Technical summary of DPRK nuclear program

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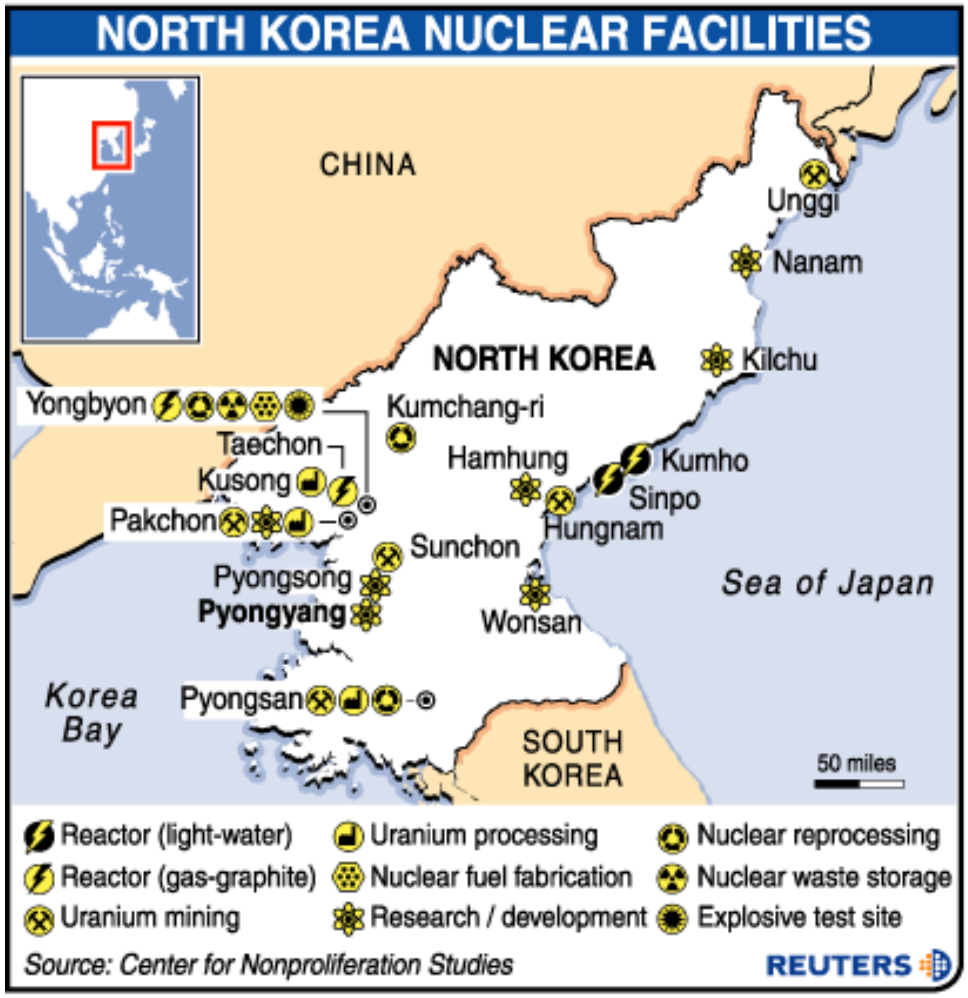
Visits to Pyongyang: S.S. Hecker and Prof. J.W. Lewis Jan. 6-10, 2004 and Aug. 23-27, 2005 and Yongbyon, Jan. 6-10, 2004



North Korea has the raw materials and nuclear infrastructure for the full plutonium nuclear fuel cycle

Key nuclear issues as of January 2004 visit

- What is the status of the nuclear reactors?
  - 5 MWe (previously operating – generates ~6 kg Pu/year)
  - 50 MWe – under construction (56 kg Pu/year)
  - 200 MWe – under construction (220 kg Pu/year)

- What happened to the spent fuel rods from 5 MWe reactor?
  - Placed in safe storage (25 – 30 kg Pu) with U.S. help
  - Monitored by IEAE until December 2002

- Does the DPRK have a uranium enrichment program?

- Does the DPRK have nuclear weapons?

Additional technical issues as of August 2005

- What is the status of the nuclear reactors?
  - 5 MWe - is it operating with a fresh core? (5 to 7 kg Pu/year)
  - 50 MWe – has construction resumed? (~ 56 kg Pu/year)
  - 200 MWe – future plans? (~ 220 kg Pu/year)
  - What is status of fresh fuel fabrication?
- Reprocessing status?
  - If reactor was refueled, what is status of spent fuel rods?
  - How much additional plutonium was extracted?
- Status of DPRK uranium enrichment program?
- Status of DPRK nuclear weapons program?

Update on status of 5 MWe reactor in Yongbyon

- **5 MWe (25 MWth) graphite-moderated, gas-cooled indigenous reactor (uses natural uranium metallic fuel)** (began operations in 1986)

We were told by the director of the Yongbyon Nuclear Center that:

- **The reactor operated from Feb. 2003 to end of March 2005**
- **The reactor operated well at full power – 25 MWth**
- **The reactor was unloaded in April 2005**
  - Prompted by concerns about fuel rods that were loaded in January 2003 and fabricated prior to Agreed Framework of 1994

  and
  - To extract the plutonium
  - Fuel rods were found to be in good shape
- **The reactor was reloaded and operations resumed in mid-June 2005**
- **They are refurbishing the fuel fabrication facility to make more fuel because they loaded the last load made prior to 1994**

Update on status of 50 and 200 MWe reactors

50 MWe reactor in Yongbyon (construction was frozen in 1994)

- **Ready to resume construction soon**
  - Redesign has been completed
  - Construction workers preparing to return
  - Some components will be retained, others replaced
  - Only the containment vessel is inside reactor now
  - Core was fabricated elsewhere in 1994 – it will be retained
- **DPRK did not give us an estimated completion date**
  - Director implied a couple of years, rather than five or six
- **Regulatory framework**
  - Start-up license from State Nuclear Regulatory Commission required before operations
  - Self-regulated for operations
- **Electricity will go into the grid**

200 MWe reactor in Tacheon (construction also frozen in 1994)

- **The are still analyzing the 200 MWe construction**
  - DPRK claims to have methods of recovering construction
  - But, investment is bigger than starting anew

Plutonium reprocessing update

We were told that:

- **8000 spent fuel rods were unloaded beginning in April 2005**
  - Cooled ~ 3 months in spent-fuel pool
- **Reprocessing to extract Pu began in late June**
  - Through-put increased by x 1.3 by technical improvements
  - Director explained the mystery of the "second" line
  - It is used as a back-up and spare
  - Director said reprocessing almost finished in late August
  - DPRK officials told Governor Richardson on Oct. 20 that they finished reprocessing and they were decontaminating the building
- **As in 2003, the Pu was processed to metal**

- **<u>U.S.</u> estimates are 10 to 14 kg Pu metal could have been extracted during this campaign**

Technical summary of Aug. 2005 visit

- **5 MWe reactor**
  - Operated for 26 mo., unloaded, reloaded – operating well at full power (can run "indefinitely").
- **Reprocessing**
  - Throughput improved by x1.3; reprocessing of 8000 fuel rods almost complete.
  - Will have extracted 10 to 14 kg plutonium (Pu) [U.S. estimate].
- **Reactor construction**
  - Redesign of 50 MWe complete. Construction workers preparing to restart construction.
  - 200 MWe still under study. Would cost more to complete than to start over.
- **Radioisotopes**
  - Run Soviet-supplied IRT research reactor occasionally to produce I-131 for thyroid cancer therapy. Limited by not having received fresh fuel since Soviet times.

DPRK is moving full-speed ahead with nuclear weapons program

Rough estimate of DPRK nuclear status as of Nov. 2005

- **Plutonium**
  - < 1994 (IRT & 5 MWe) ~ 8.4 kg (1+ weapons worth)
  - 2003 (5 MWe) ~ 25 kg (4-6 weapons worth)
  - 2005 (5 MWe) ~10-14 kg (~ 2 weapons worth)
- **Nov. 2005. Highly likely to have 43 □ 10 kg of separated plutonium**
  - > 2005 MWe capacity ~ 5-7 kg/yr (1+ weapon worth/yr)
  - Future 5 + 50 MWe ~ 60 kg/yr (~ 10 weapons worth/yr)
- **Nuclear weapons**
  - We know very little. Given demonstrated technical capabilities, we must assume they have produced at least a few simple, primitive nuclear devices.
  - No information on whether or not devices are missile capable.
- **Uranium enrichment**
  - We know even less. Continued denial by Ministry of Foreign Affairs against overwhelming evidence that they have some level of uranium enrichment program.

*Based on estimates by David Albright and Kevin O'Neill, editors, "Solving the North Korean Nuclear Puzzle," ISIS Reports (The Institute for Science and International Security), Washington, D.C., 2000 and Lewis/Hecker Jan. 2004 and Aug. 2005 visits.