



VERIFIED DENUCLEARIZATION OF NORTH KOREA

ELEMENTS OF A PHASED APPROACH

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BACKGROUND

(CHALLENGES ... AND SOME PREMISES)



WHAT ARE NECESSARY CONDITIONS FOR NEGOTIATIONS TO BEGIN ?

Continuing moratorium on nuclear weapon and ballistic missile tests

Suspension of fissile material production (plutonium and highly enriched uranium) often seen as another condition for advancing negotiations



HOW COULD THESE CONDITIONS BE VERIFIED ?

Realistically, short-term measures may have to rely (primarily) on remote-monitoring techniques; gaining confidence in the absence of undeclared/ clandestine production facilities will take time, perhaps years, even if DPRK fully cooperates

Source: DigitalGlobe (bottom)

2008 VERIFICATION PLAN

PROPOSED BY THE U.S. GOVERNMENT AS PART OF THE SIX-PARTY TALKS
(AND DESIGNED TO ADDRESS ALL ELEMENTS OF A NUCLEAR PROGRAM)

VERIFICATION MEASURES DISCUSSION PAPER

Below is a list of measures that would be applied to undertake verification activities. These measures will form the basis for development of a verification implementation plan that assigns specific responsibilities and requirements. These measures provide a means to address all elements of a nuclear program, to include plutonium production, uranium enrichment, weapons, weapons production and testing, and proliferation activities.

The verification regime consists of experts of the six parties and is responsible to the Working Group on Denuclearization of the Korean Peninsula.

- Six Party Experts will be determined by their national governments, and will coordinate their actions in order to implement the agreed verification plan.
- Experts will be permitted to bring, utilize, and remove their own equipment in the course of exercising their responsibilities, to include measurement devices, radiation detection equipment, sampling materials and equipment, and GPS receivers.
- Experts will be permitted to use their own interpreters and translators.
- Experts will be allowed free communications, including attended and unattended transmission of information generated by containment and/or surveillance or measurement devices.
- Experts will be permitted to make use of internationally established systems of direct communications, including satellite systems and other forms of telecommunication.
- Experts will be given visas in a timely manner in order to conduct/support verification activities.
- If, in the course of implementing this plan, questions arise requiring resolution, either the expert or his/her designated representative may request a meeting to consult and clarify promptly. Should such a meeting not result in resolution of questions, any of the relevant parties may call for a meeting of the relevant parties to address the questions.
- Verification activities involving weaponization-related activities, information, facilities or material, will be conducted by experts from the Nuclear Weapons States as defined by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Specifically, experts from the Nuclear Weapons States will:

VISITS

Full access to all materials at any place on a site; full access (upon request) to any site, facility, or location to confirm correctness and completeness of declaration

REVIEW OF DOCUMENTS

Full access to records (fully preserved and maintained), including originals, and information systems documenting historic nuclear material production

INTERVIEWS WITH TECHNICAL PERSONNEL

At any site, facility, or location

OTHER MEASURES

Conduct forensic measurements of nuclear materials and equipment; collect and remove samples of nuclear materials and equipment (including of reactor)

Reproduced in Appendix 4A in *Global Fissile Material Report 2009*, International Panel on Fissile Materials, www.ipfmlibrary.org/gfmr09.pdf
Original available at www.ipfmlibrary.org/gov08.pdf

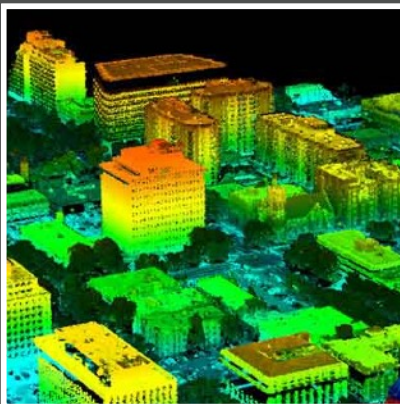
THREE LEVELS OF ACCESS

FOR POSSIBLE INSPECTIONS IN NORTH KOREA



REMOTE MONITORING

Satellite imagery in particular could be an important tool to confirm the operational status of nuclear facilities or observe (the absence of) related activities



STANDOFF DETECTION

For facilities where onsite access is considered too intrusive, at least initially, nearby sensors could provide reassurance of compliance with agreed provisions



ONSITE INSPECTIONS

Direct inspector access to declared sites and (upon request) to other sites access offers the greatest level of reassurance, especially when combined with measurements

Source: DigitalGlobe (top), NASA (middle), IAEA (bottom)

Suspension of Fissile Material Production

Can such a suspension be remotely monitored?

(REMOTE) MONITORING

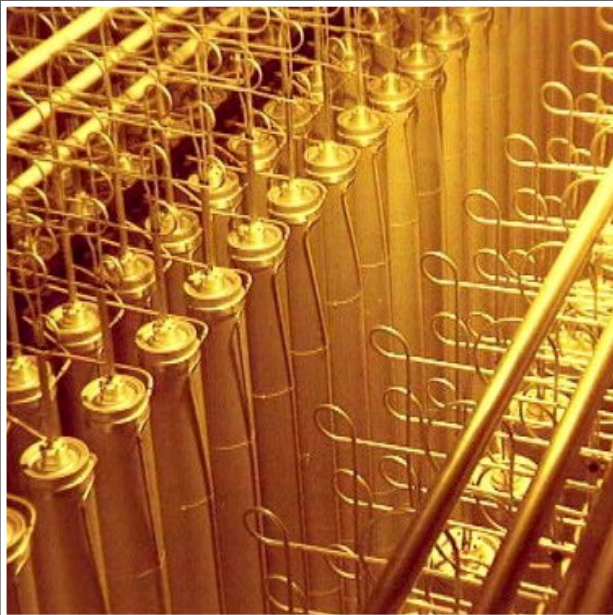
OF A FREEZE ON FISSILE MATERIAL PRODUCTION



PLUTONIUM PRODUCTION

Satellite imagery can be used to observe heat signatures, vapor plumes, cooling water discharges, and other onsite activities; these provide good evidence for a suspension of plutonium production at Yongbyon

Regional krypton-85 monitoring could provide further evidence of a freeze



NON-PRODUCTION OF HIGHLY ENRICHED URANIUM

Shutdown status of enrichment plant could (possibly) be monitored remotely; if plant is allowed to operate, then unattended measurement systems (OLEM, C/S, and perhaps even environmental sampling) could confirm non-production of HEU

Source: Google (top) and Urenco (bottom)

Making Declarations

(and Confirming Their Correctness and Completeness)

POSSIBLE BASELINE DECLARATIONS

OF NUCLEAR WARHEAD AND FISSILE MATERIAL INVENTORIES

WARHEAD DECLARATION	
	Inventory
Total number of warheads as of [DATE]
Warheads, by type/designation
Additional warhead components in storage, by type/designation

FISSILE MATERIAL DECLARATION			
	Plutonium	HEU	(Tritium)
Inventory as of [DATE]
Total material produced
Removals and losses (including material consumed in weapon tests)

Adapted from: *Global Fissile Material Report 2013*, International Panel on Fissile Materials, www.ipfmlibrary.org/gfmr13.pdf

DATA EXCHANGE

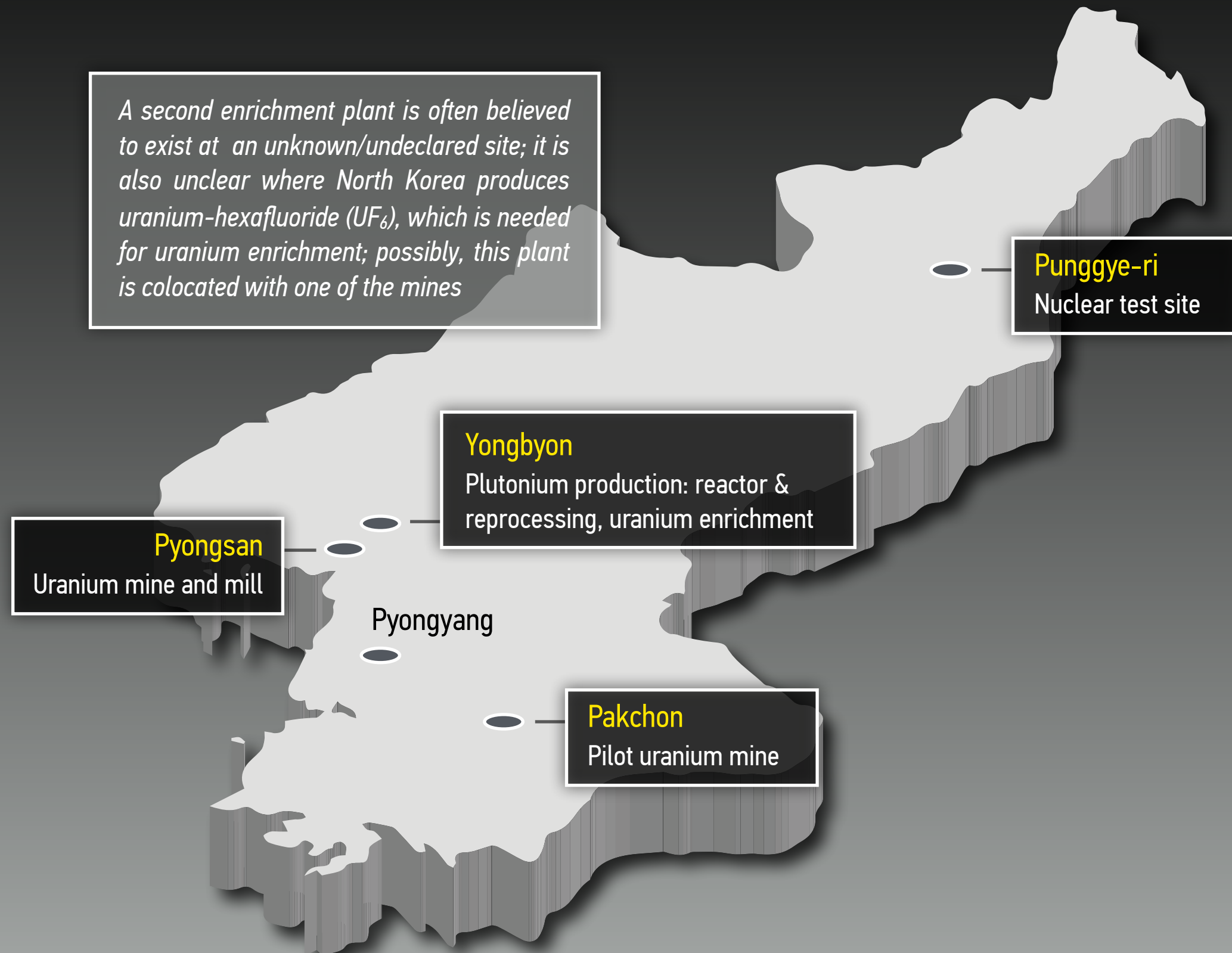
AS A BASIS FOR A MORE ROBUST VERIFICATION FRAMEWORK



In May 2008, North Korea made available about 18,000 pages of operating records with information on operation of its plutonium production reactor and the associated reprocessing facility since 1986

Verifying Completeness

SELECTED NUCLEAR SITES AND FACILITIES

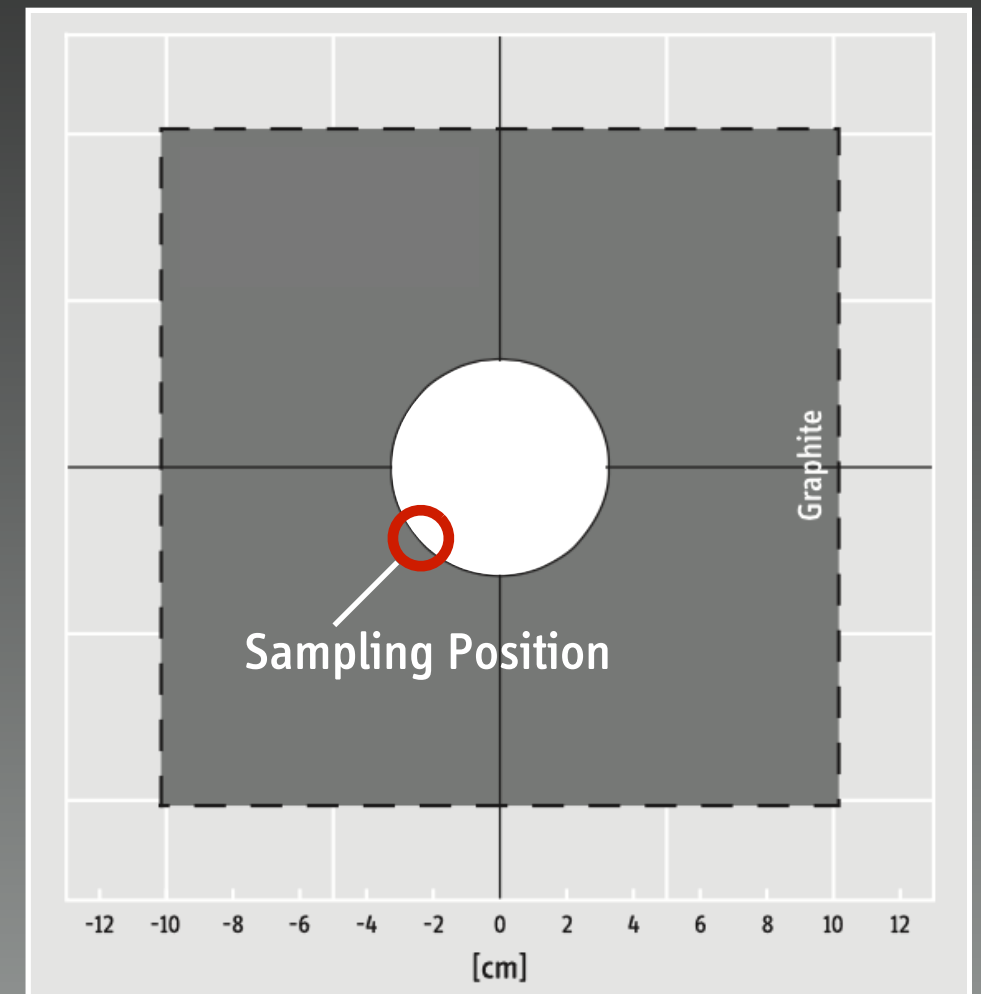


NUCLEAR ARCHAEOLOGY COULD BE USED TO VERIFY A NORTH KOREAN PLUTONIUM DECLARATION

FORENSIC ANALYSIS OF GRAPHITE SAMPLES COULD CONFIRM TOTAL PLUTONIUM PRODUCTION IN NORTH KOREA WITHIN AN UNCERTAINTY OF ± 2 KG



The banner reads: "Let's protect Dear General Kim Jong Il desperately!"
Credit: CNN/Brian Rokus, 2008



Unit cell of the DPRK Yongbyon reactor



*North Korea's Uranium Mine at Pyongsan
Coordinates: 38.324, 126.437*

Source: Google

Ryesong River

UNDERSTANDING URANIUM SUPPLY

TO GAIN CONFIDENCE IN THE ABSENCE OF UNDECLARED PRODUCTION



URANIUM MINING IN NORTH KOREA

Mining activities at few (perhaps only one) location; very low-grade ore, previously reported as 0.26%, i.e., it takes 300–400 tons of ore to extract one ton of uranium

Jeffrey Lewis, August 12, 2015, www.38north.org/2015/08/jlewis081215/



RECONSTRUCTING NORTH KOREA'S URANIUM SUPPLY HISTORY

2000 tons of ore required to make 25 kg of weapon-grade HEU or 4–5 kg of weapon-grade plutonium; understanding historic uranium production in North Korea could help dispel concerns about an undeclared enrichment plant and/or stocks of fissile material

Source: Google (top) and Rio Tinto (bottom)

NEXT STEPS / WAY FORWARD



SHORT-TERM GOALS

- Declarations and freeze of fissile material production
- Agreement on how to monitor production freeze pending final agreement on denuclearization



LONGER-TERM GOALS

- Agreement on what constitutes denuclearization
- Disposition pathways for fissile materials and/or weapon components
- Return to NPT and/or join Ban treaty (before or after elimination of weapons program)

Source: W. Keith Luse, CISAC (top) and author (bottom)

