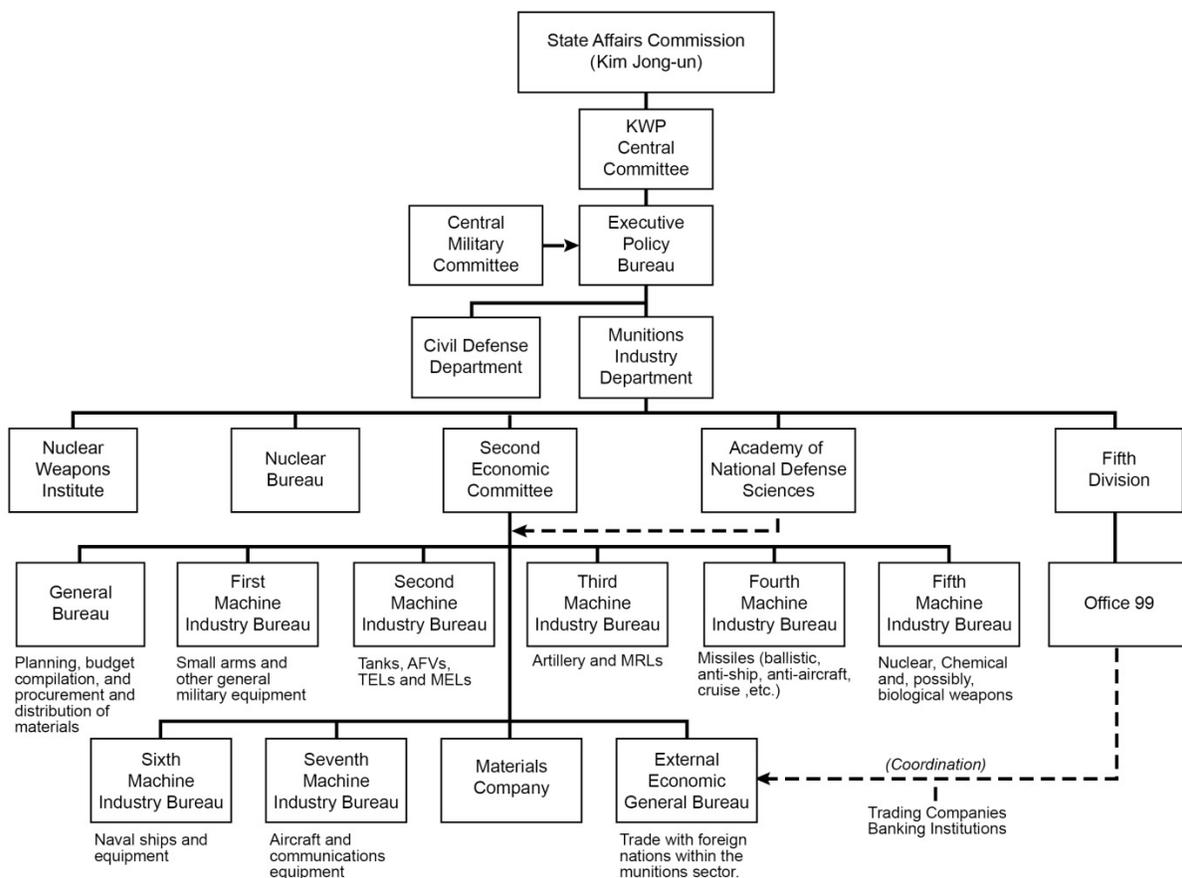
2 The Munitions Industry Department is sometimes known as the Military Supplies Industry Department.

3 Early in 2016, North Korea restored the name of the Second Academy of Natural Sciences (SANS) back to its original name of the Academy of National Defense Science (ANDS). "N.K. Renames Agency Handling Weapons Development," *Yonhap News*, March 20, 2017, <http://english.yonhapnews.co.kr/northkorea/2017/03/20/0401000000AEN20170320007051315.html>.

4 The numbered bureaus are frequently identified as General Bureau, Machinery Industry General Bureau, General Machine Industry Bureau or General Machinery Industry Bureau.

responsibilities reside primarily with the Second (transporter-erector-launcher [TEL], mobile-erector-launcher [MEL], and specialized vehicles), Third (self-propelled artillery and multiple rocket launcher systems), Fourth (ballistic missiles) and Fifth (NBC development and production) Bureaus.

The Academy of National Defense Sciences is the research and development arm of North Korea's munitions industry and is at the center of the nation's ballistic missile and NBC programs. It also appears to be responsible for providing professional training to scientists, researchers and technicians in the various specialized fields of weapons development and production. It is estimated that there are more than 50 different divisions, research institutes, test facilities and production entities are subordinate to the Academy of National Defense Sciences—all focused upon different aspects of military research and development.



### North Korea's Second Economic Committee (Simplified)

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Subordinate to the Supreme People's Assembly's Cabinet are the many ministries, commissions and departments that make up the government. Among the most significant of these to North Korea's NBC infrastructure are the State Academy of Sciences, State Academy of Medical Sciences, Ministry of Atomic Energy Industry, Ministry of Chemical Industry, Ministry of Extractive Industries, Ministry of Agriculture and Ministry of Public Health.

While there are numerous organizations within the KPA that have responsibilities contributing to the NBC infrastructure, two of the most significant are the Nuclear-Chemical Defense Bureau and the Strategic Force. The Nuclear-Chemical Defense Bureau is responsible for NBC defense within the KPA and production and distribution of defensive equipment. Significantly, it also exercises oversight and technical assistance for chemical precursor and agent production, and the distribution and storage of chemical weapons. The bureau is also believed to support the biological weapons (BW) program and has input, at the policy level and perhaps more, into the nuclear weapons development infrastructure. The Strategic Force is the organization within the KPA tasked with ballistic missiles operations and, as has been emphasized in numerous North Korean statements, it is apparently the primary organization responsible for the employment of nuclear weapons.

It is obvious, but nonetheless important to note, that there are considerable gaps in the knowledge base of North Korea's NBC infrastructure. The reasons for this are numerous but can broadly be ascribed to secrecy, dispersal of activities around the nation, a deliberate policy of camouflage, concealment and deception at all levels, an organizational environment that frequently establishes *ad hoc* entities for time-limited endeavors and the dynamic nature of internal politics that affects the political fortunes of numerous institutions and personnel. It is a forgone conclusion that there are numerous entities involved in the NBC infrastructure that are simply unknown outside of North Korea.

This preliminary briefing presents a general overview of the North Korea's NBC infrastructure, establishes a framework into which more specific information can be placed, and helps identify additional areas of potential research.

## II. Biological Weapons Infrastructure

### 1. General

According to the US Defense Intelligence Agency:

North Korea is estimated to possess an offensive biological warfare program designed to develop, produce and weaponize agents. Despite limited intelligence on the status of its biological warfare capabilities, North Korea is thought to have developed agents including an anthrax plague, cholera and toxins. The North Korea military will continue to try to increase production rates for traditional biological warfare agents concurrent with Pyongyang's effort to develop its pharmaceutical and biological products industries, but is unlikely to deploy genetically engineered biological warfare agents within the next decade.<sup>5</sup>

In a 2001 speech to the 5<sup>th</sup> Biological Weapons Convention RevCon Meeting in Geneva, then-Under Secretary for Arms Control and International Security, John Bolton elaborated:

North Korea has a dedicated, national-level effort to achieve a BW capability and has developed and produced, and may have weaponized, BW agents in violation of the [Biological and Toxin Weapons] Convention. Despite the fact that its citizens are starving, the leadership in Pyongyang has spent large sums of money to acquire the resources,

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<sup>5</sup> Defense Intelligence Agency, *A Primer on the Future Threat, The Decades Ahead: 1999-2020*, July 1999, p. 79 [Declassified].

including a biotechnology infrastructure, capable of producing infectious agents, toxins, and other crude biological weapons. It likely has the capability to produce sufficient quantities of biological agents for military purposes within weeks of deciding to do so, and has a variety of means at its disposal for delivering these deadly weapons.<sup>6</sup>

In general, the offensive employment of biological weapons by the KPA does not appear to have received the attention or resources given to chemical weapons. This is probably due to North Korea's limitations in bio-technology and the realization that once employed, there is almost no control over such weapons. Additionally, the KPA must calculate that biological warfare is potentially a greater threat to the KPA than to South Korea or the United States due to its limited medical and bio-medical capabilities. For exactly this reason, however, defensive BW has apparently received significant attention.

## 2. Organization

In its simplest form, the organization for the BW program is similar to the overall NBC program, with some specific modifications. Subordinate to the Cabinet, it is believed that the Ministries of Agriculture and Public Health provide some level of theoretical and practical research and information that inform the BW program. The Academies of Science and Medical Sciences reportedly provide theoretical and practical research and information, train personnel and conduct specific BW-related research and development. The KWP's Civil Defense Department coordinates with the KPA General Staff Department's Civil Defense Bureau and both have a defensive responsibility in coordination with the Ministries of Agriculture and Public Health.

Components of the Munitions Industry Department's Academy of National Defense Sciences and Second Economic Committee have the primary research, development and production responsibilities for BW. Within the Academy of National Defense Sciences there are several research institutes and laboratories that are dedicated to BW development and these have reportedly operated several different test facilities. Within the Second Economic Committee the Third and Fifth Bureaus appear to have a leading role in BW development and production.

Within the KPA, it appears that the primary BW defense responsibility resides with the Nuclear-Chemical Defense Bureau. This bureau, through its subordinate research, training and storage components, appears to also have a research and support role.

As with all North Korea's NBC infrastructures, there are presently no detailed and accurate estimates of the number of personnel or organizations involved in the research, development, testing or employment of biological weapons. A rough order-of-magnitude estimate, however, suggests that there are 25-50 entities and 1,500-3,000 personnel directly involved in various aspects of the BW program.

## 3. Research, Development and Production

Little is known about the specific entities engaged in BW research and development. Since the

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6 Department of State, *John R. Bolton, Under Secretary for Arms Control and International Security: Remarks to the 5th Biological Weapons Convention RevCon Meeting, Geneva, Switzerland, November 19, 2001*, <https://2001-2009.state.gov/t/us/rm/janjuly/6231.htm>

late 1980s, several entities have been associated with the BW program, yet details remain elusive and most information remains to be confirmed. Among the reported research, development and production entities are:

Facility	Subordination	Location
1 <sup>st</sup> Biological Research Institute	State Academy of Sciences	Pyongyang
2 <sup>nd</sup> Biological Research Institute	State Academy of Sciences	Hamhung
3 <sup>rd</sup> Biological Research Institute	State Academy of Sciences	Haeju
Biological Research Institute (may be the same as the Medical Research Institute)	Academy of National Defense Sciences	
Central Biology Institute (a.k.a., Central Biological Institute, Central Germ Research Laboratory)	State Academy of Sciences	
Central Epizootic Prevention Center	State Academy of Sciences	Pyongyang
Chemical and Biological Defense Research Center	Nuclear-Chemical Defense Bureau, Korean People's Army	Pyongyang
College for Army Doctor and Military Officers (a.k.a., Armed Forces Medical College)	General Staff Department, Korean People's Army	Pyongyang
Experimental Biology Institute, Biological Branch	State Academy of Sciences	Pyongyang
Hygienic and Anti-Epidemic Center		Pyongyang
Kim Hyong Chik University of Military Medicine (also known as the University of Military Medicine)	General Staff Department, Korean People's Army	Pyongyang
Kim Il Sung University Medical College	State Academy of Sciences, Kim Il-sung University	Pyongyang
Medical Biology Institute	State Academy of Medical Sciences	
Microbiology Institute (also known as the Institute of Microbiological Diseases, Institute for Medical Science, Microbiological Laboratory)	State Academy of Sciences	Pyongyang
No. 25 Factory (a.k.a., February 25 <sup>th</sup> Factory)	State Academy of Sciences	Chongju
Ponghwa Clinic Laboratories	Ministry of Health	Pyongyang
Pyongyang Medical College (Pyongyang University of Medicine)	State Academy of Sciences	Pyongyang
U/I Agar production facility	State Academy of Sciences (?)	Munchon
U/I Preventive Medicine Unit	General Staff Department, Korean People's Army	
Vaccination Institute of the Central Sanitary Quarantine Institute	State Academy of Sciences (?)	

In addition to the above, the State Academy of Sciences, Academy of Agricultural Sciences and Academy of Medical Sciences possess a number of “branches” or “laboratories” that could provide either direct, or indirect, support to the development of biological weapons and defenses. For example, the State Academy of Science’s Bioengineering Research Branch has at least 12 institutes and organizations, the Biology Branch has at least eight and the Unjong Branch at least one. There is concern that the laboratories of the Ponghwa Clinic (responsible among many things for the health and longevity of the Kim family) may be associated with the BW program. Moreover, there are a number of additional agricultural, pharmaceutical and scientific entities (some of which may be under the control of the State Academy of Sciences) that could immeasurably enhance its BW program if put to that use, including the, Aeguk Compound Microbe Center, Aoji Protein Factory, Hoeryong Koryo Medicine Factory, Hygienic and Anti-Epidemic Center, Kim Hyong Jik University of Education, Choson Pugang Pharmaceutic Co., Ltd., Jongsong Pharmaceutical General Factory, Pyongsong and Hyesan Beer Factories, Central Epizootic Prevention Center and the Virus Institute and Genetic Medicine Institute at the Kim Il Sung University.

#### 4. Testing Facilities

Although most testing is probably conducted within research institutes, it would seem reasonable that North Korea has a field test facility similar to those in Russia and the West. One report suggests, quite logically, that BW testing has been conducted on islands.<sup>7</sup> If this is correct, it would appear that islands on the west coast in the Yellow Sea would be the most likely candidates.

Defectors have stated that BW experimentation has utilized human subjects from political prisons.<sup>8</sup> For example, “...tests are conducted on political prisoners by the College for Army Doctor and Military Officers and Kim Il-sung University Medical College.”<sup>9</sup> North Korean defector Im Cheon Yong stated,

...experiments on humans date back to the late 1960s and one of the first facilities used for chemical and biological weapons tests on humans was constructed on the military controlled island of Mayang-do, just off the east coast port of Sinpo. A second facility was subsequently constructed on an island off the west coast of the peninsula, while a third is in operation alongside a political prison camp outside the city of Hyangha-ri...<sup>10</sup>

All these statements, however, remain suspect and have not yet been confirmed.

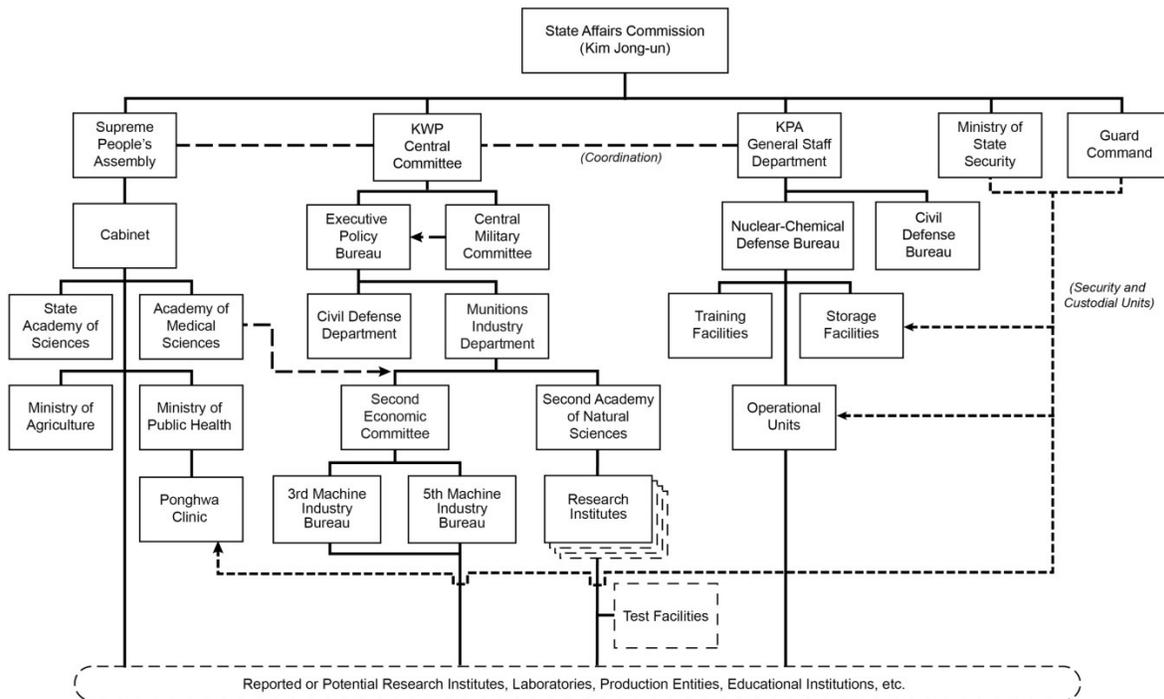
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7 Russian Federation. *The Proliferation of Weapons of Mass Destruction*, Moscow: Foreign Intelligence Service of the Russian Federation, 1993, pp. 61-62.

8 Martin Chulov, “North’s ‘Weasels’ Go West,” *Weekend Australian*, May 17, 2003, p. 23.

9 Author interview data.

10 Julian Ryall, “North Korean defector details ‘human experiments’,” *Deutsche Welle*, December 30, 2014, <http://www.dw.de/north-korean-defector-details-human-experiments/a-18161851>



**North Korea's Biological Weapons Infrastructure (Simplified)**

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### 5. Inventory and Storage

There is no reliable information concerning any biological weapons inventory or storage facilities.

## III. Chemical Weapons Infrastructure

### 1. General

According to the US intelligence sources:

North Korea almost certainly is self-sufficient in the production of all necessary precursor chemicals for first generation chemical agents, including nerve agents. The size of the North Korean chemical agent stockpile is unknown, but is estimated to be between 2,500 and 5,000 metric tons. Many of North Korea's chemical weapons are stored underground, including in railroad tunnels.<sup>11</sup>

North Korea indigenously produces militarily significant quantities and varieties of chemical weapons (CW). It also possesses the ability to effectively employ these weapons throughout the Korean peninsula and, to a lesser extent, worldwide, using unconventional methods of delivery

<sup>11</sup> Department of State, *John R. Bolton, Under Secretary for Arms Control and International Security: Remarks to the 5th Biological Weapons Convention RevCon Meeting, Geneva, Switzerland, November 19, 2001*, <https://2001-2009.state.gov/t/us/rm/janJuly/6231.htm>

(e.g., the recent assassination of Kim Jong Nam).

While public estimates of the quantity and type of CW are dated and should be viewed with caution, North Korea's continuing renovation of its large chemical complexes (e.g., the Namhung Youth Chemical Complex and the Hungnam Chemical Complex) since the early 2000s suggests that the potential for chemical precursor and agent production is significant.

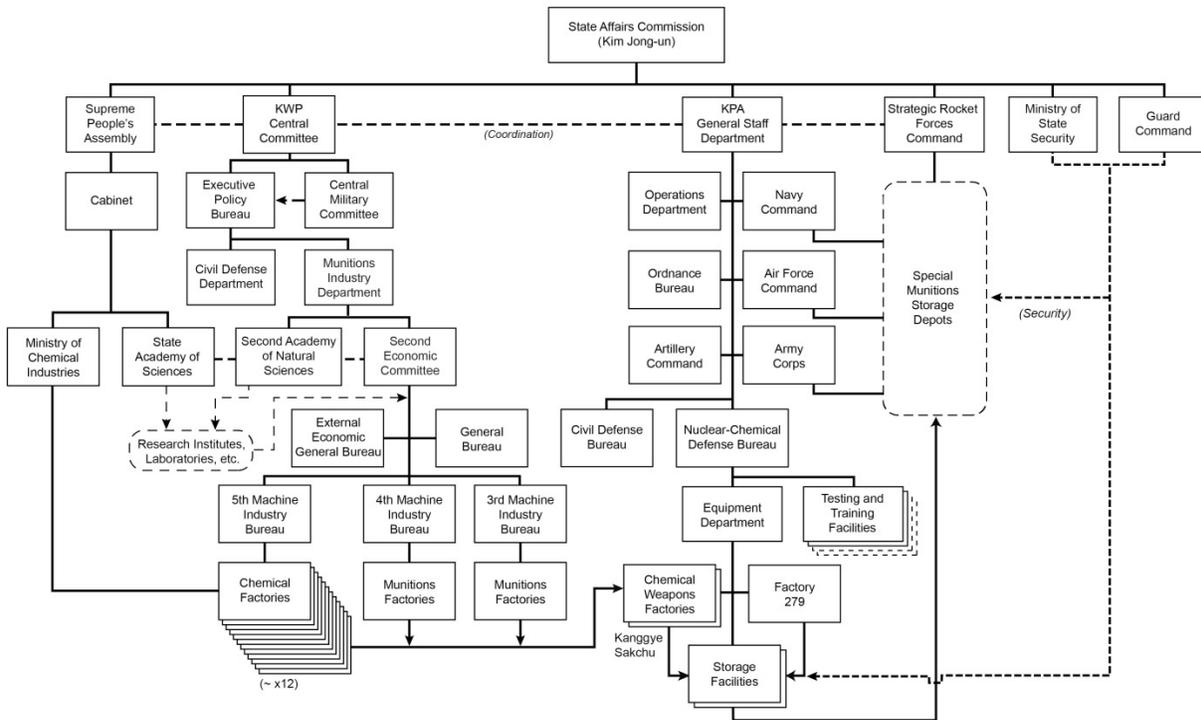
At a minimum, the KPA continues to produce and stockpile at a maintenance level a variety of chemical agents and munitions, assigns priority to research into the development of new or improved agents, and has developed chemical warheads and munitions for their short-range ballistic missiles, ground-attack aircraft and artillery. These CW are stored at Army- and Corps-level munitions storage facilities and most sources assume that they would be employed from the beginning of a renewed war on the peninsula.

## *2. Organization*

The research, development and production of chemical agents and weapons within North Korea generally follows the organizations laid out above with some specific modifications. Subordinate to the KWP is the Munitions Industries Department, which is responsible for development and production. Subordinate to the Munitions Industries Department are the Academy of National Defense Sciences and the Second Economic Committee. Various institutes and laboratories subordinate to the Academy of National Defense Sciences are reported to be involved in CW research, while the Second Economic Committee's Third, Fourth and Fifth Machine Bureaus reportedly have various responsibilities. Reportedly, the Third Bureau is responsible for overseeing the design and production of chemical munitions for artillery and multiple rocket launchers. The Fourth Bureau has a similar role but for ballistic missile warheads. The Fifth Bureau oversees the production of precursors and chemical agents, and the acquisition or production of chemical equipment (offensive and defensive).

The Nuclear-Chemical Defense Bureau is responsible for oversight and technical assistance for chemical precursor and agent production, distribution and storage of chemical weapons and production of defensive equipment. It also is responsible for NBC defense training within the KPA and response to NBC incidents. This bureau is organized into seven departments—Operations, Training, Equipment, Technology, Reconnaissance, 32<sup>nd</sup> and Underground (Tunnel) Administration—and three sections: Security, Personnel Administration and Document Management. Subordinate to the Equipment Department are the Kanggye and Sakchu Chemical Weapons Factories and the No. 279 Factory—responsible for production of defensive equipment. Subordinate to the Operations Department are seven Nuclear-Chemical Defense Battalions which are responsible for nuclear and chemical reconnaissance and decontamination.

The Academy of National Defense Sciences, Second Economic Committee and Nuclear-Chemical Defense Bureau coordinate their activities with components of both the Ministry of Chemical Industry (production) and State Academy of Sciences (civilian research and development).



**North Korea's Chemical Weapons Infrastructure (Simplified)**

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North Korea has possessed a large and diverse chemical industry since the 1960s. Numerous chemical complexes materially contribute to the CW program. Most of this contribution is, however, in the form of chemical precursors, provision of dual-use equipment and training. While there are small dedicated production lines within some larger complexes and several CW production plants and storage facilities, much of the chemical industry is dedicated to routine industrial and civilian production. There are presently no detailed and accurate estimates of either the number of personnel or organizations involved in the research, development, testing or employment of chemical weapons. Given the available information, a rough order-of-magnitude estimate suggests that there are 25-50 entities and 3,500-5,000 personnel directly involved in various aspects of the CW program. If the nuclear-chemical defense battalions and the chemical defense units within the KPA are included, add those 34,000 troops to the personnel estimate.

### 3. Research and Testing

There are conflicting reports as to where CW research and testing occurs within North Korea. The South Korean Ministry of Defense indicates that chemical weapons research facilities are located in the Kanggye, Sinuiju and Hamhung areas.<sup>12</sup> The exact nature of these facilities and the type of research being undertaken is unknown. Among the organizations reported to be involved in CW research are:

<sup>12</sup> *Defense White Paper 1990*. Seoul: Republic of Korea, Ministry of Defense, 1991, pp. 73-74. All subsequent editions of this publication recount similar information.

Organization	Location
Central Analysis Center and Chemical Department at the Pyongsong Institute of Defense	Pyongsong
Chemical Research Institute of the Academy of National Defense Sciences	Kanggye
Hamhung branch of the Academy of National Defense Sciences (probably at the Hamhung University of Chemical Industry)	Hamhung
Kim Il Sung University	Pyongyang
Sunchon University of Chemical Industry	Pyongyang

KPA defectors indicate that the Kanggye and Sakchu Chemical Weapons Factories conduct underground chemical weapons testing. This, however, is probably connected only with quality control and not weapons development. There are two known “Nuclear-Chemical Training Centers,” one under the direct control of the Nuclear-Chemical Defense Bureau and a second controlled by the KPA. These appear to be dedicated to operational training and not weapons testing and development. Field testing may also be conducted, like biological weapons, on islands in the Yellow Sea. Since the early 1990s, there have been defector and other reports claiming that the KPA has conducted chemical weapons testing on humans. However, supporting details and information are lacking.<sup>13</sup>

In December 2014, a North Korean defector, Im Cheon Yong, stated, “And then we have what they call ‘field learning.’ For the biological and chemical warfare tests, we needed ‘objects.’” He added, “At first, they used the chemical agents on mice and showed us how they died. Then we watched the instructors carrying out the tests on humans to show us how a person dies. I saw it with my own eyes.”

According to Im, human experiments date back to the late 1960s and one of the first facilities used for chemical and biological weapons tests on humans was constructed on the military controlled island of Mayang-do, just off the east coast port of Sinpo. A second facility was subsequently constructed on an island off the west coast of the peninsula, while a third is in operation alongside a political prison camp outside the city of Hyangha-ri. Im claimed, “They use anthrax bacterium as well as 40 different types of chemical weapons that the regime has developed itself. Through these experiments, they know the effects of the weapons and the amounts to be used.”

Although detailed in nature, Im’s account and all similar reports often contain internal errors and therefore should be viewed with caution pending further corroboration.

#### 4. Production

Each year, based upon current doctrine and plans, the KPA General Staff Department (especially the Artillery Command, Operations Bureau, Ordnance Bureau, and Nuclear-Chemical Defense Bureau) establishes CW requirements, which are then forwarded through the State Affairs Commission to the Second Economic Committee, Cabinet and the KWP’s Central Military Committee. Within the Second Economic Committee the requirements are reviewed and compared with the chemical industry production capabilities, and resources and finances available through the current multi-

<sup>13</sup> Author interview data; “Seoul Says N. Korea Tested Chemicals on Prisoners,” *Reuters*, September 26, 1994.

year economic plan. This review, when completed, is coordinated with the Munitions Industry Department and the Ministry of Chemical Industry. The completed review is incorporated into an industry wide production plan, which is then used to issue production orders to the various chemical factories subordinate to the Ministry of Chemical Industry and Second Economic Committee. If the production plan requires the acquisition of components, equipment or chemicals from outside North Korea, the orders are passed to the Second Economic Committee's External Economic General Bureau which is responsible for international trade within the munitions sector.<sup>14</sup>

During the year, Cabinet and Second Economic Committee factories produce and store various chemical feed stocks and precursors. When required, these are shipped in bulk form to the CW factories in Kanggye or Sakchu. As a security measure, these shipments are made by normal military train and are not easily distinguishable from other military trains by casual observation. These factories are under the control of the Equipment Department of the Nuclear-Chemical Defense Bureau, and it is at this point that control of the chemical agents apparently passes from nominal civilian to military control.

The Kanggye and Sakchu Chemical Weapons Factories reportedly receive: chemical agents from the Fifth Bureau; empty missile warheads from the Fourth Bureau; and empty mortar, artillery and artillery rocket rounds from the factories subordinate to the Third Bureau. It appears that these two factories are responsible for a wide range of activities including: the filling, packaging and shipping of "...training and war..." chemical munitions; preparation, packaging and shipment of chemical agents in bulk form; and production of aircraft and helicopter delivered weapons (e.g., spray tanks, chemical bombs, etc.) which would be filled at airfields from bulk supplies immediately prior to use.<sup>15</sup> It is believed that these factories, in coordination with the Fourth Bureau, also produce chemical warheads for ballistic missiles. In addition to the chemical weapons produced by these factories, it appears that they may also be responsible for the production, packaging, and shipment of smoke and incendiary munitions.<sup>16</sup>

It is difficult to differentiate among locations associated with just the production of feed stocks or precursors and those that produce chemical agents. This difficulty arises from several factors. Most significantly, many such facilities produce dual-use chemicals and are sometimes inaccurately described as being chemical agent factories. In many instances, these complexes produce chemicals, sometimes direct precursors, for the Second Economic Committee that will ultimately be used to produce chemical agents. This type of production is often done either in separate units within the larger complex or are simply a small portion of what is typically produced at a complex. Alternately, a complex may be involved in actual chemical agent production, but this apparently occurs in separate purpose-built subunits.

At present, the following facilities have been associated with chemical agent production:<sup>17</sup>

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14 Author interview data.

15 North Korea is producing a small number of cruise missiles and UAVs which may, in the future, be able to serve as delivery systems for chemical weapons. No information is available concerning the disposal of expired or contaminated chemical munitions.

16 Smoke operations within the KPA fall under the jurisdiction of Nuclear-Chemical Defense units and each Nuclear-Chemical Defense Battalion has an organic smoke company.

17 Yi Chung-kuk, a KPA defector, has also identified Wonsan as being the site of chemical agent production, however, no details of this are available. Author interview data.

Facility	Location	Chemical Agents
Chongjin Chemical Fiber Complex	Ch'ongjin	Blood, tear
Chongsu Chemical Complex	Ch'ongsu,	n/a
February 8 <sup>th</sup> Vinalon Complex	Hamhung	Blister, asphyxiant, tear, nerve
Hungnam Fertilizer Complex	Hungnam	Tear, asphyxiant
Hwasong Chemical Complex	Hwasong-up	Asphyxiant, nerve
Hyesan Chemical Factory	Hyesan	n/a
Kanggye Chemical Weapons Factory (also known as 108 Factory or Bio-Chemical Research Center)	Kanggye	n/a
Manpo Chemical Complex	Manpo	Blister, blood, tear
Namhung Youth Chemical Complex	Anju	Blood
No. 26 Factory	Kanggye	n/a
No. 77 Factory or Aoji-ri Chemical Complex	Aoji-ri	Blood, emetic
No. 102 Factory, 7 July Complex	Songnim	n/a
Sakchu Chemical Weapons Factory or Chongsu Chemical Complex	Sakchu	Tear, asphyxiant
Sariwon Potassic Fertilizer Complex	Sariwon	n/a
Sinhung Chemical Complex	Sinhung	n/a
Sinuiji Chemical Fiber Complex	Sinuiju	Tear, asphyxiant
Sunchon Nitrolime Fertilizer Factory of the Sunchon Vinalon Complex (also known as the Sunchon Chemical Complex)	Sunchon	Blister, blood, asphyxiant, tear
Wonsan Chemical Factory	Wonsan	n/a

In addition to the above, the State Academy of Sciences and several universities possess several “branches” or institutes that reportedly conduct research on chemical warfare agents or provide either direct or indirect support to the development of chemical weapons and defenses. Published academic papers and reports indicate that North Korean scientists and researchers are actively conducting research into a wide range of dual-use technologies that could have direct application to the development of chemical weapons. For example, in 2008, scientists at Kim Il Sung University were engaged in studying various methods of sulfur mustard decontamination, while other scientists worked on the synthesis of diethyl phosphite, which has commercial uses but is also a precursor for the G-series of nerve agents.

### 5. Inventory and Storage

The chemical weapons produced by the Kanggye and Sakchu Chemical Weapons Factories are apparently not stored locally for any great length of time, but rather are reportedly shipped by military train to the Army- and Corp-level storage facilities. There are at least five additional CW storage facilities that have been reported. Reported CW storage facilities include:

Facility	Location
Chiha-ri Chemical Corporation	Anbyon,
Maram Materials Corporation (610 Institute)	Maram-dong
U/I	Hwangchon-ni
U/I	Samsan-dong
U/I	Sanum-ni
U/I	Wangdong-ni
U/I	Hwanghae-bukto
U/I	Unknown subordinate to the Strategic Force

It is likely that there are additional entities involved in the storage of both bulk chemical agents and filled munitions.

The best estimates available credit North Korea with an annual production potential of 4,500 tons of agent in peacetime and 12,000 tons in wartime. Since 2000 and as recently in last year's Defense White Paper, the Republic of Korea Ministry of Defense has annually estimated the inventory at between 2,500 and 5,000 tons of agents. These estimates should be viewed with caution.

### III. Nuclear Weapons Infrastructure

#### 1. General

According to the 2016 Defense White Paper issued by the South Korean Ministry of National Defense:

North Korea continues to develop nuclear weapons, ballistic missiles, and chemical and biological weapons to strengthen its ability to conduct strategic attacks. It has obtained nuclear material by reprocessing spent fuel rods from the 5MWe nuclear reactor at Yongbyon, which began operating in the 1980s, and has conducted five nuclear tests to date (October 2006, May 2009, February 2013, January & September 2016). North Korea [has conducted] multiple rounds of reprocessing spent fuel rods, and it has been determined to be making substantial progress in its HEU program. It is also believed to have made substantial progress in miniaturizing nuclear warheads.<sup>18</sup>

North Korea maintains a large and relatively comprehensive nuclear weapons research, development, test and production infrastructure. It has produced and is continuing to produce militarily significant quantities of Pu-239 and highly enriched uranium (HEU) and possesses what is assumed to be a small inventory of nuclear weapons. It also possesses the potential to employ nuclear weapons throughout the Korean peninsula and potentially Japan. To a significantly lesser degree, it possesses the potential to employ these weapons across a broader region using unconventional methods of delivery. It is seeking to extend this range even further by actively pursuing the development of miniaturized nuclear warheads and intermediate-range (IRBM) and intercontinental (ICBM) ballistic missiles.

<sup>18</sup> *Defense White Paper 2016*. Seoul: Republic of Korea, Ministry of Defense, 2017, p. 27.

While significant components of North Korea's nuclear infrastructure have been identified over the past 50 years, details concerning these activities are often dated or incomplete.

## 2. Organization

In the broadest sense, the research, development and production of nuclear weapons within North Korea generally follows the organization for other weapons of mass destruction under the authority of the Supreme People's Assembly, Korean Workers' Party and the Korean People's Army. There are, however, numerous and significant differences specific to nuclear weapons development and the relationships between organizations—much of which is opaque. While there are legitimate civilian applications (e.g., medical isotope production, etc.) for small components of North Korea's nuclear program, the clear majority is dedicated to weapons research, development and production. Due to ongoing North Korean efforts at camouflage, concealment and deception (e.g., changing names of organizations, use of *ad hoc* organizations, etc.), it is extremely difficult to conclusively identify organizations, subordination and responsibilities. The chain-of-command is even more challenging to penetrate because some nuclear program personnel belong to multiple civilian and military organizations. Therefore, there are undoubtedly numerous entities involved in the NBC infrastructure that are unknown outside of the country.

The two primary organizations involved in the nuclear program—the Ministry of Atomic Energy Industry and the State Academy of Sciences—are subordinate to the Cabinet of the Supreme People's Assembly.<sup>19</sup> Of the secondary organizations subordinate to the Cabinet, the Ministries of Chemical Industry and Extractive Industries play important but limited roles in the nuclear program. The Ministry of Atomic Energy Industry is the outward face of North Korea's nuclear program. In the past, its members engaged in international discussions and meetings; however, the growing sanctions on North Korea's nuclear program and associated personnel have limited the number of publicly identified ministry personnel. Sources suggest that the Ministry of Atomic Energy Industry is a “front” for the Munitions Industry Department's Nuclear Bureau.<sup>20</sup> Additionally, many members of the Ministry of Atomic Energy Industry may, in fact, be Nuclear Bureau or Nuclear Weapons Institute personnel.

The State Academy of Sciences, through numerous subordinate organizations, plays the central role in the nuclear program. Among its main duties, it operates and maintains the North's nuclear reactors and several research and production facilities; conducts theoretical and practical research; trains theoretical and practical scientists, technicians and support personnel; and provides critical input into the program and policy decision-making processes. The Ministries of Chemical Industry and Extractive Industries support the nuclear program by providing raw materials (e.g., chemicals for reprocessing, mining and milling uranium ore, rare earth minerals, etc.) and trained technical personnel.

Subordinate to the KWP is the Munitions Industries Department, which is responsible for weapons

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19 On April 12, 2013, the Supreme People's Assembly established the Ministry of Atomic Energy Industry, replacing the General Bureau of Atomic Energy, “...for the purpose of modernizing the nation's atomic energy industry and putting it on a solid foundation of latest science and technology so as to increase the production of nuclear materials, improve their quality and further develop the independent nuclear energy industry.” The previous bureau was also known as the Bureau of Atomic Energy or General Department of Atomic Energy.

20 Sometimes identified as the “Atomic Bureau.”

development and production. Subordinate to the Munitions Industry Department are the Nuclear Bureau, Nuclear Weapons Institute, Second Economic Committee and Academy of National Defense Sciences.

The precise subordination of the Nuclear Bureau and Nuclear Weapons Institute are unclear. While the Nuclear Bureau would seem to fit within the Second Economic Committee, sources clearly place it within the Academy of National Defense Sciences. The bureau, along with the Nuclear Weapons Institute, appears to be responsible for the nuclear weapons development program and may exercise control over the Ministry of Atomic Energy Industry. Such a role overlaps with significant aspects of the mission of the Second Economic Committee's Fifth Bureau, which is the development of nuclear weapons and related technologies. It is conceivable that these two organizations are one-in-the-same.

The Second Economic Committee's Fifth Bureau works closely with the Fourth Bureau for missile warhead development as well as the State Academy of Sciences, which apparently has an important role in nuclear testing. The Academy of National Defense Sciences administers nuclear weapons related research institutes and laboratories. In this role, it is also responsible for the acquisition or development of various types of nuclear related electronic equipment, defensive equipment, etc. It apparently also plays some role, in cooperation with the State Academy of Sciences, in overseeing the scientific departments and institutes, colleges and universities engaged in nuclear research (e.g., Atomic Energy Faculty at Kim Il Sung University). It appears from public statements concerning weapons design and development attributed to the Nuclear Weapons Institute (sometimes called the Atomic Weapons Institute) that it is subordinate to the Academy of National Defense Sciences. This, and its specific responsibilities, have yet to be confirmed.

The KPA's Nuclear-Chemical Defense Bureau along with the KWP's Civil Defense Department and civil defense components of the Ministry of People's Security have nuclear defense and response missions. It is likely that the subordinate components of the Nuclear-Chemical Defense Bureau concerned with defensive and protective equipment coordinate with their counterparts in the Second Economic Committee's Fifth Bureau and other organizations. Likely included in this category are the Institute of Radiation Protection and Radioactivity Defense Research Institute. According to a defector, the leadership of the Nuclear-Chemical Defense Bureau has a policy role surrounding nuclear weapons development.<sup>21</sup> The nature of this role is unclear.

Due to the supreme importance of the nuclear program and weapons to the Kim Jong Un regime, both the Ministry of State Security and Guard Command are undoubtedly tasked with the mission of security for a majority of nuclear related facilities and organizations. The Guard Command likely operates, and is responsible for, security of any nuclear weapons storage facilities.

In the past, the Ministry of People's Security's 27<sup>th</sup> Engineer Bureau was responsible for much of the construction performed at North Korea's nuclear facilities. During the past several years, however, a majority of the KPA and Ministry of People's Security's engineer units were reorganized and subordinated to the Ministry of People's Armed Forces. It would appear that the 27<sup>th</sup> Engineer Bureau, and the responsibility for nuclear related construction, has also been moved to the ministry.

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<sup>21</sup> Author interview data.

While it is likely that North Korea has designed air-delivered nuclear weapons, it appears from countless North Korean public statements that they consider ballistic missiles to be the primary delivery system for these weapons. By extension this indicates that the Strategic Force likely provides input into the design of nuclear warheads for ballistic missiles and participates to some degree in testing.

Reliable estimates of the numbers of personnel and organizations involved in North Korea's research, development, testing and production of nuclear weapons are extremely elusive and have varied substantially over time. The primary reasons for this are North Korea's active and ongoing efforts to hide the extent and capabilities of its nuclear weapons program and differences over whom to count within such estimates—while a nuclear scientist would certainly count, what about the janitor in a nuclear laboratory, a nuclear technician's family, the administrative staff, the workers at a uranium mine, or academics teaching nuclear physics. Nevertheless, two estimates stand out. In October 2009, the South Korean Ministry of National Defense stated that it had identified approximately 100 nuclear-related locations within North Korea. In talks with South Korea, North Korean Vice-Foreign Minister Kim Kye Gwan once stated that "...the South should compensate for the layoff of the North's 3,000 engineers working at nuclear facilities."<sup>22</sup> Combining these figures with reported organizations and personnel strengths, a conservative order-of-magnitude estimate suggests that there are 100-150 entities and 9,000-15,000 personnel directly involved in the research, development, testing or production of nuclear weapons. These figures do not include units or personnel of the Strategic Force, Air and Anti Air Force or special operations forces that may be tasked with the operational employment of nuclear weapons. The KPA's nuclear-chemical defense battalions and the chemical defense units within the KPA, which are tasked with nuclear defense, are also not included.

### *3. Research, Development and Production*

The majority of North Korea's nuclear research, development and production infrastructure is centered at the Yongbyon Nuclear Scientific Research Center, approximately 85 kilometers north of the capital of Pyongyang. Among the many institutions reported as being located here are:

- Atomic Energy Research Institute
- Radioactive Isotope Processing Laboratory (existing)
- Radioactive Isotope Processing Laboratory (under construction)
- Neutron Physics Research Institute
- Nuclear Electronics Research Institute
- Nuclear Materials Research Institute
- Nuclear Physics Research Institute

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22 "3,000 Experts Run NK Nuclear Program," *Korea Times*, May 2, 2012, [http://www.koreatimes.co.kr/www/news/nation/2012/05/116\\_110127.html](http://www.koreatimes.co.kr/www/news/nation/2012/05/116_110127.html).

- Nuclear Weapons Institute
- Radiation Protection Research Institute
- Radiochemistry Research Institute
- Reactor Design Research Institute
- Uranium Resource Development Institute

Nuclear related education and theoretical research and development appear to be centered around the various institutes of the University of Chemical Industry located in Hamhung; University of Science (e.g., Nuclear Physics Research Institute, Chemical Department, etc.) located in Pyongsong; Kim Il Sung University (e.g., Atomic Energy Faculty) located within the capital city of Pyongyang; Kim Chaek University of Technology (Nuclear Physics and Engineering Faculty which operates a Soviet Union-manufactured cyclotron) also located within Pyongyang; and the State Academy of Sciences (e.g., Nuclear Physics Research Institute) located in Pyongsong.

In October 2009, the South Korean Ministry of National Defense stated that it had identified approximately 100 nuclear-related locations within the DPRK. This figure includes research centers, laboratories, mines, the facilities at Yongbyon and other locations. Many of these that have been mentioned in official documentation have yet to be accurately located.<sup>23</sup> For example, the General Committee on Nuclear Engineering and Science, Institute for Nuclear Studies, Institute of Nuclear Medicine, Reactor Hazards Committee, to name but a few. Other strongly suspected activities have yet to be located—for example, a centrifuge production factory, a lithium-6 production facility, a pilot centrifuge enrichment facility, a pilot reprocessing facility, and a tritium production facility.

Among facilities that have been identified and located are:

Facility/Activity	Location	Comment
0.1 MWt Critical Assembly	Yongbyon	Operational
5 MWe Reactor	Yongbyon	Operational
25-30 MWe Experimental Light Water Reactor	Yongbyon	Not operational yet
50 MWe Reactor	Yongbyon	Abandoned
200 MWe Reactor	Taechon	Abandoned
1,000 MWe LWRs (x2)	Kumho-ri	Abandoned
August Industrial Company	Yongbyon	Fuel rod fabrication for the 5 MWe Reactor
Building 500	Yongbyon	Abandoned waste storage
Fiber Chemistry Laboratory	Hamhung	

<sup>23</sup> A large part of this challenge is simply disambiguating the numerous similar names of organizations and facilities.

Fuel Fabrication Plant	Unknown	Its location and capabilities are unknown.
Institute of Radiation Protection	Wonsan	Likely associated with the Nuclear-Chemical Defense Bureau
IRT-DPRK (IRT-2000)	Yongbyon	Operational
Kim Il Sung University	Pyongyang	
Kusong Uranium Processing Facility	Kusong	Reported site of a uranium processing facility and a uranium mine
Nuclear Electronics Research Institute	Yongbyon	Reactor control and automation systems
Nuclear Physics and Engineering Faculty, Kim Chaek University of Technology	Pyongyang	
Nuclear Physics Research Institute, Chemical Department, Pyongsong University of Science	Pyongsong	
Pakchon Nuclear Facility	Pakchon	
Punggye-ri Nuclear Test Site	Punggye-ri	Test site for all North Korea's underground nuclear weapons tests
Radiation Research Institute	Pyongyang	Medical use of use of isotopes
Radio-Chemistry Laboratory	Yongbyon	Reprocessing facility
Radioactive Isotope Processing Laboratory	Yongbyon	Adjacent to the IRT reactor. Operational status unknown
Radioactive Isotope Processing Laboratory	Yongbyon	Under construction
Radioactive Isotope Utilization Research Institute	Chongjin	Industrial use of isotopes
Radioactivity Defense Research Institute	Pyongyang	Likely associated with the Nuclear-Chemical Defense Bureau
Taechon Nuclear Facility	Ch'onggye	Reported site of an underground uranium enrichment and possible reprocessing facility
Underground waste storage facility	Yongbyon	Abandoned waste storage
University of Chemical Industry	Hamhung	
Uranium Enrichment Workshop	Yongbyon	Operational HEU production facility with 2,000-4,000 centrifuges
Uranium Hexafluoride Production Facility	Unknown	
Yongbyon High Explosive Test Site	Yongbyon	Reported location of more than 70 tests involving high explosives
Yongdok-dong High Explosive Test Site	Kusong	Site of high explosives testing

#### 4. Mining and Milling

It is estimated that North Korea possesses 26 million tons of natural uranium deposits, of which about four million could be economically extracted. Additionally, the country is endowed with an abundance of rare earth minerals.

Although the status, quality and quantity<sup>24</sup> of the uranium ore being mined and milled in North Korea is unknown, 10 locations have been associated with mining activities and three with milling operations:

Facility	Location	Comment
April Industrial Enterprise	Pakchon	Milling
Cholsan	Cholsan	Mining
Hamhung	Hamhung	Mining
Hyesan	Hyesan	Mining
January Industrial Mine	Pyongsan	Mining
Kusong Processing Facility and Mine	Kusong	Reported as both a uranium processing facility and uranium mine
Maebong-san	Maebong-san	Mining
Namchon Joint Chemical Industrial Company	Pyongsan,	Milling
Sinpo	Sinpo	Mining
Songchon-up		Possibly related to the May 18 <sup>th</sup> Mine Complex
Sunchon	Sunchon	Milling
Unggi	Unggi	Mining
Wolbingson Uranium Mine	Kumchon	Mining

#### 5. Inventory and Storage

Estimates of North Korea's fissile material and weapons inventory continue to vary considerably. A 2017 study estimates that at the end of 2016, North Korea could possess 33 kg of Pu-239 and 175 kg of HEU (assuming only one operational centrifuge facility). Taking into consideration reasonable technical and production inefficiencies, this inventory could indicate an inventory of 6-9 Pu-239 and 13-18 HEU weapons.<sup>25</sup>

24 At the first plenum of the DPRK Cabinet in 2013 Pak Pong-ju, newly appointed as premier, called for further prospecting and mining of uranium resources. This is the same year the General Bureau of Atomic Energy was superseded by the Ministry of Atomic Energy Industry.

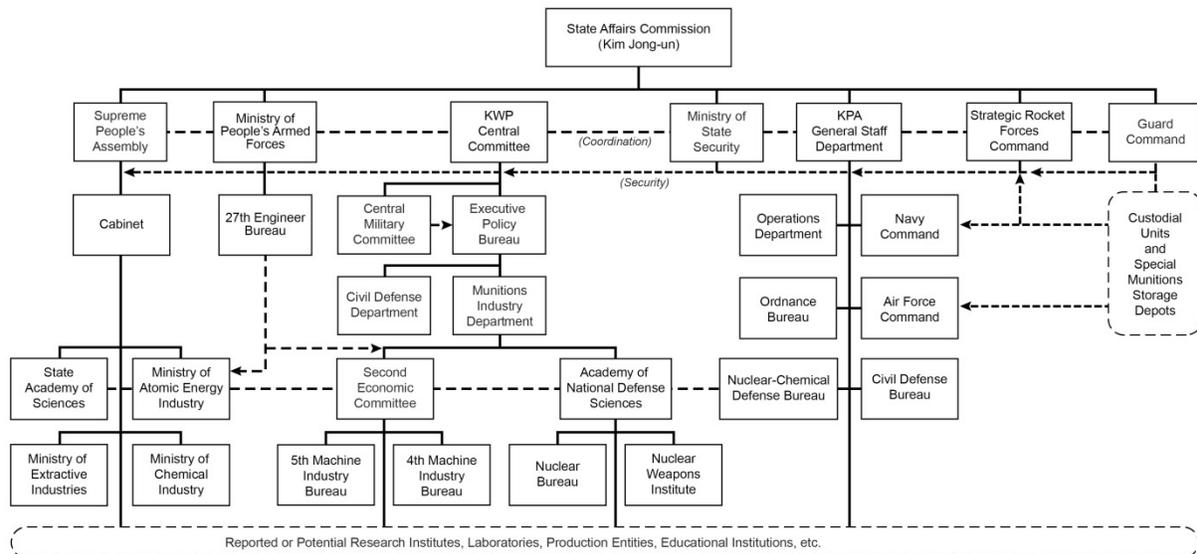
25 Inventories of available HEU and HEU weapons could be significantly higher if there is a second operational HEU facility. See: David Albright, *North Korea's Nuclear Capabilities: A Fresh Look Summary of Major Findings in Conjunction with PowerPoint Slides Presented During a Series of Talks Given in DC*, Institute for Science and International Security, April 28, 2017, [http://isis-online.org/uploads/isis-reports/documents/North\\_Korea\\_Nuclear\\_Capability\\_Estimates\\_Summary\\_28Apr2017\\_Final.pdf](http://isis-online.org/uploads/isis-reports/documents/North_Korea_Nuclear_Capability_Estimates_Summary_28Apr2017_Final.pdf); David Albright, *Future Directions in the DPRK's Nuclear Weapons Program: Three Scenarios for 2020*, February 26, 2015, [http://38north.org/wp-content/uploads/2015/09/NKNF\\_Future-Directions-2020.pdf](http://38north.org/wp-content/uploads/2015/09/NKNF_Future-Directions-2020.pdf).

There is a complete lack of information concerning the location of any nuclear weapons storage facilities within North Korea or the organizations that may be responsible for them. Given known North Korean organizational structures, the supreme importance of the nuclear program and weapons to Kim Jong Un, and Kim's desire for absolute control, it is probable that a component of the Guard Command (the force responsible for the personal safety of the Kim family) serves as the custodial unit for weaponized fissile material and weapons. The Ministry of State Security likely performs a broader security mission for the nuclear infrastructure.

The Strategic Force is, by North Korea's own admission, the primary organization tasked with the delivery of nuclear weapons and likely contains an organization tasked with receiving weaponized fissile material or weapons from custodial units and possesses training versions of nuclear warheads.

### 6. Testing

To date, North Korea's five confirmed underground nuclear tests have shown a general trend towards increasing yields. Despite the North's claim of testing a thermonuclear device, there is no evidence to indicate this occurred during any of these tests. While the North has so far conducted all its nuclear tests from the Punggye-ri Nuclear Test Facility, the isolated mountainous regions of the northern part of the country and their abundant active and abandoned mining activities present numerous options for future tests to be conducted elsewhere should Kim Jong Un desire to do so. Preparations to test at a location different from Punggye-ri would likely go undetected.



**North Korea's Nuclear Weapons Infrastructure (Simplified)**

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