North Korea builds a nuclear arsenal: A 12-year retrospective

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DPRK nuclear program

Nuclear Capability	January 2003
Nuclear reactors	5 MWe – standby 50 MWe – standby 200 MWe - abandoned
Fuel fabrication	Standby – corroding U conversion - operating
Uranium enrichment	DPRK – denied US – Oct. 2002 accusation
Nuclear export	UF6 to Libya Reactor to Syria
Political	Kim Jong-il No mention of nukes

Plutonium production halted. Uranium enrichment – building capacity.
No nuclear weapons, no successful long-range rockets.

DPRK nuclear program

Nuclear Capability	January 2003	December 2014
Nuclear reactors	5 MWe – standby 50 MWe – standby 200 MWe - abandoned	5 MWe restarted ELWR near completion
Fuel fabrication	Standby – corroding U conversion - operating	Reactivated Fuel for ELWR
Uranium enrichment	DPRK – denied US – Oct. 2002 accusation	YB centrifuge facility Covert facilities ?
Nuclear export	UF6 to Libya Reactor to Syria	Any customers?
Political	Kim Jong-il No mention of nukes	Kim Jong-un New constitution declares DPRK nuclear state

DPRK nuclear program

Nuclear Capability	January 2003	December 2014
Plutonium	0 to 10 kg	24 to 42 kg
HEU (Highly enriched U)	Likely zero	Possibly 150 kg
Nuclear tests	Zero	3 (possible 4th)
Nuclear weapons	Likely zero Pu Zero HEU	~ 6 Pu + 6 HEU = 12
Long-range rockets	One failed Taepodong-1 launch (1998)	Successful Unha-3 launch (Dec. 2012)

Yyongbyon visits allowed estimates of plutonium

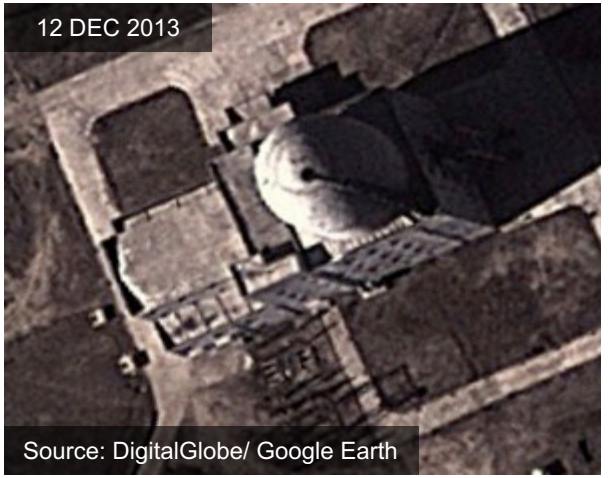
November 2010 visit to Yongbyon presented us with a new reality

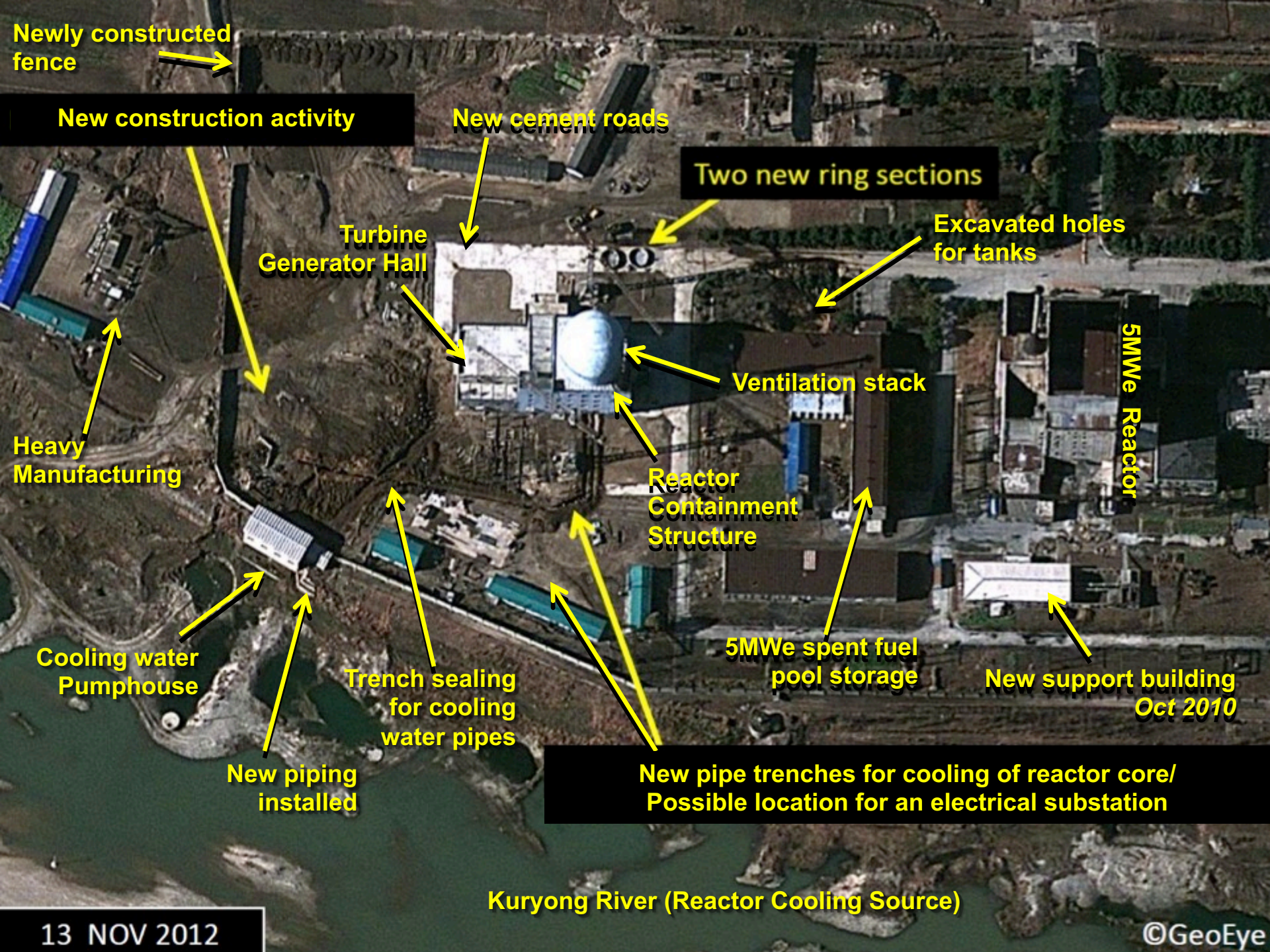
"We will convert our center to an LWR and pilot enrichment facility."

Vice Minister Ri Yong-ho, Nov. 2010

No foreigners have been at Yongbyon since Nov. 2010

Overhead imagery




Newly constructed fence
New construction activity
New cement roads
Two new ring sections
Turbine Generator Hall
Excavated holes for tanks
Ventilation stack
5MWe Reactor
Heavy Manufacturing
Reactor Containment Structure
Cooling water Pumphouse
Trench sealing for cooling water pipes
5MWe spent fuel pool storage
New support building Oct 2010
New piping installed
New pipe trenches for cooling of reactor core/ Possible location for an electrical substation
Kuryong River (Reactor Cooling Source)
13 NOV 2012
©GeoEye

Purely illustrative - this is not Yongbyon, but close to what we saw (Nov. 12, 2010)

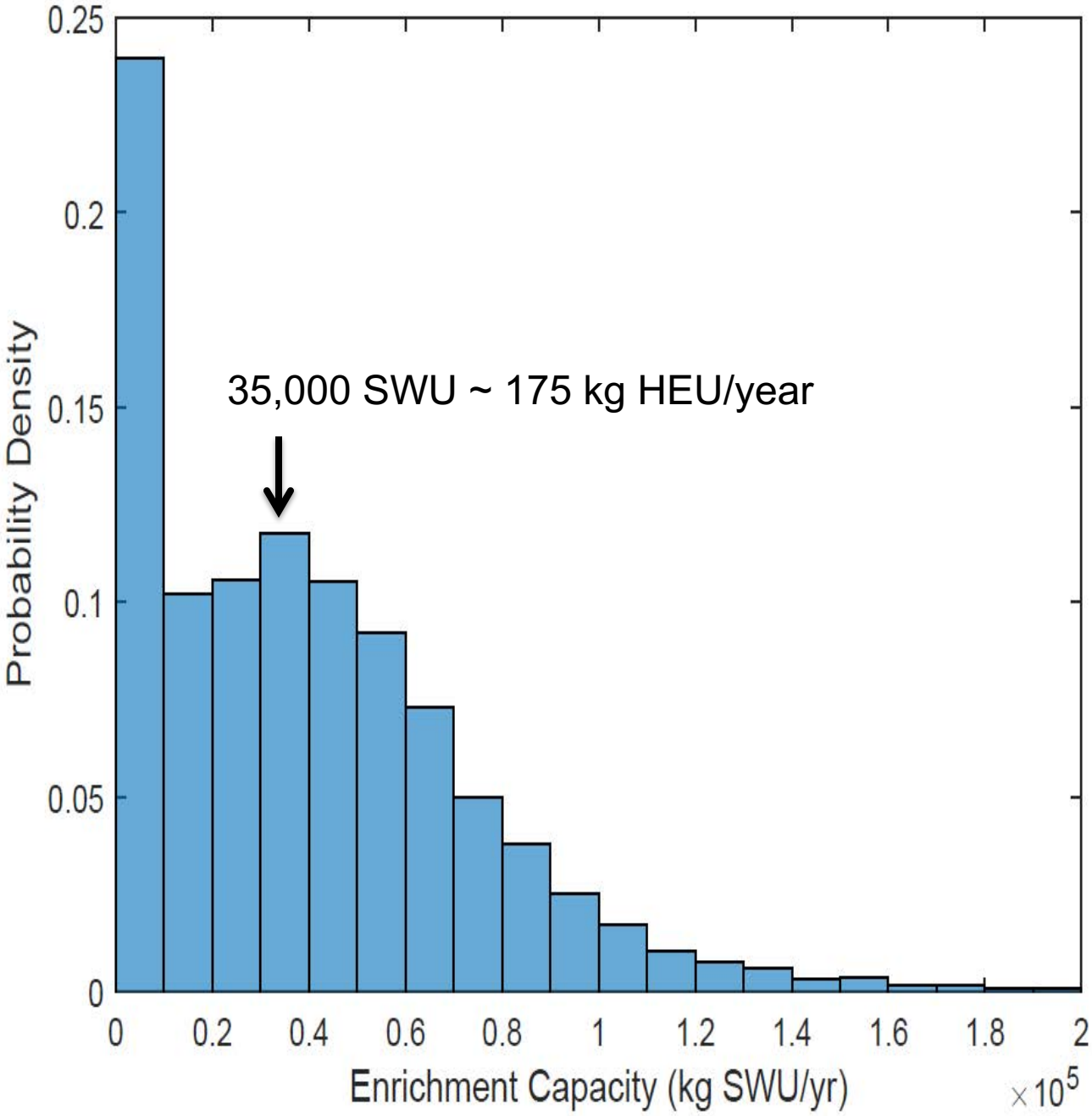
Piketon, Ohio Centrifuge plant, 1984 (Department of Energy)
Several additional centrifuge lines were removed graphically to try to get this as close as possible to the centrifuge cascades we saw in Bldg. 4 at Yongbyon


What is current centrifuge capacity?
How much imported and how much indigenous?

IHS **Jane's Satellite Imagery Analysis**

Yongbyon, North Korea
39.770027 N 125.750307 E
Image Date: 3 February 2014 / Pleiades Satellite

The fuel fabrication facility is the largest of the functional areas in the southern half of the Centre. Visible is a new centrifuge building with an expected capacity of 2,000 centrifuges.


0.25
0.2
0.15
0.1
0.05
0
Probability Density
35,000 SWU ~ 175 kg HEU/year
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Enrichment Capacity (kg SWU/yr)
×10^5

Potential DPRK nuclear program by 2020

Nuclear Capability	December 2016 Estimates	2020
Plutonium	34 – 52 kg	Possibly 70 kg
HEU (Highly enriched U)	Possibly 450 kg	~150 kg/yr
Nuclear tests	3 or 4	Possibly 4
Nuclear weapons	Possibly 8 Pu + 18 HEU	~10 Pu + 42 HEU
Long-range rockets	Unha-3 Possibly more tests	Musudan or KN-08 tests

DPRK delivery systems

- SCUD (mobile, liquid fueled) 300 – 600 km
- KN-02 Toksa SRBM (solid fueled, like SS-21)
- Nodong IRBM (mobile, liquid fueled) 1200 – 1500 km
- 60 Il-28 light bombers
- **Future**: Long-range Taepodong ICBM (based on Unha SLV)
- Road mobile Musudan IRBM
- KN-08 ICBM (~ 9000 km)
- Short-range, sea-based land-attack missiles

Pyongyang's inventory of older liquid-fueled missiles is impressive, but its history shows a striking lack of progress compared to Pakistan and Iran.
John Schilling and Henry Kan, US-Korea Institute at SAIS, 2015

Images of DPRK's "Musudan" IRBM and KN-08 ICBM

Side View of the Musudan IRBM missile and MAZ-547A TEL as featured in the 10 Oct 2010 military parade in Pyongyang. Source: AP/Wide World

In this April 15, 2012 file photo, a Chinese TEL carries the North Korean KN-08 missile.
(AP Photo/Vincent Yu, File)

Neither has been flight tested as far as we know

The great miniaturization debate

KN-08 ICBM Deployed?

"Our assessment is that they have the ability to put a nuclear weapon on a KN-08 and shoot it at the homeland," Admiral William Gortney, the head of the U.S. Northern Command (April 7, 2015)

"We have not seen them do that" and "we haven't seen them test the KN-08."

What are the prospects for North Korea?

- **Little hope of giving up nukes in the near term**

- **Must stop nuclear build up first**

- **Settle for 3 No's in return for 3 Yes's**
  - No more bombs
  - No better bombs (no nuclear or missile testing)
  - No export

  In return
  - Address the North's security concerns
  - Provide energy assistance
  - Provide economic assistance

But, how to get started?

Possible steps to 3 No's – halt and roll back

Nuclear activity	Informal agreement	Potential next steps	Intermediate steps
Plutonium	Stop 5 MWe	Unload fuel, reprocess, safeguard	Terminate all plutonium operations. Dismantle.
HEU	Open YB Centrifuge Facility - inspect	Open all other YB facilities. Declare all UE ops	Close covert facilities. Negotiate on YB.
Nuclear tests	Moratorium	Destroy test tunnels	Cease all testing
Missiles	Moratorium	Declaration. Offer satellite launch services.	No long-range tests. Provide launch services.
LWR	Declaration	Safety inspection.	Decide on future of LWR.