

# **North Korea: Problems, Perceptions and Proposals**

Co-authored by

Frank Barnaby, Oxford Research Group  
and Nick Ritchie, Oxford Research Group

OXFORD · RESEARCH · GROUP

**April 2004**

## Contents

<b>List of Abbreviations and Acknowledgements</b>	<b>2</b>
<b>Executive Summary</b>	<b>3</b>
<b>Introduction</b>	<b>6</b>
<b>United States' Strategy for dealing with North Korea</b>	<b>7</b>
Washington's perception of the threat	7
The 'War on terrorism'	8
The White House dilemma	8
How the situation may develop in the short- medium-term	10
<b>Non-military approaches</b>	<b>11</b>
Track-II diplomacy	11
Shuttle diplomacy	11
Economic and trade incentives	11
Arms control and transparency measures	12
Confidence Building Measures	13
Economic sanctions	13
Summary of recommendations	14
<b>The Nuclear Weapons Programme of North Korea</b>	<b>15</b>
Nuclear Weapons	15
North Korea's nuclear weapons programme: Outline	15
North Korea's nuclear weapons programme: Analysis	17
North Korea's Highly Enriched Uranium Programme	20
North Korea's potential nuclear weapons capabilities: Overview	23
North Korean nuclear delivery systems	23
Chemical and biological weapons programmes	24
North Korea's conventional forces	26
<b>Appendix A:</b>	
Key problems that a <i>Non-military</i> approach will have to address	27
<b>Appendix B:</b>	
Key problems that a <i>military</i> approach will have to address	28

## **List of Abbreviations**

BMD	Ballistic Missile Defence
BNFL	British Nuclear Fuels Limited
BWC	Biological Weapons Convention
CBM	Confidence Building Measure
CFE	Conventional Forces in Europe
CIA	Central Intelligence Agency
DPRK	Democratic People's Republic of Korea
GDP	Gross Domestic Product
GNP	Gross National Product
HEU	Highly Enriched Uranium
IAEA	International Atomic Energy Agency
IFI	International Financial Institution
IMF	International Monetary Fund
KEDO	Korean Peninsula Energy Development Organisation
KPA	Korean People's Army
LWR	Light Water Reactor
NPT	Non Proliferation Treaty
ROK	Republic of Korea
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WMD	Weapons of Mass Destruction

## **About the authors**

**Frank Barnaby** is Oxford Research Group's Technical and Scientific Consultant. Before joining ORG over sixteen years ago, Frank worked as a nuclear physicist at the Atomic Weapons Research Establishment and on the senior scientific staff of the Medical Research Council, and was Director of the Stockholm International Peace Research Institute for 10 years. He is a prolific author of books and articles on military technology, defence, security and disarmament issues, and contributes regularly to radio and television.

**Nick Ritchie** is an Associate Researcher with Oxford Research Group. He joined the Group in September 1999 and until recently served as Researcher and Programme Coordinator, where he was involved in research, the organisation of consultations, programme development, financial management and managing the O.R.G. website. In September 2003 he left Oxford to begin a PhD at the Department of Peace Studies, University of Bradford, on US post-Cold War nuclear weapons policy, where he continues to work with ORG.

## **Acknowledgements**

We gratefully acknowledge the support of the Joseph Rowntree Charitable Trust, and other funders and supporters for making the publication of this report possible. We would also like to acknowledge Nick Ritchie for his help in researching and editing this report, and James Kemp and Mark Powys-Smith for their assistance producing the report.

## **Executive summary**

There is widespread concern that the current US strategy of aggressive preventative action to deal with threat from nuclear proliferation and ‘problem states’ such as Iran and North Korea will lead to pervasive instability and the further proliferation of nuclear weapons.

The reinvigoration of North Korea’s nuclear-weapon programme has caused the most serious breakdown so far in US-North Korea relations. Both sides remain unwilling to back down from polarised positions that could lead to regional nuclear proliferation or draw the protagonists into a military conflict involving Japan and South Korea.

This report analyses Washington’s perception of the threat posed by North Korea, its place in the ‘war on terrorism, and US strategy for dealing with the crisis. It sets out a series of pragmatic, non-military measures that can be taken to facilitate progress towards a negotiated settlement of the current crisis. It also provides an independent analysis of North Korea’s nuclear weapons programme, including its suspected highly-enriched uranium programme and ballistic missile capabilities. The report has been developed through discussions with experts on this issue in the UK, many of who have spent time in North Korea.

## **The view from Washington**

Washington has firmly placed North Korea in the ‘axis of evil’ and considers the development of North Korea’s nuclear weapons programme to be a major threat both to the US, its allies and its interests in the region. This report argues that Washington has the same incompatible options it has had since it came into office: containment, military action, or negotiation.

- **Military action** is unlikely to occur since such action could lead to a regional conflict and 100s of 1000s, if not millions, of casualties.
- Many in the US Administration argue that North Korea could acquire a significant nuclear missile arsenal in the foreseeable future and that North Korea cannot be trusted to comply with international obligations.
- A **hard-line approach** is advocated to further isolate North Korea. Success requires the full cooperation of South Korea and China, which is unlikely to be forthcoming: South Korea is intent on maintaining and improving inter-Korean cooperation and China’s political, security and economic concerns in the Asia Pacific region are such that it will continue to provide aid to North Korea for the foreseeable future. A hard-line approach appears to offer no pragmatic route to a resolution of the current crisis
- It is likely that the **US position** of insisting on complete, verifiable irreversible nuclear disarmament before any deal can be struck is unrealistic and will lead to a continuation of the status quo, allowing North Korea to continue to produce and reprocess more plutonium.
- A **negotiated solution** is the only one that can work, however difficult it may be.

## **Pragmatic, non-military measures**

Section two details a range of realistic and constructive non-military measures that can be taken to facilitate progress towards a negotiated settlement of the current crisis. There are several **constructive actions the US could do to work towards a negotiated solution:**

1. Strongly encourage the US to establish a permanent presence in Pyongyang. The UK has been able to do much more by having contact with North Korea. If the US had had a presence in North Korea from 1994 the current crisis would not have happened. It is important to increase the number of diplomats in Pyongyang.
2. The US could offer a conditional security assurance of no use of force while negotiations are ongoing. This might involve a 1-year non-aggression pact in exchange for verification and inspections
3. Revive the deal to limit the North's ballistic missile programme that was on the table towards the end the Clinton presidency. If successfully dealt with it could pave the way towards an agreement on the North's nuclear programme
4. Move North Korea away from dependency on world food programme handouts and into a proper development programme. UNDP has had a full development programme in place since 1998. This needs US support.
5. The US should appoint a high-level representative to North Korea, in the mould of William Perry under President Clinton, dedicated to the North Korea problem.

### **Constructive actions North Korea must be encouraged to do:**

1. Freeze all nuclear activity.
2. Issue a full declaration of Japanese citizens abducted by the DPRK.
3. Increase transparency of the distribution of food and medical aid.

A key issue is **energy security**. North Korea's energy sector is extremely dilapidated. The international community should use North Korea's urgent need for energy supplies to reduce the dangers of conflict on the Korean Peninsula. The development of regional energy cooperation is the most practical measure of them all. It is the key to getting North Korea away from dependency and beginning to rebuild its dilapidated industrial base. South Korea is willing to provide the North with electricity. Three measures have been proposed:

- A new energy deal to replace KEDO with an international organisation involving China, US, Russia, Japan, South Korea and the EU. This could involve abandoning the nuclear light-water reactor projects in favour of thermal power generation facilities and resume heavy fuel oil supplies.
- Develop the Russian proposal to sell natural gas to North Korea subsidised by South Korea.
- Develop the proposed gas pipeline from China to South Korea to serve the South Korean market, and use it to integrate North Korea into a regional gas market.

However, there are two major **unresolved issues affecting economic approaches**:

- It is not clear whether or not the major powers do in fact want to progressively integrate North Korea into the world community/world economy given the serious objections to allowing North Korea to become an industrialised nation again.
- The seriousness of the North Korean leadership's desire for economic regeneration is also suspect. Whilst some North Korean officials seek economic recovery, some in the military who handle the issues do not, since it could undermine their authoritarian power.

Any agreement must improve the lives of the **North Korean people**. USAID estimated that the North Korea famine of the 1990s was the worst in the 20<sup>th</sup> century per head of population with a figure of 2-3 million dead. Further isolation of North Korea through further economic sanctions is likely to cause more suffering for the North Korean people.

### **North Korea's nuclear programme**

Much has been written about North Korea's nuclear weapons programme and its inclusion in the 'Axis of Evil' described by President Bush in his State of the Union speech in January 2002.

However, North Korea is an extraordinarily closed and secretive country and published details about its nuclear weapons programme are usually speculative and often suspect.

The third part of the report provides an independent analysis of North Korea's nuclear weapons programme, including its suspected highly-enriched uranium programme and ballistic missile capabilities. The report makes a clear distinction between what is known, what is generally accepted, what is suspected and what is predicted.

The report contends that North Korea's economic underdevelopment, particularly its dilapidated energy infrastructure, places serious constraints on its ability to expand its plutonium-based nuclear weapons programme, its suspected highly-enriched uranium programme and its long-range ballistic missile programme.

## **Introduction**

There is widespread concern that the current US strategy of aggressive preventative action to deal with threat from nuclear proliferation and ‘problem states’ such as Iran and North Korea will lead to pervasive instability and the further proliferation of nuclear weapons. The use of preventative military force was used to deal with Iraq, Washington’s premier ‘problem state’, in March 2003 despite broad opposition and a variety of robust non-military proposals for dealing with Baghdad’s suspected WMD programme and humanitarian abuses.

The reinvigoration of North Korea’s nuclear-weapon programme has caused the most serious breakdown so far in US-North Korea relations. Both sides remain unwilling to back down from polarised positions that could draw the protagonists into a military conflict involving Japan and South Korea or lead to regional nuclear proliferation.

The first part of this report outlines Washington’s current strategy for dealing with North Korea, its perception of the North Korean threat, and the three policy options it faces: negotiation, containment, or military action.

The second part of the report details a range of constructive and punitive non-military approaches to facilitate progress towards a negotiated settlement of the current crisis and the constructive role that the British government could play. These include confidence building measures, track-II diplomacy, shuttle diplomacy; economic and trade incentives – particularly energy security measures –, arms control and transparency, and economic sanctions.

The third part of the report provides an independent analysis of North Korea’s nuclear weapons programme, including its suspected highly-enriched uranium (HEU) programme and ballistic missile capabilities. The extent of North Korea’s suspected chemical and biological weapons programmes and conventional military forces are also outlined.

## **United States Strategy for dealing with North Korea**

### **Washington's Perception of the Threat**

1. The conventional wisdom in official Washington is that North Korea:

- Has fabricated two nuclear weapons using plutonium;
- Has deployed these two nuclear weapons on 1,400-kilometre range Nodong-1 ballistic missiles;
- Will soon produce 5 or 6 more nuclear weapons using plutonium;
- Will eventually deploy nuclear weapons on 2,000-kilometre range Taepodong-1 ballistic missiles;
- Could produce about 280 kilograms of plutonium a year, enough to produce about 65 nuclear weapons a year, if it completes two partly constructed reactors;
- Is working towards a ballistic missile with an intercontinental range capable of striking the continental USA;
- Has a uranium-enrichment programme that could produce two or more nuclear weapons a year by about 2006;<sup>1</sup>
- Has constructed secret underground facilities as part of its nuclear weapons programme;
- Continues to sell ballistic missile technology to 'rogue states';
- Has chemical and biological weapons programmes;<sup>2</sup>
- Will sell plutonium and highly-enriched uranium to the highest bidder, including terrorist organisations, when it has accumulated sufficient reserves;
- Cannot be trusted to comply with international agreements.

2. Many in the US Administration argue that North Korea could, if not stopped, acquire a nuclear arsenal similar in size to those of China, France and the United Kingdom in the foreseeable future. Unchecked this arsenal could eventually include both plutonium and HEU weapons carried by Taepodong-2 ballistic missiles capable of striking most of the United States. The North Korean nuclear missile threat is cited as one of the primary rationales for the development and deployment of extensive missile defence systems by the United States. There is also a conviction that North Korea will sell nuclear technology and materials to other 'rogue states' that could threaten the United States, its interests or allies, as it has done with ballistic missile technology.

3. Given North Korea's behaviour over the past 20 years many in the US national security elite are convinced that North Korea cannot be trusted to comply with international obligations. North Korea has abrogated the NPT, the Chemical Weapons Convention and the Joint Declaration on the Denuclearisation of the Korean Peninsula and has refused to sign the Biological and Toxins Weapons Convention. Any agreement that is reached would need to be subject to the most intense verification to ensure compliance.

4. It would also appear that the United States is not willing to enter into another bi-lateral agreement with North Korea and take on the burden of responsibility for making any such agreement work. Instead the US wants to see a multilateral solution in which China, South Korea, and Japan all have a stake, along with the USA, in making any potential agreement work. This could, for example, see China taking an active part in activities such as verification and the provision of economic incentives.

---

<sup>1</sup> CIA estimate provided to Congress on November 19, 2002 available at [www.fas.org/nuke/guide/dprk/nuke/cia111902.html](http://www.fas.org/nuke/guide/dprk/nuke/cia111902.html)

<sup>2</sup> 2001 CIA National Intelligence Estimate 'Foreign Missile Developments and the Ballistic Missile Threat Through 2015'



## The 'war on terrorism'

5. On entering office at the beginning of 2001 the Bush Administration undertook a reassessment of the President Clinton's policy towards North Korea. This was based on concern about North Korean nuclear activities and the continuing viability of the 1994 Agreed Framework between the US and North Korea that sought to freeze and dismantle Pyongyang's nuclear weapons programme. The review concluded that the United States should seek "improved implementation of the Agreed Framework, verifiable constraints on North Korea's missile program, a ban on missile exports, and a less threatening North Korean conventional military posture".

6. Following the attacks of September 11, 2001 President Bush labelled North Korea part of the 'Axis of Evil' in his January 2002 State of the Union address which brought 'rogue states', including North Korea, Iran and Iraq, under the umbrella of the 'war on terrorism'. The Bush Administration and many in Congress continue to view the North Korean crisis as part of the broad 'war on terrorism', based on the premise that North Korea is a known state-sponsor of terrorism (according to the US State Department) and might sell nuclear materials directly or indirectly to terrorist organisations in the future.<sup>3</sup> In July 2003 US Under Secretary of State for Arms Control and International Security, John Bolton, stated that North Korea will not be allowed to "peddle its deadly arsenal to rogue states and terrorists throughout the world".<sup>4</sup>

7. In spite of the impression given by the Bush Administration, there is no firm evidence that North Korea is linked to terrorist acts. It was alleged that North Korea was linked with the bombing during a 1983

South Korean state visit to Burma, an attack that killed 17 South Koreans, including several cabinet members, and just missed killing the former South Korean President Chun Doo Hwan. It was also accused of involvement in the 1987 bomb that destroyed a Korean Air Lines commercial jet, killing all 115 people on board. North Korea continues to give sanctuary to members of the Japanese Red Army Faction who hijacked a Japanese commercial jet in 1970, flying it to North Korea. It is for this last reason that the US State Department keeps North Korea on its list of state sponsors of terrorism. Following September 11 a North Korean Foreign Ministry spokesman voiced regret and reiterated North Korean opposition to all forms of terrorism. It is not known to have engaged in any form of international terrorism in the 1990s and beyond and has no known links to al-Qaida.

## The White House dilemma

8. The White House response to the reinvigoration of North Korea's nuclear weapons programme at the end of 2002, and the consequent abrogation of the Agreed Framework was surprisingly muted. At the time, Washington did not want to be distracted from its determination to take military action against Iraq. Furthermore, it did not want to be seen to be blackmailed by North Korea. The US did not want to risk a confrontation by defining 'lines in the sand' that it might be forced to enforce if North Korea brazenly continued with its nuclear weapons programme.

9. Instead, the US called on North Korea to accept the return of International Atomic Energy Agency (IAEA) inspectors and to restore the IAEA's monitoring equipment at Yongbyon. North Korea announced that it would consider sanctions, if applied by the UN Security Council against it for violation of NPT safeguards obligations, as an act of war. The US has in fact not sought such sanctions. Instead, the Bush Administration has continued its policy of slowly increasing pressure on Pyongyang, while carefully not

---

<sup>3</sup> *'Iran and North Korea: US Policy Toward the "Axle of Evil"'*, United States Senate Republican Policy Committee, August 25 2003

<sup>4</sup> *'Dictatorship at the Crossroads'*, speech by John Bolton, East Asia Institute, Seoul, South Korea July 31 2003, [www.state.gov/t/us/rm/23028.htm](http://www.state.gov/t/us/rm/23028.htm).

provoking North Korea, hinting that the US was flexible about diplomacy but refusing to agree to negotiate until North Korea dismantles its nuclear weapons programme. The Bush Administration, therefore, is still faced with the same incompatible options it has had since it came into office: military action, containment, or negotiation.

### **Military action**

10. Washington could, if it chose to do so, destroy North Korea's nuclear facilities at Yongbyon. But, if, as suspected by some, North Korea has built secret nuclear facilities, perhaps in a mountain, a military attack on Yongbyon would not completely destroy North Korea's nuclear capability. North Korea may also have successfully hidden any ballistic missiles it may have equipped with nuclear warheads.

11. America's allies in the region – particularly South Korea and Japan – are strongly opposed to military action against North Korea. North Korea may respond by attacking US forces on the Demilitarised Zone and/or bombard Seoul with artillery and missiles. South Korea and Japan would, of course, be the main casualties of any North Korean retaliation. The stakes would be much higher if North Korea has, and used, nuclear weapons. Given that US policy is not to damage its alliances with South Korea and Japan, the military option is not open to the US. To underline this, Washington has announced that 'it has no intention of invading North Korea' and will work for a 'peaceful resolution' of its dispute with North Korea. Indeed many analysts argue that military action is very unlikely to occur and that such rhetoric is most appropriately viewed in the context of 'psychological warfare'.

### **Containment, isolation and collapse**

12. Many leading officials in the Bush Administration, and many Republicans, have been very critical of the 1994 Agreed Framework. They believe that the Framework was essentially a 'blackmail pay-off' to the rogue regime of North Korea, a member of

the 'Axis of Evil', amounting to a reward for unacceptable behaviour. These officials argue for a policy of containment and isolation, with the aim of provoking the collapse of the regime of Kim Jong Il (described by Bush as a 'pygmy' whom he 'loathed'). A policy that, they say, would solve the problem of Pyongyang's nuclear-weapon and ballistic-missile programmes once and for all. The Proliferation Security Initiative announced in May 2003, although a global arrangement, is specifically geared towards stopping the illicit trade in ballistic missiles from North Korea. It must be remembered that the likely effect of any sanctions is that the North Korean *people* will suffer even more and the regime will, given its past history, survive intact.

13. Nonetheless, the Bush Administration has tried, and failed so far, to persuade countries in the region to join in a coalition to further isolate North Korea and force it to abandon its nuclear ambitions. South Korea is intent on maintaining and improving inter-Korean cooperation; Russia wants to further the development of projects with North Korea; and China's political, security and economic concerns in the Asia Pacific region are such that it will continue for the foreseeable future to provide aid to North Korea. All of this is enough to prevent the collapse of Kim's regime. This hard-line approach would appear to offer no pragmatic route to a resolution of the current crisis.

### **Negotiation**

14. Less hawkish Bush officials argue that, although the Agreed Framework did not eliminate North Korea's nuclear-weapon programme, it did stop North Korea producing more plutonium for nuclear weapons. This group argues for continued diplomatic methods, negotiation and economic inducements to limit North Korea's nuclear-weapon and ballistic-missile programmes. The dilemma is that, if the US offers inducements to North Korea, such as economic benefits and perhaps a non-aggression agreement, to limit North Korea's nuclear and missile activities, it would improve the regime's prospects for survival

and breach Bush's principle of not rewarding North Korea in any way for complying with its commitments. Both the USA and North Korea stepped back from their entrenched positions of late 2002-early 2003 and participated in three-party multilateral talks in Beijing in April 2003 and six-party multilateral talks in Beijing in August 2003 and February 2004. A further round of six-party talks is still under discussion.

15. So far, US efforts to pressure North Korea have failed. Instead of agreeing to American demands, North Korea has continually increased the stakes, whilst the US struggles to formulate a clear policy.

### **How the situation may develop in the short- medium-term**

16.

1. The crisis is defused when Chairman Kim Jong-Il reverses his policies and adopts reformist policies at home, cooperative ones abroad, and takes credible steps towards nuclear disarmament. Financial and other aid from South Korea, the US, Japan, China, Russia and the EU help North Korea rebuild its collapsed economy.
2. The six-party talks process continue until after the US election in November 2004. Substantive multi-lateral or bilateral discussions take place between Pyongyang and the new US Administration leading to a new 'grand bargain'. This involves a series of phased steps building on a short-term North Korean nuclear freeze and US pledge not to use force. The US accepts that verifiable nuclear disarmament is not a viable first step and North Korea accepts a multi-lateral solution is the only way forward. The 'grand bargain' approach has not yet been fully tested. In particular Kim Jong-Il has not been tested on whether, given the right conditions, he will actually take steps towards dismantling North Korea's nuclear weapons programme.

3. The status quo prevails. Negotiations yield little or no substantive progress. Pyongyang continues to hint that it will take a softer line while at the same time continue developing its weapons of mass destruction. The US continues its policy of containment, from time to time threatening to destroy North Korea's nuclear facilities by military action. It will be dissuaded from doing so by South Korea and Japan, its allies in the Asia-Pacific region, and by China and Russia. The US accepts North Korea's possession of a limited number of nuclear weapons. It is important to remember that the US has already lived with North Korea having one or two nuclear weapons for over 10 years.
4. North Korea aggressively develops its nuclear weapons and ballistic missile capabilities and eventually tests both its nuclear weapons and long-range missiles. North Korea deploys a significant arsenal of plutonium and HEU-based nuclear weapons and shows no interest in bargaining away its nuclear capabilities. Neither the United States nor China is likely to allow such a situation to develop since spread of nuclear weapons in the region could lead to the proliferation of nuclear weapons to South Korea and Japan.
5. The North Korean regime implodes, followed by reunification with South Korea. This would be enormously expensive for South Korea; South Korea will, therefore, not work for or welcome the collapse of the North Korean economy.
6. There is the final although remote possibility of a war on the Korean peninsula to forcibly disarm and remove the North Korean regime. In such a war, weapons of mass destruction may well be used, millions may be killed. The cost of post-war reconstruction would be huge. Another Korean war would be an utter, unthinkable catastrophe. An alternative policy is necessary.

## Non-Military Approaches

### Track-II diplomacy

17. Track-II diplomacy refers to the work of individuals or NGOs working in private with government representatives and experts in the fields of consultation, dialogue and training to facilitate creative solutions to major international and internal crises. It has been argued that track-II diplomacy will not work because North Korea has had endless opportunities to engage, but they will not do so in a sustained or consistent manner. Nevertheless:

- **There is undoubted value in continuing track-II engagement because it can help dispel misrepresentations, find common ground and facilitate understanding and improved relations over the long-term.**
- **Very few have direct contact with the Korean People's Army (KPA), including the Chinese. However, the US Army does have contact with the KPA through the Missing In Action (MIA) programme. This contact could be developed and expanded into a broader track-II approach.**

### Shuttle diplomacy

18. Shuttle Diplomacy is a diplomatic tool for crisis management and aversion, or a first step towards face-to face communication. When adversaries are unwilling or unable to engage in direct negotiations on each other's or neutral territory, a mediator may travel between the hostile parties to initiate dialogue, relay messages and suggest ideas for de-escalation of the crisis.

19. In the current crisis it would help the US and North Korea focus on current and future initiatives to move dialogue forward and keep it focussed, and avoid the confrontational exchanges of face-to-face talks. Chinese shuttle diplomacy has already been successfully used to achieve the August 2003 six-party talks in Beijing.

20. A very high-level US statesman could be a very successful intermediary since North Korea appears only to be interested in high-level US contacts. Therefore:

- **Either President Carter should return to North Korea to mediate between Washington and Pyongyang as he did in 1994; or**
- **The US should appoint a high-level representative to North Korea, in the mould of William Perry under President Clinton, dedicated to the North Korea problem.**

21. Direct talks are essential, since multilateralism can only go so far, especially with North Korea. Therefore:

- **The US should establish a permanent US presence in North Korea, such as an embassy to allow shuttle diplomacy to have a concrete effect.**

### Economic and trade incentives

22. Economic and trade incentives such as trade agreements can be used independently, or in conjunction with sanctions, to encourage a state to change or modify particular policies. The aim is to influence a state's policy by offering it an economic or trade incentive, which is only available once the change in policy is agreed and implemented.

23. In the current crisis such incentives can switch the focus of attention to the needs of a country which, when addressed in economic or trade terms, can mitigate fears based on national security concerns or resource shortages. They can also work very effectively within the framework of coercive diplomacy where incentives are backed by credible threats and the failure to comply can lead to the removal of an incentive or more coercive action. Many in the Bush Administration, however, consider such

incentives as a form of appeasement that will only yield short-term benefits and then encourage North Korea to increase its demands. Nonetheless, North Korea's trade with other countries is tiny and trade and economic incentives could be a real lever to push North Korean behaviour in a more positive direction. Actions that could be taken are:

- **Moving North Korea away from dependency on world food programme handouts and into a proper development programme. UNDP has had a full development programme in place since 1998. This needs US support.**
- **Take the necessary measures to allow North Korea access to International Financial Institutions (IFIs) such as the World Bank, IMF and Asian Development Bank to facilitate economic development.**
- **A crucial measure includes removing North Korea from the US State Department's list of states that sponsor terrorism.**

#### **Energy security measures**

24. North Korea's energy sector is extremely dilapidated. The international community could use North Korea's urgent need for energy supplies to reduce the dangers of conflict on the Korean Peninsula. The development of regional energy cooperation is the most practical measure of them all. It is the key to getting North Korea away from dependency and beginning to rebuild its dilapidated industrial base. South Korea is willing to provide the North with electricity. Three measures have been proposed:

- **A new energy deal to replace the Korean Peninsula Energy Development Organisation (KEDO) with an international organisation involving China, US, Russia, Japan, South Korea and the EU. This could involve abandoning the nuclear light-water reactor projects in favour of thermal**

**power generation facilities and resume heavy fuel oil supplies.**

- **Develop the Russian proposal to sell natural gas to North Korea subsidised by South Korea.**
- **Develop the proposed gas pipeline from China to South Korea to serve the South Korean market, and use it to integrate North Korea into a regional gas market.**

25. There are two major unresolved issues affecting economic approaches:

- It is not clear whether or not the major powers do in fact want to progressively integrate North Korea into the world community/world economy given the serious objections to allowing North Korea to become an industrialised nation again.
- The seriousness of the North Korean leadership's desire for economic regeneration is also suspect. Whilst some North Korean officials seek economic recovery, some in the military who handle the issues do not, since it could undermine their authoritarian power.<sup>5</sup>

#### **Arms control and transparency measures**

26. Arms control and transparency measures are used by states within a co-operative framework to foster honesty and openness with regard to their military capabilities. The aim is to avert the development of crises resulting from miscalculations and uncertainty and to foster co-operation, predictability and stability.

27. In the current crisis arms control and transparency measures could stabilise relations between the US and North Korea by clarifying the exact capabilities of each side and prevent escalation of the crisis by

---

<sup>5</sup> For example when North Korea was offered \$2-3 billion in infrastructure development it declined the offer, insisting instead on \$ 1 billion hard currency, eventually settling for ½ billion cash.

instilling a measure of predictability. A range of measures have been proposed, such as establishing a Senate Arms Control Observer Groups on US-DPRK relations along the lines of USSR model, developing an accord styled after the CFE (Conventional Forces in Europe) treaty to verifiably limit heavy weaponry on the entire Korean peninsula or a joint ROK-DPRK monitoring and verification organisation modelled on the Argentina-Brazil Agency for the Accounting and Control of Nuclear Material (ABACC).

28. However, it appears that North Korea will not accept any such measures with the exception of measures relating to its ballistic missile programme. This issue could arguably be dealt with separately since sales have reportedly dropped off and the missiles remain inaccurate. The US should therefore:

- **Revive the deal to limit the North's ballistic missile programme that was on the table towards the end of the Clinton presidency. If successfully dealt with it could pave the way towards an agreement on the North's nuclear programme.**

### Confidence Building Measures

29. Confidence building measures (CBMs) often refer to formal and informal military and political measures, specific actions or agreements designed to build trust and reduce uncertainties among potential adversaries. They may also include social, economic and cultural actions and can be unilateral, bilateral or multilateral. Such measures can prevent disputes escalating into conflict by building a common framework for long-term co-operation and establish predictability in the actions of others. Five CBMs could be initiated to address the current crisis:

- **Removing of North Korea from the US State Department's list of states that sponsor terrorism. This is feasible but would need goodwill on both sides. It would require North Korea to hand over the old Japanese Red Army members living in North Korea. They**

**could be handed over to a third country.**

- **The US should look again at establishing some sort of US liaison office in Pyongyang. If the US had had a presence in North Korea from 1994 the current crisis would not have happened. It is important to increase the number of diplomats in Pyongyang.**
- **The US could offer a conditional security assurance of no-use of force while negotiations are ongoing. This might involve a 1-year non-aggression pact in exchange for verification and inspections.**
- **North Korea could constructively issue a full declaration of Japanese citizens abducted by the DPRK.**
- **North Korea could increase transparency of the distribution of food and medical aid.**

30. One key unresolved issue is whether or not there is still a constituency in the State Department that *wants* to see North Korea removed from the list of states that sponsor terrorism and a gradual normalisation of relations with North Korea.

### Economic sanctions

31. Economic sanctions are coercive measures imposed by one country or coalition of countries, against another country, its government, or individual entities therein, to bring about a change of behaviour or policies. Sanctions are most frequently employed by international and regional organisations and economically and militarily powerful states and can be seen as a bargaining tool to provide leverage for negotiation, a punitive measure or prelude to war.

32. In the current crisis punitive economic sanctions would demonstrate international unity and co-operation, but there are serious questions over whether any multilateral sanctions could be properly enforced. They could potentially change the behaviour of Kim Jong-Il's regime, but they could also leave the regime intact whilst causing yet

more suffering of the North Korean people. The US has already implemented one sanction in the form of the Proliferation Security Initiative that will interdict suspected North Korean shipments of WMD and ballistic missiles and cut off a major source of hard currency.

33. Three further options could be pursued:

- **Deny hard currency by stopping narcotics trafficking and counterfeiting.**
- **Stop remittances from ethnic Koreans living in Japan.**
- **Stop ROK-DPRK ventures such as the Mount Keumgang enterprise**

34. A crucial issue that remains unresolved is how far North Korea would push China before Beijing deems it necessary to apply sanctions. Sanctions will only be effective if China is actively involved. China is wary of applying sanctions because they may squeeze North Korea until it cracks in unpredictable ways and cause a destabilising flood of refugees across the North Korean border.

35. It should be observed that the North Korea famine of the 1990s was the worst in the 20<sup>th</sup> century per head of population if the figure of 2-3 million dead is correct, as USAID estimated.

### **Summary of specific recommendations for the USA and North Korea**

36. There are five constructive actions the US government could undertake to work towards a long-term resolution of the current nuclear stand-off:

1. Establish a permanent presence in Pyongyang. The UK has been able to do much more by having contact with North Korea.
2. Offer a conditional security assurance of no use of force while negotiations are ongoing. This might involve a 1-year non-aggression pact in exchange for verification and inspections

3. Revive the deal to limit the North's ballistic missile programme that was on the table towards the end the Clinton presidency. If successfully dealt with it could pave the way towards an agreement on the North's nuclear programme
4. Move North Korea away from dependency on world food programme handouts and into a proper development programme. UNDP has had a full development programme in place since 1998. This needs US support.
5. Appoint a high-level representative to North Korea dedicated to the North Korea problem.

37. There are three constructive actions North Korea must be encouraged to undertake:

1. Freeze all nuclear activity.
2. Issue a full declaration of Japanese citizens abducted by the DPRK.
3. Increase transparency of the distribution of food and medical aid.

## The Nuclear Weapons Programme Of North Korea

### Nuclear weapons

38. Nuclear weapons can be fabricated using either plutonium or highly-enriched uranium. North Korea is known to have a plutonium-based nuclear weapons programme and is suspected of developing a uranium-based programme.

39. Plutonium is produced as an inevitable by-product in nuclear reactors as they burn up their uranium fuel. When spent fuel is removed from a reactor it can be sent to a reprocessing plant. This plant chemically separates the plutonium from other products in the spent fuel. The separated plutonium can be used to make nuclear weapons. There are different types of plutonium depending on the chemical composition. A minimum of 11kg of plutonium of a type best suited for manufacturing nuclear weapons is required for a nuclear explosion. Using what is known as a reflector, or tamper, can reduce the necessary amount to 3-4kg.

40. Uranium-based nuclear weapons require a specific type, or isotope, of uranium, called U-239. Natural uranium contains only 0.7% U-239. A nuclear weapon requires uranium containing more than 93% U-239. The amount of U-239 in uranium can be increased in a uranium enrichment plant. Enrichment plants are used to make commercial nuclear fuel. However, uranium is generally enriched to less than 5% for use as fuel in nuclear power stations. If uranium is enriched to above 20% it is defined as highly-enriched uranium, or HEU. A minimum of 56kg of weapon-grade HEU is required for a nuclear explosion. Using a reflector or tamper can reduce the necessary amount to about 20kg.

### North Korea's nuclear weapons programme: Outline

41. North Korea is an extraordinarily closed and secretive country. Information and empirical data about its nuclear programme has always been hard

to find. Consequently, published details are usually speculative. Most publicly available information on North Korea's nuclear weapon and ballistic missile programmes is released by US intelligence agencies. Reports in the press and official reports that cite accurate figures for the production of nuclear plutonium and the quality and quantity of a potential North Korean nuclear arsenal are of necessity tentative and suspect. The world must rely on remote monitoring, information from defectors, and official inspections conducted by the International Atomic Energy Agency (IAEA) under the Nuclear Non-Proliferation Treaty (NPT) from 1992-2003 to assess North Korea's nuclear weapons capability.

#### 42. *What is known:*

- North Korea possesses weapons-grade plutonium from reprocessing spent fuel from its Yongbyon-1 reactor – exactly how much is unknown;
- North Korea has a medium- and long-range ballistic missile programme;
- North Korea has sold medium-range ballistic missile technology.

#### 43. *What is generally accepted:*

- North Korea has enough weapons-grade plutonium for at least 1-2 nuclear weapons;
- North Korea has undertaken work to develop nuclear warheads using weapon-grade plutonium;
- North Korea has restarted the Yongbyon-1 reactor.

#### 44. *What is suspected:*

- North Korea has reprocessed 8,000 spent nuclear fuel rods and extracted enough weapon-grade plutonium for 3-6 nuclear weapons;
- North Korea has embarked on an HEU programme;



- North Korea has mated nuclear warheads with medium-range ballistic missiles;
- North Korea has secret, possibly underground, nuclear weapons facilities;

45. ***What is predicted:***

- North Korea may start producing HEU for nuclear weapons by 2006-07;
- North Korea may restart construction of two new reactors for completion by the end of the decade;
- North Korea may conduct a small nuclear test.

### **Background**

46. North Korea established a nuclear energy research complex in 1964 at Yongbyon about 100 kilometres north of Pyongyang. In 1965 a Soviet research reactor was constructed at the site. The operation of Yongbyon-1 gave rise to the suspicion that North Korea was intent on producing nuclear weapons. This suspicion was enhanced by the discovery in 1989 that North Korea had built a plutonium reprocessing plant at Yongbyon to separate plutonium from the fuel elements removed from the Yongbyon-1 reactor. In addition to the former Soviet Union, China actively helped North Korea with its nuclear programme during the 1970s and 1980s.

#### **North-South security dialogue**

47. During the late 1980s and early 1990s South Korea embarked on a new initiative to discuss security matters with the North. This resulted in two agreements: the Agreement on Reconciliation, Non-Aggression, Exchanges and Cooperation, and the Joint Declaration on the Denuclearisation of the Korean Peninsula. The Joint Declaration, signed in 1991 and entered into force in 1992, proscribed the testing, manufacture, production, possession and deployment of nuclear weapons and the possession of nuclear reprocessing and uranium enrichment facilities. However, an agreed inspection regime was never agreed and North-South dialogue stalled at the end of 1992.

#### **IAEA inspections**

48. North Korea acceded to the NPT in 1985 under international pressure, but did not allow inspections by the IAEA, required under the NPT, until 1992. IAEA inspections concluded that North Korea had not declared all of the spent reactor fuel that it had removed from the Yongbyon-1 reactor in 1989, thus violating the NPT. In 1993 North Korea prevented the IAEA inspecting two undeclared facilities and announced its withdrawal from the NPT. The US responded with the threat of sanctions. Tensions were diffused after former US President Jimmy Carter visited North Korea to negotiate with North Korean leader Kim Il Sung. After a few months of negotiations an 'Agreed Framework' was bilaterally concluded between the USA and North Korea aimed at formulating a resolution of the North Korean nuclear issue. The agreement was signed in Geneva on 21 October 1994.

#### **The Agreed Framework**

49. In the 1994 agreement, North Korea agreed to 'freeze' its nuclear programme, including the construction of its two new Magnox nuclear reactors at Yongbyon and Taechon and any further reprocessing of spent nuclear fuel, and eventually dismantle its nuclear facilities. In exchange, North Korea was to receive an annual delivery of 500,000 tonnes of heavy fuel oil for heating and electricity production and two new nuclear-power reactors, scheduled for completion in 2003 but later put back until 2008, to replace North Korea's Magnox reactors. The new light-water reactors (LWRs) would be somewhat less suitable for producing plutonium for use in nuclear weapons than North Korea's own Yongbyon-1 reactor and the two new Magnox reactors under construction. The IAEA was to inspect North Korea's nuclear facilities to ensure that the agreement was not being violated.

50. In addition, political and economic relations between the USA and North Korea were to be normalised and both countries would work for a nuclear-weapons-free zone on the Korean peninsula. The US pledged in

the Agreement to “provide formal assurances to the DPRK against the threat or use of nuclear weapons by the United States”. Both sides have failed to live up to their obligations.

### The current crisis

51. In October 2002 at a meeting with Assistant Secretary of State James Kelly in Pyongyang, the North Koreans, according to US accounts, admitted that they are actively pursuing a nuclear weapons programme. Pyongyang reportedly confirmed to James Kelly Washington’s suspicion that North Korea had a separate programme to produce enriched uranium, presumably as part of its nuclear weapons programme. Publicly, North Korea has said that it retains ‘the right’ to have nuclear weapons but it has since denied that it has an HEU programme.

52. Nevertheless, soon after this meeting the USA suspended the oil shipments to North Korea and North Korea announced that it intended to reactivate the nuclear facilities that were mothballed in 1994. The Yongbyon-1 nuclear reactor was to be restarted, the reprocessing facility was to be reactivated and the construction of the two larger reactors was to be resumed. According to US intelligence, Pyongyang moved fuel rods to the Yongbyon-1 reactor and technicians began work to restart the reactor in December 2002. At this time, North Korea ordered IAEA inspectors to leave the country. When operating, the reactor can again produce plutonium for nuclear weapons. In January 2003, Pyongyang announced that North Korea was withdrawing from the NPT. No other country has withdrawn from the Treaty.

53. In January 2004 an unofficial delegation of US experts visited Pyongyang and Yongbyon, hosted by the DPRK Ministry of Foreign Affairs Ambassador Li Gun.<sup>6</sup> On his

---

<sup>6</sup> The delegation comprised Professor John Lewis, Stanford University; Dr Siegfried Hecker, Los Alamos National Laboratory; Charles Pritchard, Brookings Institute and formerly US special envoy for DPRK affairs; Keith Luse and Frank Januzzi, Senate Foreign Relations Committee experts.

return Siegfried Hecker reported that the Yongbyon-1 reactor had been restarted and was operating smoothly and that the 8,000 fuel rods had been removed from their storage pool and, based on his observations and discussions, had probably been reprocessed at the fully operational reprocessing facility.<sup>7</sup>

54. In the absence of IAEA inspections, the outside world simply does not know how advanced North Korea’s nuclear weapons programme is. According to America’s Central Intelligence Agency the uranium-enrichment programme could be producing two or more nuclear weapons a year by about 2006. It is open to question whether Pyongyang might eventually sell nuclear material and technology to other countries, particularly in the Middle East, since it already sells ballistic missiles.

### North Korea’s nuclear weapons programme: Analysis

55.

#### Known North Korean nuclear facilities:

- IRT DPRK research reactor (still operational);
- Yongbyon-1 5-Mwe reactor (‘frozen’ in 1994 but possibly restarted in 2003);
- ‘Radiochemistry Laboratory’ reprocessing plant at Yongbyon (‘frozen’ in 1994 but possibly restarted in 2003);
- Uranium nuclear reactor fuel rod fabrication plant at Yongbyon (‘frozen’ in 1994 but possibly restarted in 2003)
- Uranium mining, milling and refining facilities;
- Yongbyon-2 50-Mwe reactor (construction halted in 1994 but possibly restarted in 2003);
- 200-Mwe reactor at Taechon (construction halted in 1994 but possibly restarted in 2003).

---

<sup>7</sup> Hecker, S (2004) *Visit to the Yongbyon Nuclear Scientific Research Center in North Korea* United States Senate Committee of Foreign Relations: Washington D.C.

### **IRT-DPRK research reactor**

56. North Korea's General Department of Atomic Energy began operating the small nuclear research reactor, called IRT DPRK, in August 1965 at Yongbyon. The pool reactor, having a steady output of 8,000 kilowatts and supplied by the former Soviet Union, is used for research and training purposes. The operation of IRT DPRK is not remarkable. A large number of countries operate such small reactors, often to produce radioisotopes for medical, industrial or agricultural purposes and for research and training in nuclear physics and nuclear engineering.

### **The Yongbyon-1 5-Mwe reactor**

57. In the early 1980s, US intelligence discovered that North Korea was constructing another reactor, Yongbyon-1, at the Yongbyon nuclear complex. The reactor reportedly went critical on August 14, 1985 and became operational in January 1986. Yongbyon-1 is a gas-cooled (using carbon dioxide gas) and graphite-moderated reactor, fuelled with natural uranium – usually called a Magnox reactor. The reactor is designed to hold a total of about 8,000 fuel rods, containing about 50 tonnes of uranium, in its core. This type of reactor very effectively produces plutonium of the type preferred for the fabrication of nuclear weapons (weapon-grade plutonium). It is similar to the Magnox reactors, developed in the 1950s and used by the British at the nuclear establishment at Windscale, now called Sellafield, for the production of plutonium for Britain's first nuclear weapons. Yongbyon-1 has a power output of 5 megawatts of electricity (Mwe) or about 25 megawatts of thermal energy and could produce up to about 6 or 7 kilograms of weapon-grade plutonium per year of *full operation*. The reactor uses natural uranium fuel, which is abundant in North Korea.

58. The reactor was shut down in 1989 for refuelling for around 70 days and US intelligence agencies believe North Korea removed fuel rods from the reactor for reprocessing. In May 1994 North Korea shut the reactor down once more and removed approximately 8,000 fuel rods, presumably

for reprocessing. Following the 1994 Agreed Framework the fuel rods were encased and stored at Yongbyon. They have now been removed from their storage pool and are thought to have been reprocessed between January and June 2003.

59. According to the US Congressional Research Service, if the reactor were restarted now it could generate 14-18kg of plutonium in 3 years, reprocess it by mid-2006 and convert it into plutonium metal to fabricate into nuclear warheads by early 2007.<sup>8</sup>

### **Plutonium reprocessing facilities**

60. The existence of a reprocessing plant at Yongbyon to separate plutonium from the fuel elements removed from the Yongbyon-1 reactor was reported in 1989.<sup>9</sup> It is thought that work began on the reprocessing plant, or 'Radiochemistry Laboratory' as it is known, in 1986 and was due for completion in the mid-1990s. North Korea reportedly ran a 'hot-test' of the facility in 1990 with a combination of fresh and spent fuel rods and extracted about 60 grams of plutonium.<sup>10</sup> IAEA inspections in 1992 concluded that the plant was indeed a reprocessing facility, although not all the necessary equipment had been installed. The following year inspectors discovered that North Korea was preparing to install a second reprocessing line in the building. A much smaller facility, the Isotope Production Laboratory, also based at Yongbyon has reportedly separated small amounts of plutonium from spent fuel rods. This facility was not frozen under the Agreed Framework.

61. According to David Albright of the Institute for Science and International Security, in 1994 the reprocessing plant was capable of extracting about 60-70kg of

---

<sup>8</sup> North Korea's Nuclear Weapons: How Soon an Arsenal?, Congressional Research Service, S. A. Squassoni, April 23 2003, p. 6.

<sup>9</sup> Wall Street Journal, 19 July 1989

<sup>10</sup> Hecker, S (2004) *Visit to the Yongbyon Nuclear Scientific Research Center in North Korea* United States Senate Committee of Foreign Relations: Washington D.C. p7

weapon-grade plutonium from spent Magnox fuel each year. A second reprocessing line would double the plant's reprocessing capacity. He suggests that North Korea could further expand this plant, or build another one, to reprocess additional spent Magnox fuel from the two new reactors whose construction was halted in 1994.<sup>11</sup> In January 2004 North Korea reportedly stated that the reprocessing capacity of the facility operating under normal conditions is 110 tonnes of spent uranium fuel per year.<sup>12</sup>

#### **The 50-Mwe reactor at Yongbyon and the 200-Mwe reactor at Taechon**

62. North Korea was constructing a second Magnox reactor, Yongbyon-2, with a power output of 50 Mwe, at Yongbyon and a third one, with a power output of 200 Mwe, at Taechon. The construction of these reactors ceased in 1994 and reports suggest that the sites have fallen into disrepair. If North Korea energetically pursued the construction of these facilities, under optimistic conditions the reactors could conceivably become operational within 8-10 years. David Albright estimates that all three reactors (Yongbyon-1, Yongbyon-2 and the reactor at Taechon) could produce between 210 and 280kg of weapon-grade plutonium per year.<sup>13</sup> However, it is reasonable to doubt whether these reactors will ever be completed under the current regime.

#### **Suspected facilities**

63. Numerous US, South Korean and Japanese intelligence documents report suspected underground nuclear facilities for enriching uranium or reprocessing and storing plutonium. These include suspected

underground facilities at Mount Chonma, Hagap, Pakchon, Taechon and Yongjo-ri. The evidence for these facilities is very tenuous. For example it has been reported that traces of krypton-85 have been found at the Mount Chonma site, indicating clandestine reprocessing, but this has not been verified in any way.

#### **Nuclear weapons**

64. Before 1994, North Korea removed spent fuel elements from the Yongbyon-1 reactor and apparently reprocessed some of them. Estimates of the actual amount of weapon-grade plutonium separated by North Korea vary. The US State Department believes that North Korea has about 7 kilograms and the CIA gives a similar figure. However, some intelligence reports from Japan and South Korea suggest up to 24kg.<sup>14</sup> North Korea has not explicitly admitted it possesses nuclear weapons but it often refers to its 'deterrent' without going into any detail. The likelihood is that it does have one or possibly two. The 8,000 spent fuel rods removed from the Yongbyon-1 reactor in May 1994 and in all likelihood reprocessed in 2003 could yield 25-30kg of weapon-grade plutonium for perhaps three or four nuclear weapons (other estimates suggest 5 or 6).<sup>15</sup>

65. The history of other nuclear weapon powers shows that North Korea is likely to use more than an absolute minimum amount of plutonium in its first nuclear weapons, to make sure that the design will work. It is reasonable to assume that it would need at least 6 kilograms of weapon-grade plutonium for each of its first nuclear weapons of the implosion type. The first American nuclear-weapon test, called Trinity, and the Nagasaki bomb each used 6 kilograms of plutonium; each produced explosive yields equivalent to that of 21,000 tonnes of TNT.

---

<sup>11</sup> Solving the North Korean Nuclear Puzzle, Appendix 3: Setting the Record Straight About Plutonium Production in North Korea, D, Albright & H. Higgins, [www.isis-online.org/publications/dprk/book/app.html](http://www.isis-online.org/publications/dprk/book/app.html)

<sup>12</sup> Hecker, S (2004) *Visit to the Yongbyon Nuclear Scientific Research Center in North Korea* United States Senate Committee of Foreign Relations: Washington D.C. p7

<sup>13</sup> Solving the North Korean Nuclear Puzzle, Appendix 3: Setting the Record Straight About Plutonium Production in North Korea, D, Albright & H. Higgins, [www.isis-online.org/publications/dprk/book/app.html](http://www.isis-online.org/publications/dprk/book/app.html)

---

<sup>14</sup> *North Korea's Nuclear Weapons Program*, L.A. Nicksch, Congressional Research Service, October 9 2002, p. 5

<sup>15</sup> *North Korea's Nuclear Weapons: How Soon an Arsenal?*, Congressional Research Service, S. A. Squassoni, April 23 2003, p. 5.

66. When North Korea is confident that its design is likely to work as planned, it is likely to use less plutonium in each weapon, reducing the amount to perhaps 3 or 4 kilograms per weapon. Some assume that North Korea would be prepared to jump straight away to fabricating nuclear weapons with the smaller amount of plutonium and assume therefore that North Korea has fabricated two nuclear weapons from the 7 or so kilograms of plutonium it now probably has.

67. If North Korea completes construction of the 50-Mwe and 200-Mwe reactors, it could generate up to 280 kilograms of plutonium a year if the reactors are operated at full capacity. Under reasonable operating conditions, the reactors could produce about 200 kilograms of plutonium a year. This amount of plutonium could, in theory, make about 65 nuclear weapons a year. This figure assumes that North Korea, by that time, has acquired the same sort of nuclear weapons expertise as the established nuclear weapon states and uses 3-4kg of weapon-grade plutonium for each nuclear warhead. This level of expertise can only be achieved through nuclear testing. North Korea would also have to expand its reprocessing facilities to produce this many nuclear weapons per year.

68. For comparison, a large commercial Magnox reprocessing plant, such as B-205 operated by British Nuclear Fuels Limited (BNFL) at Sellafield, UK, can reprocess up to 1,200 tons of spent Magnox fuel per year. This could yield 600kg of weapon-grade plutonium annually. However, this is a major industrial undertaking.

### **High explosives**

69. High explosives are used in explosive 'lenses' in nuclear weapons based on an implosion design. It was reported in 1989 that North Korea was engaged in research on conventional high explosives at Yongbyon, another indication of a nuclear weapons

programme.<sup>16</sup> South Korean intelligence sources have stated that North Korea was unable to use the Yongbyon High Explosive Test Site after the 1994 Agreed Framework, and began building a new test site in Yongdok-dong. These intelligence sources report that as of 2002 North Korea had conducted seventy high explosive tests at this site.

### **North Korea's Highly Enriched Uranium Programme:**

#### **Producing highly-enriched uranium for nuclear weapons**

70. Knowledge of North Korea's uranium enrichment programme is, to say the least, very little. It is not known, for example, if North Korea has yet enriched any uranium and, if it has, the level of enrichment that has been achieved. It has been reported that Pakistan has given significant assistance to North Korea in its nuclear programme, in return for ballistic missile technology. It may have given North Korea advanced technology for the enrichment of uranium and data on designing and fabricating a nuclear weapon. Abdul Qadeer Khan, the Pakistan nuclear scientist who directed Pakistan's nuclear-weapon programme, has recently confessed that he was responsible for the supply of nuclear technology, know-how and nuclear-weapon designs to North Korea, as well as to Iran and Libya. Khan exposed an international network of nuclear suppliers operating in several countries.

71. Although North Korea has denied having an HEU programme, it is entirely conceivable that North Korea embarked on an HEU programme in the event that the Yongbyon nuclear complex was permanently shut-down under the 1994 Agreed Framework.

72. There are five main methods for the enrichment of uranium – gaseous diffusion, laser enrichment, chemical enrichment, gas centrifuges, and calutrons. It is generally assumed that North Korea is using, or intends

---

<sup>16</sup> *Jane's Defence Weekly*, 23 September 1989

to use, the gas centrifuge method. The CIA estimates that North Korea began a centrifuge-based uranium enrichment programme in 2000 and could, based on this intelligence, be in a position to begin producing HEU for nuclear weapons by around 2005-06.

73. The gas used in gas centrifuges for the production of highly enriched uranium for nuclear weapons is uranium hexafluoride, an extremely corrosive gas. All operational components in the centrifuges must, therefore, be made from materials that do not corrode. Gas centrifuges contain rotors, cylinders rotating at very high speeds, made from special materials, particularly maraging steel or carbon fibre, and constructing these components is not an easy task.

74. The critical mass of a bare sphere of weapon-grade enriched uranium is about 56 kilograms. For comparison, the critical mass of a bare sphere of weapon-grade plutonium is about 11 kilograms. Assuming that North Korea uses an implosion type design with a sphere of highly-enriched uranium and surrounds the sphere with a reflector or tamper, it could cut the critical mass to about 20 kilograms. North Korea is likely to use more than an absolute minimum amount of highly enriched uranium in its first nuclear weapons. It can be assumed that it would need at least 25 kilograms of highly enriched uranium for each weapon of the implosion type. A strategically significant nuclear force for North Korea would consist of at least six nuclear weapons, requiring 200 or so kilograms of highly enriched uranium, allowing for some wastage.

#### **How many centrifuges would North Korea need?**

75. A North Korean facility containing 3,000 centrifuges could produce 7,500 SWU per year or about 40 kilograms of highly enriched uranium per year.<sup>17</sup> It would take this facility

---

<sup>17</sup> The capacity of a gas centrifuge is measured in separative work units (SWUs). A reasonable estimate is that each centrifuge of the type that North Korea is likely to produce would have a capacity of about 2.5 SWU per year. That this is likely is indicated by the

at least 5 years to produce enough highly-enriched uranium for the nuclear force of six nuclear weapons. With sufficient expertise in HEU-based nuclear weapons 40kg per year could provide two nuclear weapons.

76. Assuming that about 60 per cent of the centrifuges have to be rejected as sub-standard, a reasonable assumption, North Korea would need to produce about 5,000 centrifuges for the facility. Moreover, gas centrifuges break down frequently because of the mechanical stresses they are under. A steady supply of replacement machines must, therefore, be produced. A facility operating a cascade of 3,000 centrifuges would use as much energy, electrical power, as a largish city – roughly 1,000 kilowatt-hours per gram of highly-enriched uranium. It would, therefore, be impossible to operate such a facility clandestinely. Building and operating effectively a gas centrifuge facility of a useful size is not a trivial task – it is an industrial undertaking. It would probably take North Korea at least five or six years to build such a facility and begin producing significant amounts of highly enriched uranium.

#### **North Korea's Economic Difficulties**

77. North Korea's economy is in a poor shape and it is reasonable to question the country's ability to run a gas centrifuge plant of significant size to produce highly enriched uranium. North Korea's economic problems arise from a combination of a dictatorial regime that has mishandled the economy; natural disasters, particularly floods; the ending of COMECON markets following the collapse of the Soviet Union; and western economic sanctions, particularly those applied by the USA. In the 1990's, famine in North Korea killed hundreds of thousands of people. In fact the North Korean famine was the

---

example of Iraq. In 1991, Iraq was testing two prototype centrifuges. In one test, a carbon-fibre rotor was spun at up to 60,000 rpm (a wall speed of roughly 450 meters per second). The enrichment capacity during the best test run reached 1.9 SWU per year. IAEA inspectors estimated that an output of 2.7 SWU per year could have eventually been achieved, but this would have required much more development work.

worst in the 20<sup>th</sup> century per head of population if the figure of 2-3 million dead is correct, as USAID estimated.

78. With a population of about 24.5 million, its annual Gross National Product is about US\$20 billion, or about US\$800 per capita/year. For comparison, with a population of about 47.3 million, South Korea's annual GNP is about US\$425 billion population, or about US\$9,000 per capita/year. North Korea's per capita GNP is about one tenth of that of South Korea. After the Korean War, North Korea was sustained by considerable economic aid from the Soviet Union. The collapse of the Soviet Union hit North Korea hard and saw its GDP steadily contract, probably by about 5 percent annually, between 1990 to 1998 inclusive. In recent years the economy has slowly begun to grow.

79. North Korea's economy is based on self-reliance, which means in practice isolationist self-sufficiency. However, its severe economic difficulties have forced the country to accept international economic food aid and to impose some limited market reforms. A small amount of foreign investment is now allowed. Joint ventures with South Korean companies now generate annually more than US\$100 million. The major sectors of North Korea's economy are agriculture and mining. The North Korean elite is also known to raise significant finances through money laundering and trafficking narcotics. Manufacturing production is currently only about 10 percent of the level in the late 1980s and reliant on technology dating from the 1960s and 1970s.

80. Peter Hayes of the Nautilus Institute argues that the conventional North Korean military requires a growing economy, and Kim Jong-Il requires the continued support of the North Korean army. He also maintains that within a decade Korean Communist Party leaders will be operating integrated trading empires similar to the South Korean conglomerates such as Hyundai and Daewoo. Their operations, he predicts, will be

concentrated in an urban commercial and manufacturing zone on the northern side of the De-Militarised Zone. The Kaesong project, which involves the construction of a huge industrial estate on the North-South border, with all electricity and utilities supplied directly by South Korea across the De-Militarised Zone, may be the precursor to this kind of development. Nevertheless, estimates of the willingness of the Kim Jong-Il regime to shift from a corrupt, criminal economic base to a commercial national economy vary enormously.<sup>18</sup>

#### **North Korea's energy base**

81. The bulk of North Korea's energy comes from coal and hydropower. Coal accounts for nearly 90 percent of North Korea's energy consumption. Hydroelectric power plants based on primitive technology generate about two thirds of North Korea's electricity. The country's electricity consumption in 2000 was only two thirds of that in 1991, although it increased in 2000 and later years. Flood damage has been a major problem for hydroelectric power plants. There is some prospect that South Korea will provide some electricity to North Korea to ease North Korea's electricity shortage. Russia is another possible supplier of electricity to North Korea. But a major problem is that the North's grid system for electricity transmission is in a very bad shape. Problems with the transport of coal by rail have, for a number of years, caused North Korea's coal-fired power plants to run well under capacity. North Korea lacks indigenous supplies of oil. Oil accounts for about 6 percent of North Korea's primary energy consumption. There is a possibility that oil reserves may be exploitable in West Korea Bay and the Tachon-Rajin area near the Chinese border.

82. Because of the shortage of fossil fuels, North Korea has for some time shown an interest in nuclear power for the generation of electricity. KEDO, a consortium including

---

<sup>18</sup> Hayes, P (2003) *Bush's Bipolar Disorder and the Looming Failure of Multilateral Talks with North Korea* Nautilus Institute: Berkeley

South Korea, Japan, the European Union and the United States, was to provide two light water reactors to North Korea as part of the 1994 Agreed Framework to freeze North Korea's nuclear weapons programme. Site preparation and the training of North Korean technicians began in mid-2002. The project is now stalled over the recent crisis and is likely to be scrapped.

### North Korea's potential nuclear weapons Capabilities: Overview

83.

<i>Weapon-grade plutonium</i>		
Already thought to have:	7-10kg	1-2 nuclear weapons
If 8,000 fuel rods are reprocessed:	25-30kg	Another 3-4 nuclear weapons
If Yongbyon-1 is restarted:	6kg per year	1 nuclear weapon per year
If Yongbyon-2 and Taechon reactors come online between 2012-2014:	200-275kg	Enough for 40-65 nuclear weapons per year
<i>Highly-enriched uranium</i>		
If HEU plant becomes operational by 2005-07:	40kg per year	Enough for 1.5 nuclear weapons per year

### North Korean nuclear delivery systems

84. North Korea could deliver nuclear weapons by combat aircraft and ballistic missiles, although it clearly seems to prefer ballistic missiles as a delivery system and has a very energetic ballistic missile programme dating back to the 1960s.

85. North Korea has received considerable external assistance for its missile programme: in the 1960s the former Soviet Union supplied North Korea with various types of missiles, missile technologies and training; China gave missile technology to North Korea from the 1970s; and Egypt supplied North Korea with

Soviet Scud B missiles, launchers and support equipment in 1980.

86. North Korea has deployed, or is developing, several types of ballistic missile of various range. North Korea tested its first ballistic missile, the *Hwasong-5* (a cloned Soviet Scud-B), in 1984. It subsequently developed the *Hwasong-6*, or Scud-C, by reverse engineering and enhancing Scud technology.

87. North Korea began to develop the *No-dong* missile, based on Scud technology, in 1988 and conducted its only successful flight test in 1993. It is reportedly designed to carry a nuclear warhead. According to the *Bulletin of the Atomic Scientists* (March/April 2003) the No-dong has a range of about 1,400 kilometres and can carry a payload of between 770 and 1,200 kilograms. This payload should be adequate for nuclear weapons of the type likely to be the one used by North Korea for its first generation of nuclear weapons. About 100 No-dong missiles are deployed.

88. Syria, Iran, Pakistan and Libya have all bought, or seek to buy, No-dong missiles. The Nuclear Threat Initiative organisation maintains that No-dong sales to Pakistan in the 1990's were part of a deal for North Korea to acquire technology and/or materials for a uranium-enrichment programme. This claim has been supported by the confession of leading Pakistani nuclear scientist Abdul Qadeer Kahn January 2004, who admitted that he sold nuclear technology to Iran, Libya and North Korea throughout the 1990s.<sup>19</sup> The Pakistani *Ghauri* ballistic missile is reportedly based on the No-dong. It is also reported that the Iranian *Shahab-3* ballistic missile is based on No-dong missiles purchased from North Korea.

89. North Korea is also developing two longer-range missiles called the Taepodong-1

<sup>19</sup> GlobalSecurity.org (2004) *A. Q. Khan* GlobalSecurity.org: Alexandria. Available at <http://www.globalsecurity.org/wmd/world/pakistan/khan.htm> on February 18 2004.



and Taepodong-2. The Taepodong-1 has a range of about 2,000 kilometres and can carry a payload of about 1,200 kilograms. It uses a No-dong missile as its first stage and a Scud variant (Hwasong-5 or 6) as the second stage. In August 1998 North Korea conducted its first and only flight test of the Taepodong-1. The missile comprised 3 stages and its official mission was to place a small satellite in space. Other analysts have argued that the test-flight was a wake-up call to demonstrate North Korea's ballistic missile capabilities. The first two stages worked but the final stage failed. Debris from the missile was found in the Pacific Ocean 6,400km from the launch site. The unannounced test had a major impact on both US and Japanese assessments of the threat that North Korea posed.

90. The Taepodong-2 missile is thought to have begun development in the late 1980s. It is reported to be a 2-stage missile and may have a range of between 3,500 and 6,000 kilometres with a payload of between 700 and 1,000 kilograms.<sup>20</sup> It has not yet been tested and it is not clear whether North Korea possesses a functional version of this missile. According to US intelligence North Korea conducted missile engine tests in 1994. US intelligence states that North Korea is working towards a ballistic missile, possibly the Taepodong-2, which will have an intercontinental range capable of striking the continental United States.<sup>21</sup>

---

<sup>20</sup> The 2000 CIA National Intelligence Estimate 'Foreign Missile Developments and the Ballistic Missile Threat Through 2015' states that: "*The Taepo Dong-2 in a two-stage ballistic missile configuration could deliver a several-hundred-kg payload up to 10,000 km—sufficient to strike Alaska, Hawaii, and parts of the continental United States. If the North uses a third stage similar to the one used on the Taepo Dong-1 in 1998 in a ballistic missile configuration, then the Taepo Dong-2 could deliver a several-hundred-kg payload up to 15,000 km—sufficient to strike all of North America*"

<sup>21</sup> The 2000 CIA National Intelligence Estimate 'Foreign Missile Developments and the Ballistic Missile Threat Through 2015' states that: '*North Korea's multiple-stage Taepo Dong-2, which is capable of reaching parts of the United States with a nuclear weapon-sized (several hundred kg) payload, may be ready for flight-testing.*'

91. The US cannot reliably discover whether or not North Korea has actually fabricated nuclear weapons nor can it determine whether or not North Korea, if it has fabricated nuclear weapons, has deployed them on ballistic missiles. Warheads have to be made light enough and small enough to fit on a missile, and robust and sophisticated enough to withstand the stresses of missile flight. The range of the Taepo-dong-1 and Taepodong-2 missiles are also subject to speculation.

92. In 2000 the US reached an agreement with North Korea to lift US economic sanctions, in place since the Korean War, in exchange for a moratorium on further missile tests. North Korea originally demanded \$1 billion annually to stop it exporting its missiles to other countries. The US declined the offer.

93. The suspicion that North Korea may be developing, and may eventually deploy, long-range ballistic missiles, carrying nuclear or biological warheads, capable of threatening the American mainland is a major reason why the President Bush is pursuing so energetically a Ballistic Missile Defense system. The US goal is to have a system, designed to shoot down a small number of relatively unsophisticated ballistic missiles, operational by 30 September 2004. The system, able to defend the US from an attack by, for example, North Korean missiles, will include interceptor missiles, radars, space-based sensors and command and control elements, mainly deployed in Alaska but also including early-warning radars at Fylingdales in the England and Thule, in Greenland. Japan is also developing a sophisticated BMD system with the United States to counter North Korea's ballistic missile capabilities.

### **Chemical and biological weapons programmes**

94. Very little is known about North Korea's chemical and biological weapons. It is reasonable to assume that North Korea has a stockpile of chemical agents of various types. It is probable that North Korea has developed nerve agents and mustard gas and produced

munitions, perhaps including missile warheads, able to deliver them. North Korea seems less interested in biological weapons, but it has the capability to produce and possibly to deploy anthrax, cholera, yellow fever and plague in munitions. The extent of the production and deployment of biological and chemical weapons by North Korea is not known.

### **Chemical weapons**

95. In 1954, North Korea received, from the Soviet Union and China, some chemical warfare agents and technologies captured from the Japanese during the Second World War. Although North Korea tried in the late 1950s to develop an indigenous chemical industry based on its deposits of natural raw materials it was unable to produce significant quantities of chemical weapons. In 1964, North Korea made an agreement with Japan to buy agricultural chemicals. This enabled North Korea to import the chemicals required to produce the nerve agent tabun, mustard gas and organo-phosphorus compounds. However, agriculture and fertiliser factories cannot operate anywhere near full capacity because of the lack of electricity and the age of the technology, much of which dates back to the 1960s.

96. By 1990, North Korea is thought to have established an operational chemical weapon programme, producing militarily significant amounts of nerve agents and a variety of chemical munitions. According to the Federation of American Scientists (FAS): “North Korea is believed to possess a sizable stockpile of chemical weapons, which could be employed in offensive military operations against the South. North Korea has also devoted considerable scarce resources to defensive measures aimed at protecting its civilian population and military forces from the effects of chemical weapons. Such measures include extensive training in the use of protective masks, suits, detectors, and decontamination systems. Though these measures are ostensibly focused on a perceived threat from U.S. and South Korean forces, they could also support the offensive

use of chemical weapons by the North during combat”.

97. The FAS, while admitting that the production rate and types of chemical munitions are not known, maintains that: “North Korea has at least eight industrial facilities that can produce chemical agents”. It also states that: “In the assessment of US intelligence services, their reserves, accommodated in perhaps half a dozen major storage sites and as many as 170 mountain tunnels, are at least 180 to 250 tons, with some estimates of chemical stockpiles run as high as 5,000 tons” and that “North Korea is capable of producing and employing chemical weapons that virtually all the fire support systems in its inventory could deliver, including most of its artillery pieces, multiple rocket launchers and mortars. Some bombs the Air Force employs also could deliver chemical agents, as could the FROG or the SCUD missile”.

98. The North Korean military forces are thought to have mature chemical defence systems able to detect chemical agents and decontaminate personnel and equipment. Military personnel are equipped with protective masks and suits. In addition, the population engages from time to time in chemical warfare drills. The aim of the authorities is to issue protective masks to the whole population. North Korea has not yet signed the 1993 Chemical Weapons Convention and it is not likely to do so in the near future because it objects to the verification measures required by the treaty.

### **Biological weapons**

99. North Korea has paid less attention to biological weapons than to chemical and nuclear weapons perhaps because it lacks expertise in biotechnology or because biological warfare is harder to control. In a war against South Korea or American forces in South Korea, biological weapons would be as dangerous to North Korean forces as to those of the enemy. Therefore, North Korea is not likely to use biological weapons although

it could use biological agents against food crops or water supplies.

100. Nevertheless, North Korea, assisted by experts from other countries, began a research and development programme into biological warfare in the 1960s. In 1980, North Korea is thought to have begun the significant production of biological warfare agents or toxins and biological weapons. It has sufficient biotechnology facilities to support the production of some quantities of toxins and viral and bacterial biological warfare agents. Probable biological warfare agents include anthrax, cholera, yellow fever and plague. North Korea may have weaponised these agents. North Korea acceded to the Biological Weapons Convention (BWC) in 1987.

### **North Korea's conventional forces**

101. Large conventional military forces, containing a total of nearly two million personnel, face each other across the border (the de-militarised zone) between North and South Korea. They are armed with modern major weapons (main battle tanks, armoured vehicles, warships, combat aircraft, and surface-to-surface and surface-to-air missiles). Many of the weapons and personnel are kept on alert status.

102. North Korea's armed forces are thought to total about 1 million people in active service and 4.7 million in the reserves. The army has about 950,000 personnel, the navy has about 46,000 and the air force about 86,000. The army deploys about 3,500 main battle tanks and FROG and SCUD-C surface-to-surface missiles. The navy operates submarines, frigates, and patrol and coastal vessels. The air force operates mainly MiG (-17, -19, -21, -23, and -29), Su-7 and Su-25 aircraft.

103. For comparison, South Korea operates military forces with a total of 686,000 active personnel and 4.5 million reserves. The army is 560,000 strong; the navy has 63,000 personnel; and the air force 63,000. The army deploys about 2,300 main battle tanks and surface-to-surface missiles. The navy operates submarines, destroyers, frigates, corvettes and patrol and coastal vessels. The air force operates mainly F-16, F-5 and F-4 aircraft. The USA has about 37,000 military personnel in South Korea – 29,000 in the army, 300 in the navy and 7,600 in the air force.

**Appendix A: Key problems that a *non-military* approach will have to address**

104.

1. Overcoming the belligerence of hard-liners in Washington that favour further isolation to precipitate either DPRK collapse or war, and don't want to allow the Kim Jong-Il regime to survive even if it abandons its nuclear weapon programme because, they argue, he cannot be trusted.
2. Dealing with the North Korean regime's tendency to take advantage of any form of engagement and violate international agreements.
3. Getting a full declaration of DPRK's nuclear capabilities.
4. How to verify DPRK compliance with any disarmament agreement and what to do if the DPRK breaks it.
5. Bush's personal 'loathing' of Kim Jong-Il.
6. Dismantling DPRK's long-range ballistic missile programme.
7. Japanese hostility over Japanese citizens kidnapped by DPRK. The issue has become politicised to the extent that compromise is currently politically untenable.
8. South Korea, Japan and China favour DPRK reform and eventual peaceful reunification – not punitive sanctions and 'tailored containment' favoured by US.
9. Consequences of allowing DPRK to become an overt nuclear weapons state
10. Huge problem of refugees if DPRK situation deteriorates – particular concern for China.

## **Appendix B: Key problems that a *military* approach will have to address<sup>22</sup>**

105.

1. It cannot be certain that a pre-emptive strike would eliminate North Korea's nuclear weapons capability, or any nuclear weapons or nuclear material it may currently possess.
2. Nuclear material may be spread to surrounding countries following strikes against North Korea nuclear facilities.
3. North Korea would probably retaliate with a counter attack against South Korea. Seoul, Which has a population of 10.3 million, lies within the range of North Korea long-range artillery and North Korea has an estimated 500-600 Scud missiles that could strike targets throughout South Korea. North. 70% of North Korea army ground units are located within 100 miles of the demilitarised zone, estimated at 645,000 personnel.<sup>23</sup>
4. The number and mobility of North Korean artillery pieces and ballistic missile make them difficult targets to destroy.
5. North Korea may retaliate against the 37,000 US troops stationed in North Korea.
6. North Korea may retaliate against Japan. North Korea is estimated to have deployed around 100 No-dong missiles capable of striking Japan.
7. North Korea may use chemical artillery shells, Scud missiles equipped with chemical warheads and possibly a nuclear weapon.
8. A military approach will result in 100,000's of refugees for South Korea and China to deal with.
9. A new regime installed by a US-led military regime change may not be willing to dismantle North Korea's nuclear weapons programme.
10. Casualties would be enormous. It is estimated that US and South Korean military forces may suffer 300,000-500,000 casualties in the first 90 days of a conflict, with 100,000s of civilian casualties. Civilian and military casualties would probably number more than a million.
11. Reconstruction costs would be phenomenal. A 1994 estimate suggested a war would cost the US more than \$100 billion and the destruction and interruption of business would cost a trillion dollars to the countries involved and their immediate neighbours.<sup>24</sup>
12. There exists possibility that US may deploy nuclear weapons to South Korea, which may, in the event of a chemical or nuclear retaliatory attack from North Korea, be used against the North.

---

<sup>22</sup> In particular see Phillip Saunders, '*Military Options for dealing with North Korea's Nuclear Program*', Center for Non-Proliferation Studies, Monterey Institute of International Studies, available at [www.cns.miiis.edu/research/korea/dprkmil.htm](http://www.cns.miiis.edu/research/korea/dprkmil.htm), from which most of this information is taken.

<sup>23</sup> Joseph S. Bermudez Jr., *The Armed Forces of North Korea*, I.B. Tauris, 2001, p.3 and International Institute for Strategic Studies, *The Military Balance 2002-03*, Oxford University Press, 2002, p.153 cited in *Stand-off with North Korea: War Scenarios and Consequences*, Colin Robertson and Stephen Baker, Center for Defense Information, Washington.

<sup>24</sup> Gen. Gary Luck, testimony before the Senate Armed Services Committee, January 26 1995.