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International Safeguards

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Nuclear Programs of Iran and North Korea – Recent Developments

Olli Heinonen
Belfer Center for Science and International Affairs
Harvard Kennedy School

12 May, 2013

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Path to Nuclear Weapon Capability

- All nuclear weapons programs took place parallel to civilian programs.
- Nuclear power alone is not a stepping stone to weapon capability, but mastering of sensitive technologies is:

  - Reprocessing
  - Uranium enrichment

- Know-how ; technologies cannot be un-invented

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Nature of the Iranian Efforts

- Iran diverted nuclear material from late 1980's till 2003.
- Iran pursues its program vigorously regardless of the hardships relying increasingly on indigenous resources.
- Iran has not suspended its enrichment and heavy water reactor related activities requested by the UN Security Council.
- Iran continues to buy equipment and material from black markets.
- Iran is developing sensitive technologies: enrichment and heavy water reactors
- Iran has limited its cooperation with the IAEA; it has been found non-compliant and in violation with its obligations under the safeguards agreement.
- Iran is engaged in R&D related to nuclear weapons design.

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Nuclear Fuel Cycle Facilities

Mining

Gcchine
Saghand

Milling

Gcchine
Ardakan

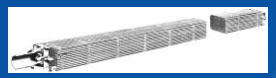
Conversion

Isfahan

Enrichment

Natanz
Fordow

Fuel Fabrication



Isfahan

Reactors

TRR
Bushehr
IR-40
Others, planned

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Fuel Enrichment Plant – February 2013

- Average production up to 250 kg UF6 3.5 % U-235 per month.
- 53 cascades enriching with 8992 IR-1s.
- 74 IR-1 cascades fully installed.
- 180 IR-2m centrifuges had been installed.
- Iran plans to install 3000 IR-2m centrifuges.

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Fordow Fuel Enrichment Plant – February 2013

- Average production ca 10 kg UF6 20 % U-235 per month.
- 4 cascades each 174 IR-1s enriching (two tandem cascades).
- Additional 12 cascades each 174 IR-1s installed.
- In addition, PFEP has produced ca 4 kg UF6 20 % U-235 per month.

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UF6 production as of February 2013

Cumulative production:

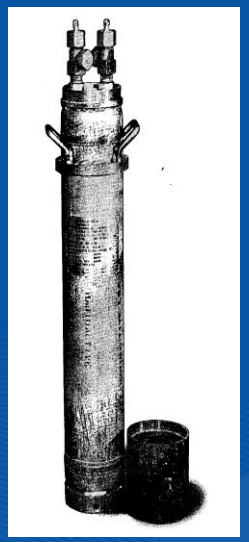
- 8271 kg UF6 up to 5 % U-235,
- 280 kg UF6 20 % U-235,

In stock as UF6:

- 6207 kg UF6 up to 5 % U-235
- 134.9 kg UF6 20 % U-235

UF6 fed to conversion in Isfahan:

- 111 kg 20 % U-235 UF6



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Do not play with fire

- **"Peaceful enrichment technology is extremely important for Iran, not only for industrial development but also as a "virtual deterrent". A military attack might change Iran's objective from virtual to real nuclear deterrent. It would certainly strengthen the influence of Iran's military establishment in government policy and cause Iran to accelerate its drive to modernize its military."**

Seyed Hossein Mousavian ,The Iranian nuclear crisis, Memoir, Carnegie Endowment for International Peace, 2012,Page 14.

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Withdrawal from the NPT is an option

- **“Iran will keep open the prospect of withdrawing from the Nuclear Nonproliferation Treaty and will seriously consider it if the West intensifies sanctions or refers the case to the U.N. Security Council.”**
- **“Iran cannot remain a treaty member at the same time it is being sanctioned.”**

AP quoting statements of Alaeddin Boroujerdi on the website of TV Al-Alam, 8 April, 2013.

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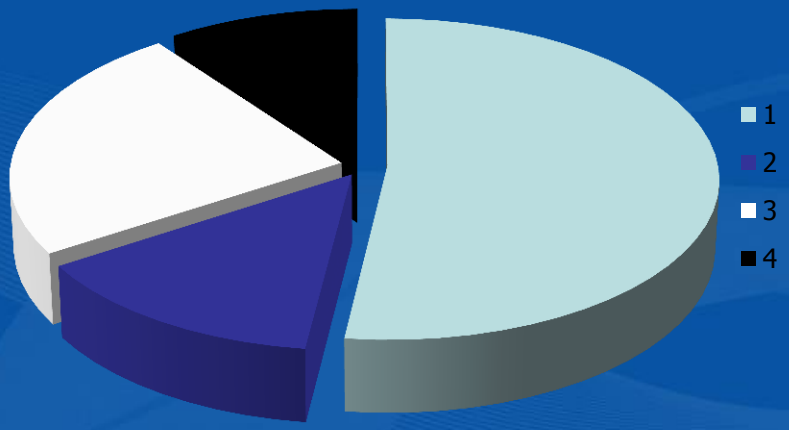
Where is 20 % UF6 produced ?

Estimated locations of 20 % UF6 as of May 2013

- **1. UF6 at PFEP and FFEP - 169 kg**
- **2. UF6 produced since Feb 2013 - 45 kg**
- **3. Material recoverable for 20 % UF6 – 78 kg**
- **4. Fuel assemblies produced at FPFP- 33 kg**



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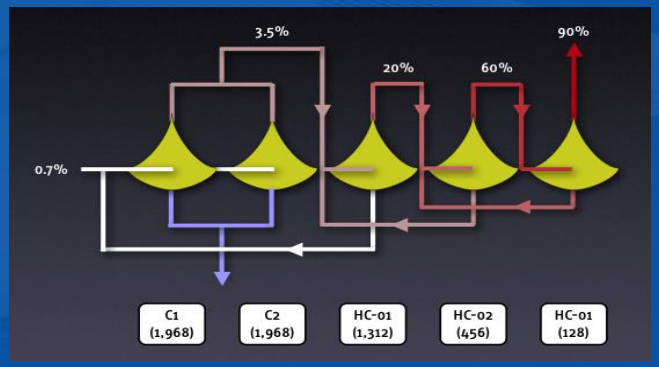
Breakout Scenario – Example 1

- *Use IR-1s at Fordow in two steps*:
- From 20 % to 60 %, and then 60 % to 90 % UF6.
- Use current tandem cascades.
- It will take two months to have 90 % U-235 UF6 using roughly 220 kg 20 % UF6.
- If IR-1s of Natanz are used in single cascades, it will take less than a month with 300 kg 20 % UF6.



Breakout Scenario – Example 2

Use 1800 IR-2s at Natanz or elsewhere in two steps:

- **From 20 % to 60 %, and then 60 % to 90 % UF6.**
- **Use 8 cascades for the 1st step, and 2 cascades for the second step.**
- **1 month to have 90 % U-235 UF6 using roughly 240 kg 20 % UF6, if enrichment capacity is 3 SWUkg/yr.**
- **Original design capacity is ca 6 SWUkg/yr, but Iran hardly has required raw materials to achieve that.**

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North Korea – A Nuclear State in Transition

- Program started in 1953
- Infrastructure built with the support of the Soviet Union
- NPT Safeguards agreement,1992
- Agreed Framework, 1994
- North Korea proliferates, after 2000
- Joint statement, 2007
- Statement on 27 February 2012

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Nuclear Fuel Cycle Facilities

Mining

Pakchon
Pyongsan
Unknown ?

Milling

Pakchon
Pyongsan
Unknown ?

Conversion

Yongbyon

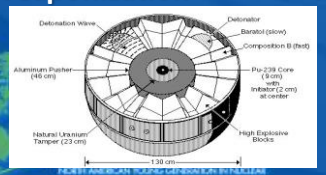
Enrichment

Yongbyon
Unknown ?

Fuel Fabrication

Yongbyon

Weaponization



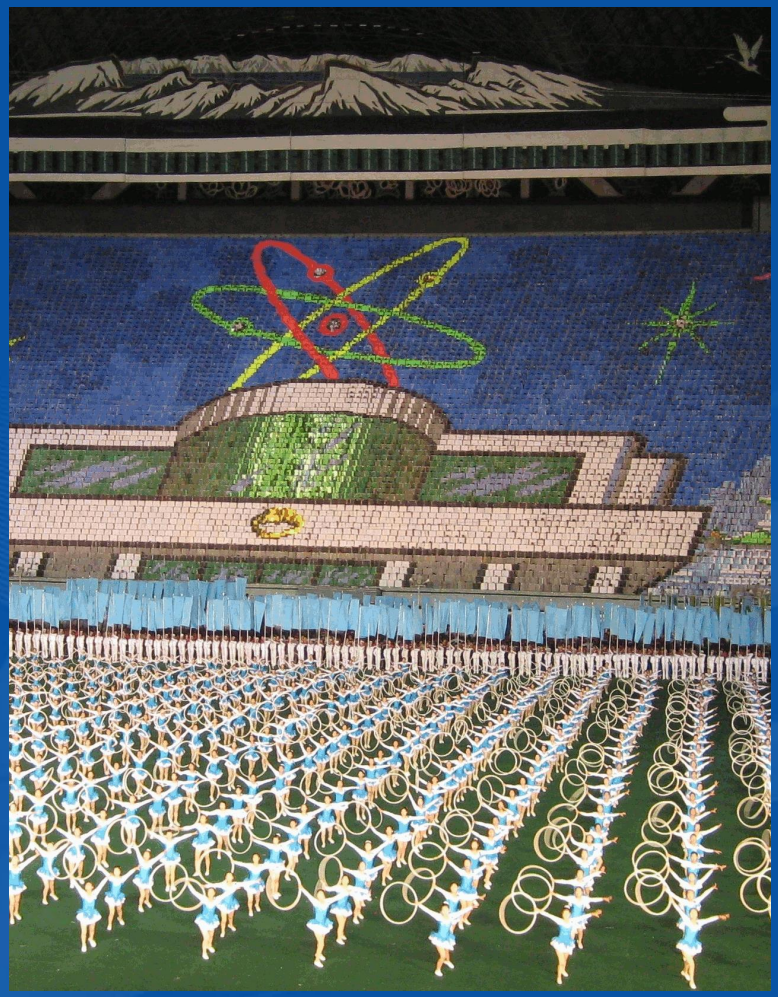
Reprocessing

Reactors

5 MWth Yongbyon
LWR construction
IRT

Nature of the North Korean Efforts

- It pursues its program vigorously regardless of the hardships relying heavily on indigenous resources – Juche philosophy
- It continues to buy equipment and material from black markets
- It withdrew in 1993 (2003) from the NPT and 1994 from the IAEA
- It has been in breach with its obligations under the safeguards agreement from 1992
- It has not heeded to the UNSC resolutions
- It has been proliferating sensitive nuclear technologies and nuclear materials



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Proliferation Activities

- Pakistan – UF6

- Libya – UF6

- Syria – Reactor
  Fuel fabrication ?

- Myanmar ?

- Iran ?

Road Ahead

- Current estimated plutonium stocks sufficient ,at least, for half a dozen nuclear explosives.
- The DPRK could have by the end of 2014 HEU stocks for another half a dozen nuclear devices, if it decides to do so.
- It is highly likely that there is, at least, an additional enrichment R&D installation, and a UF6 production facility in the DPRK. DPRK secretly proliferated by exporting technology and nuclear materials.
- Next phase should have a robust verification regime from the beginning; the US DPRK agreement on 29 February 2012 was a good albeit small step forward.
- 6 Party talks were brought to halt by the missile and nuclear tests.

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Disarmament difficult

- **"Denuclearization of the Korean Peninsula remains the unshakable will of the army and people of the DPRK."**
- **"The nuclear force of the DPRK will always remain in the hands of its army and people as the most powerful means to protect the sovereignty of the country and its supreme interests and deal a retaliatory blow at the strongholds of aggression against it till the world including the U.S. is denuclearized."**

DPRK NDC Policy Department Issues Statement, KCNA, 18 April, 2013.

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