

Scope & Verification of a Fissile Material (Cutoff) Treaty

A Progress Report from the International Panel on Fissile Materials (IPFM)

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Berlin Article VI Forum, Rathaus Schönberg

January 29, 2009, 9:00-10:30 AM

FM(C)T-related reports on the IPFM Website

www.fissilematerials.org

Draft Fissile Material (Cutoff) Treaty -- Arend Meerburg, Li Bin, John Burroughs, Merav Datan, Jean duPreez, Rebecca Johnson, Fred McGoldrick, R. Rajaraman, Henrik Salander, Tom Shea, Princeton group

Country Perspectives on the Challenges to a Fissile Material (Cutoff) Treaty – Li Bin, Avner Cohen, Jean-Marie Collin, Anatoli Diakov, Jean duPreez, Rebecca Johnson, Fred McGoldrick, Zia Mian, Marvin Miller, A.H. Nayyar, R. Rajaraman, Annette Schaper, Tatsujiro Suzuki,

Global Fissile Material Report 2008

Soon also:

Article-by-article discussion

Article in Arms Control Today (April?) – Meerburg and von Hippel

Global Fissile Material Report 2008

Scope and Verification of a Fissile Material (Cutoff) Treaty
(www.ipfmlibrary.org/gfmr08.pdf)

Overview

1. Nuclear Weapon and Fissile Material Stockpiles and Production

A Verified Fissile Material (Cutoff) Treaty

2. Why an FM(C)T is Important
3. Design Choices: Scope and Verification

Verification Challenges

4. Uranium Enrichment Plants
5. Reprocessing Plants
6. Weapon-origin Fissile Material: The Trilateral Initiative
7. HEU in the Naval-reactor Fuel Cycle
8. Challenge Inspections at Military Nuclear Sites
9. Shutdown Production Facilities

Appendix: Fissile Material and Nuclear Weapons

IPFM Design Recommendations for an FM(C)T

1. Verified by the IAEA, like the NPT.

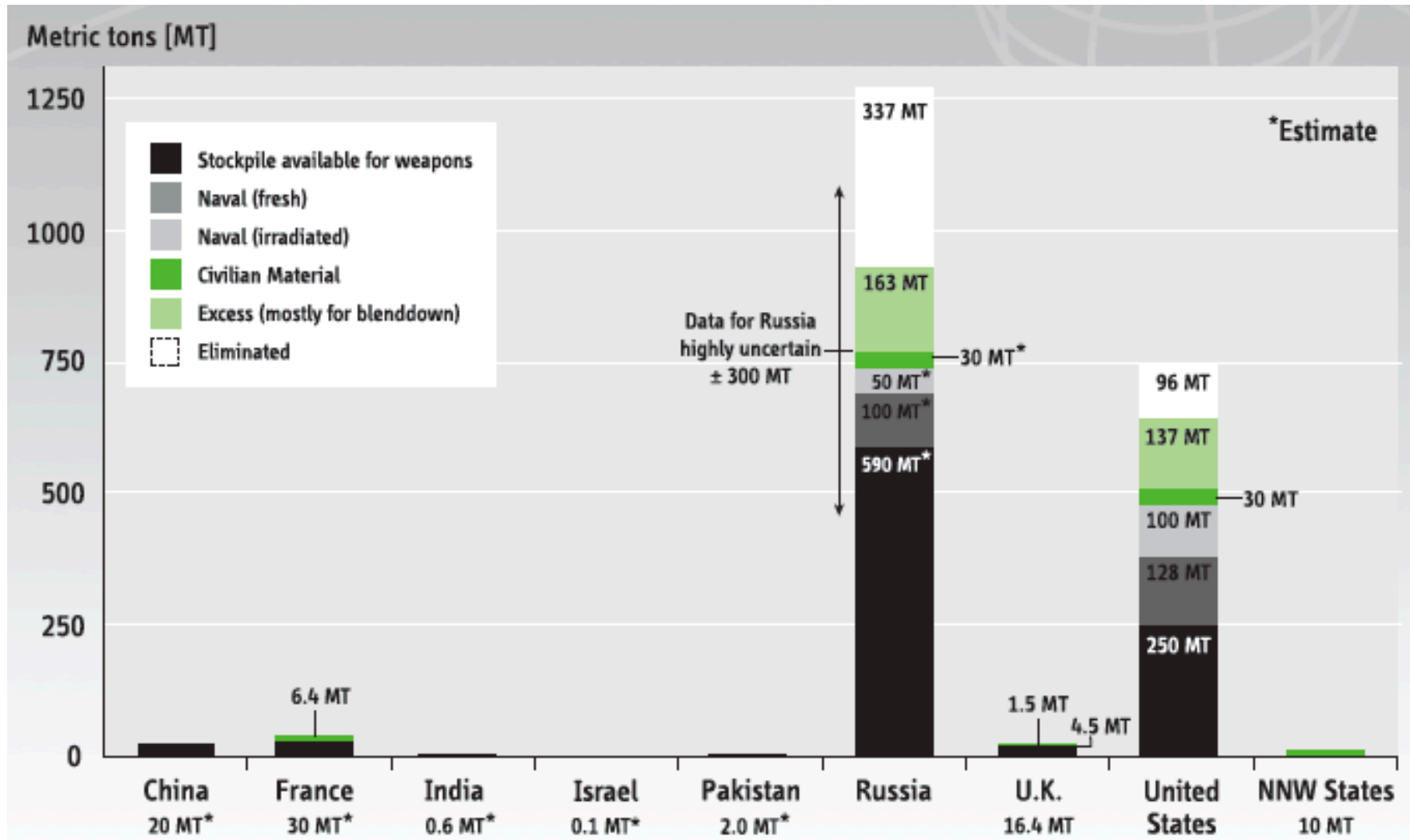
2. Include verified commitments that:

- ***Pre-existing civilian stocks and stocks declared excess for military purposes will not be used for military purposes.***
- ***Pre-existing stocks of highly enriched uranium (HEU) committed to fuel naval and other military reactors will not be used for weapons.***

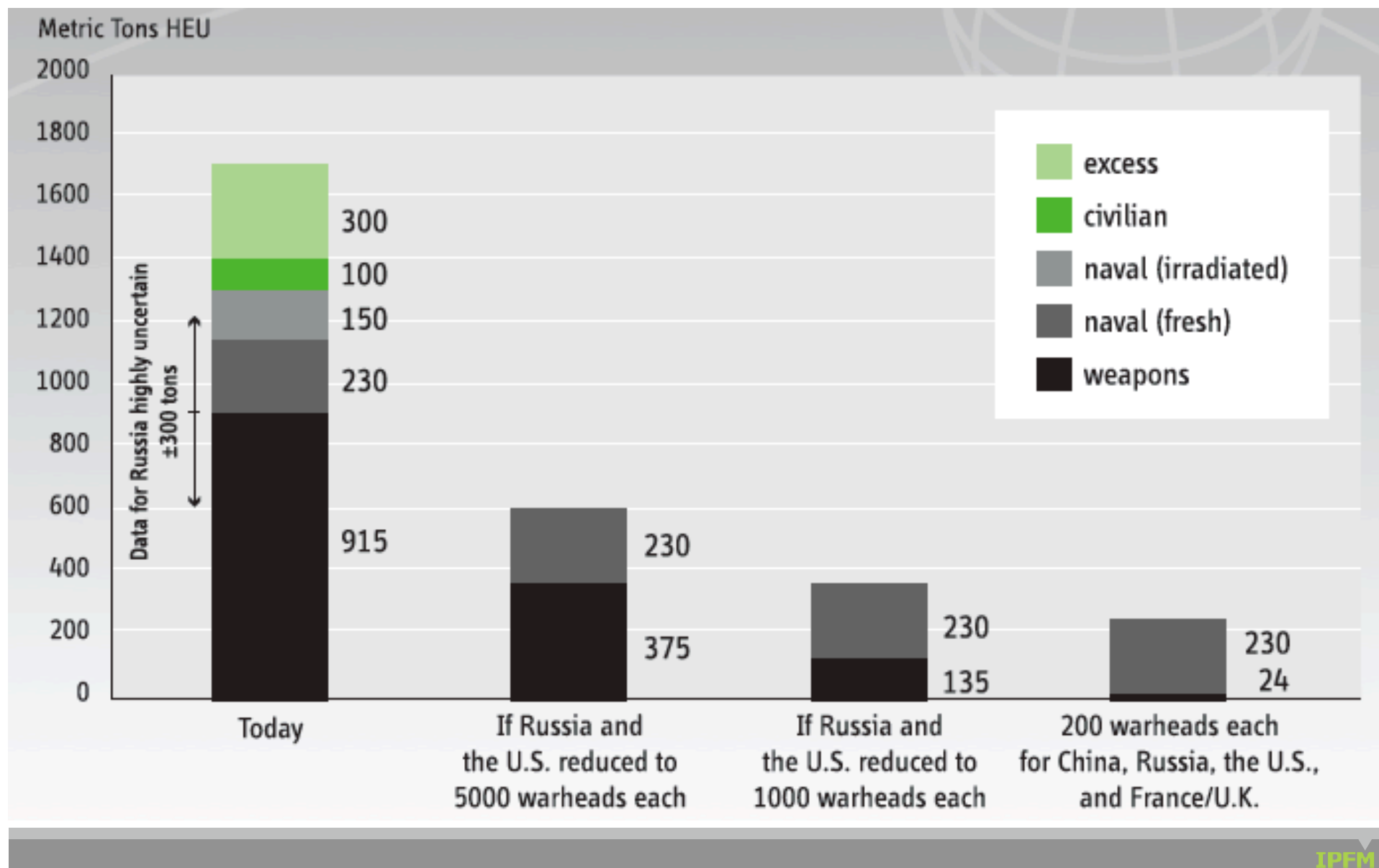
U.S. has reserved for future naval-reactor fuel use 128 tons of excess weapon-grade uranium -- enough for 5,000 nuclear weapons. Russia presumably has a similar stockpile.

The significance of pre-existing stocks: HEU

1600±300 tons total: weapons-55%; naval fuel-20%; excess-20%; civilian-5%

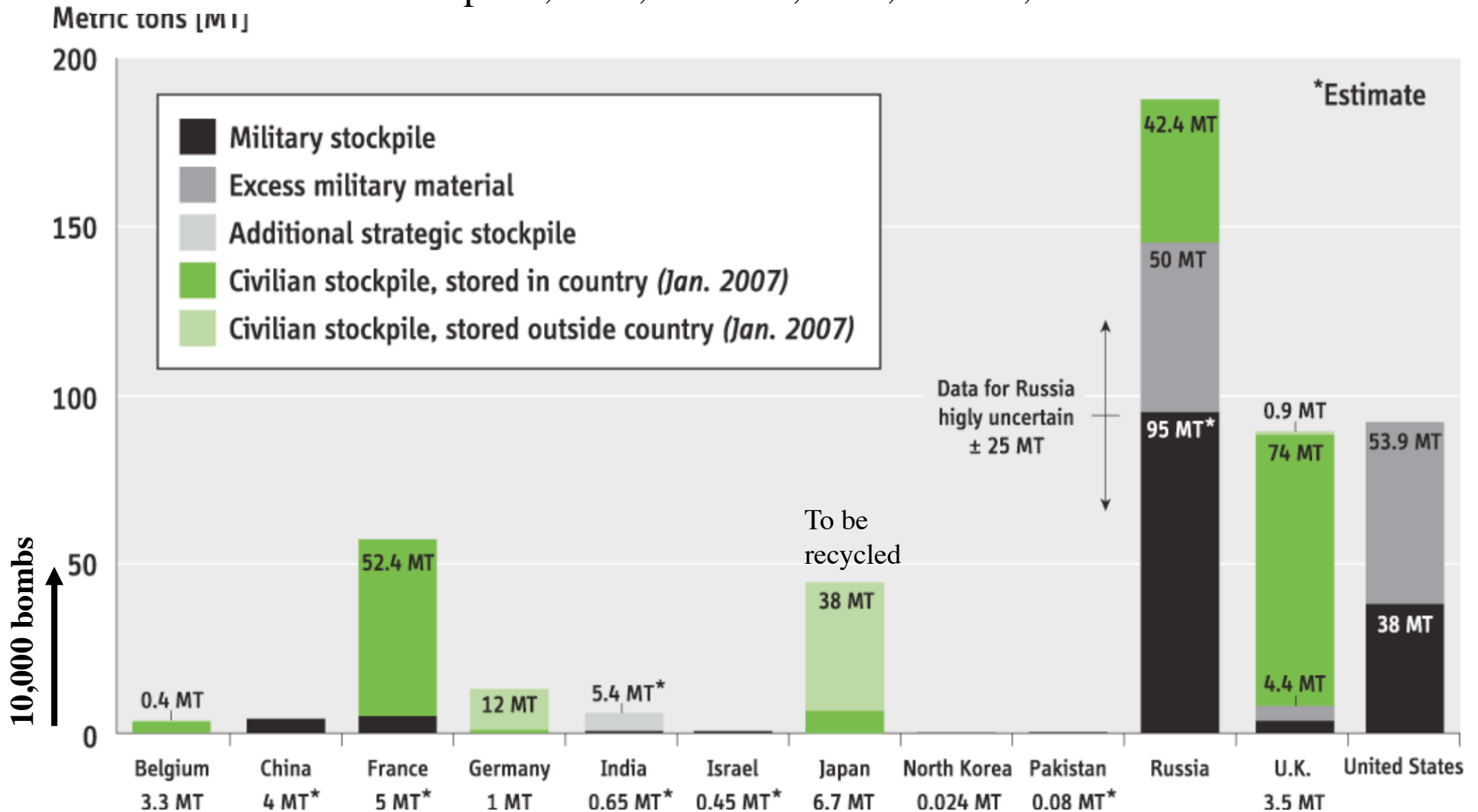


The shadow of naval HEU over nuclear disarmament

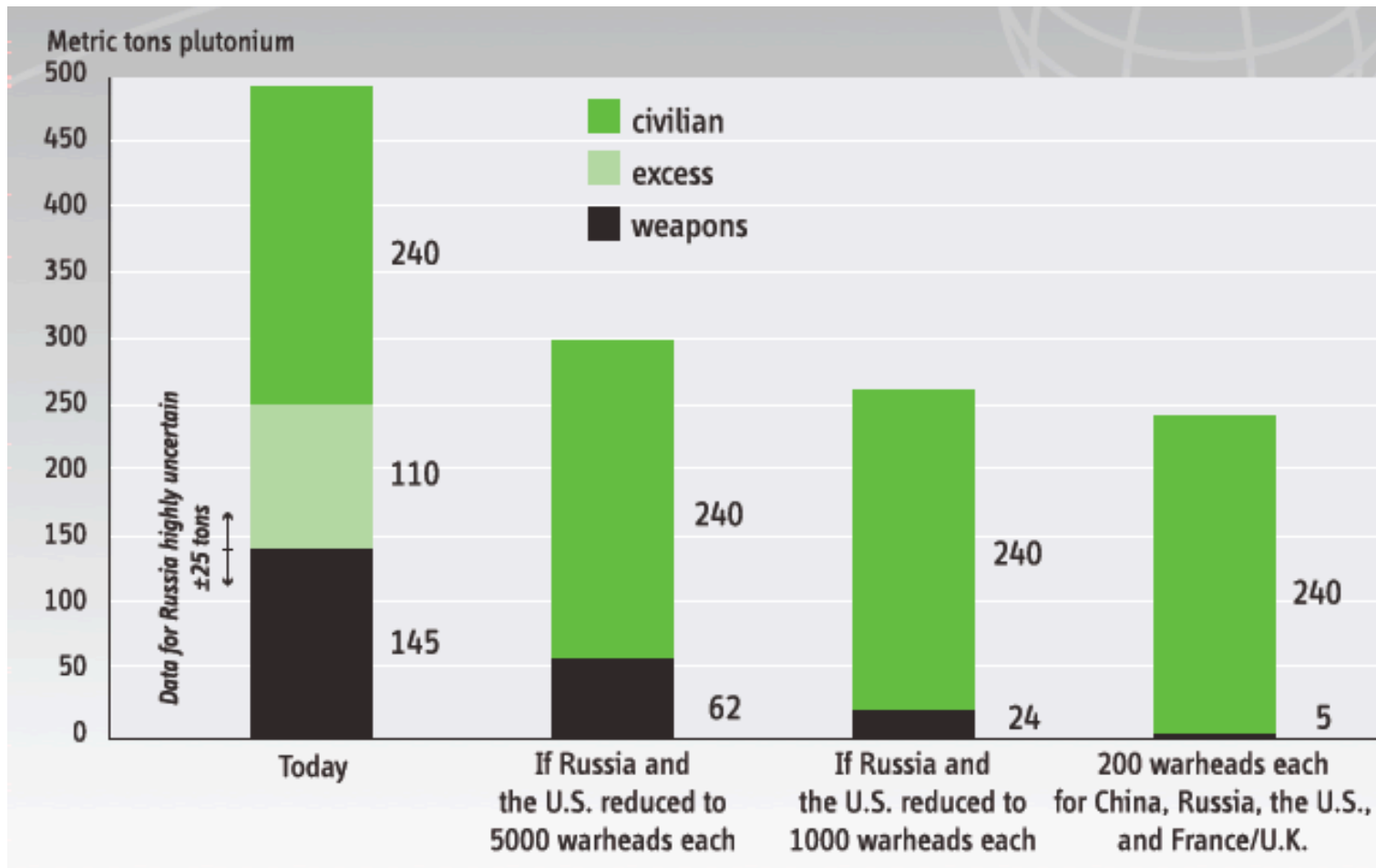


The significance of pre-existing stocks: Plutonium

Weapons, 30%; Civilian, 50%; Excess, 20%



The shadow of separated civilian plutonium over nuclear disarmament



Change of outlook with Obama Administration

"The Nonproliferation Treaty is the cornerstone of the nonproliferation regime, and the United States must exercise leadership needed to shore it up. So we will

- Seek agreements with Russia to secure further reductions in weapons under START, we will
- Work...toward ratification of the Comprehensive Test Ban Treaty, and we will dedicate efforts to
- *Revive negotiations on a verifiable Fissile Material Cutoff Treaty.*"

--Hillary Clinton, January 13, 2009, Confirmation Statement

Verification Challenges

Verifying:

1. Shutdown of enrichment & reprocessing plants not converted to non-weapons purposes – (chapter 9 in *GFMR08*)

2. Non-diversion of material declared excess for weapons purposes –
Worked out for plutonium in weapon components in Trilateral (Russia - U.S.-IAEA) Initiative – (Tom Shea, IAEA-ret., chapter 6, *GFMR08*)

3. *Non-diversion at pre-existing reprocessing plants*

Shirley Johnson, IAEA ret, designed Rokkasho safeguards, chap. 5, *GFMR08*

4. *Non-production of HEU at enrich. plants that formerly produced HEU*

5. *No undeclared enrichment or reprocessing at military nuclear facilities*

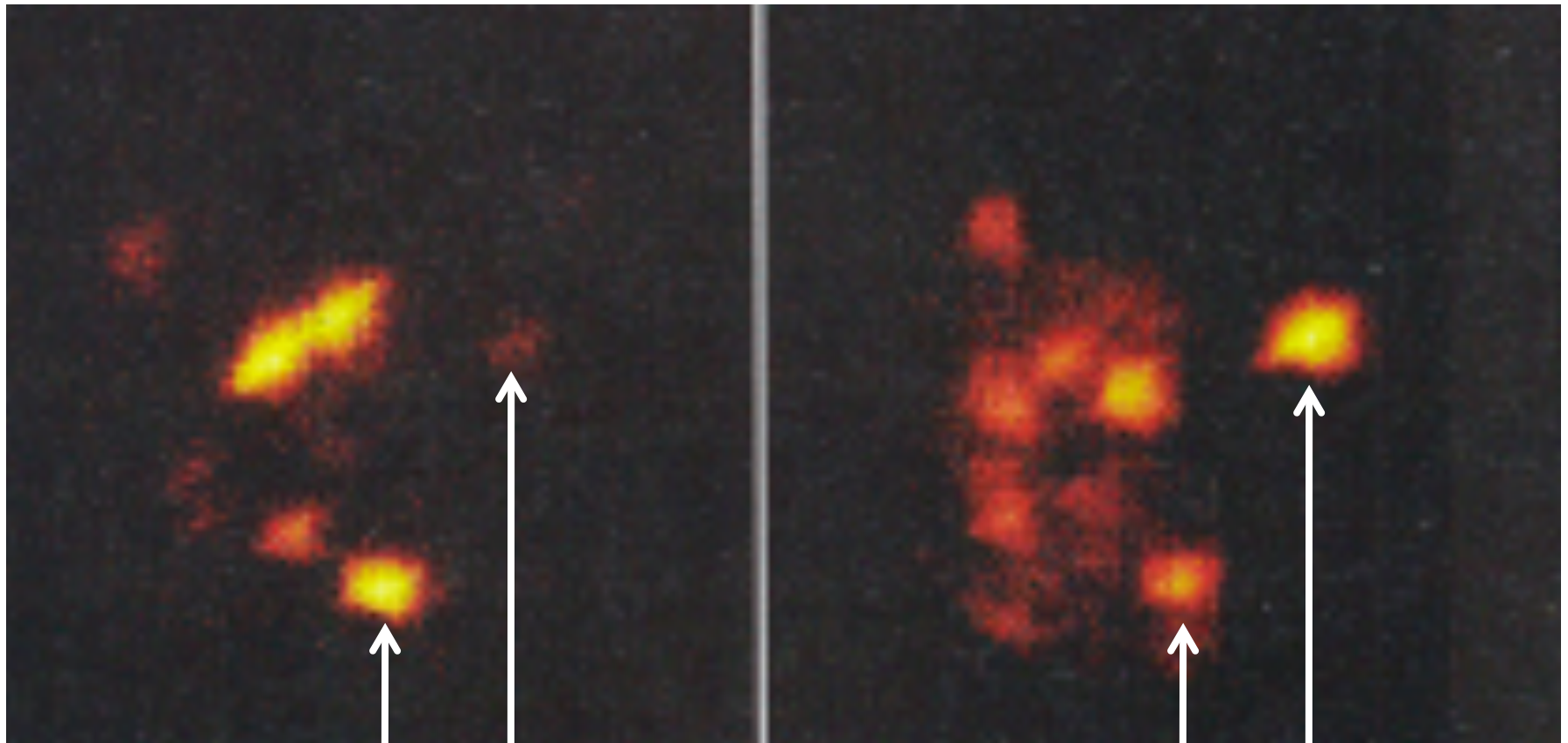
6. *No diversion of HEU from naval-reactor fuel cycles.*

While minimizing extra IAEA safeguards costs.

**3,4. Half of reprocessing & enrichment plants in nuclear-weapon states
already subject to or *offered* for international safeguards**
(5/11 reprocessing plants and 9/14 enrichment plants)

	Reprocessing Plants	Enrichment Plants
China	Yumenzhen (not)	Shanxi (IAEA), <i>Lanzhou II</i> (offered)
France:	UP1, UP2 (Euratom)	Georges Besse I/II (Euratom)
India	Tarapur (IAEA, in the past) Kalpakkam (not), Trombay (not)	Ratehalli (not)
Israel	Dimona (not)	
Pakistan	Nilore (not)	Kahuta (not)
Russia	Mayak (not), Seversk (to shut down), Zheleznogorsk (to shut down)	<i>Angarsk</i> (offered to IAEA), Novouralsk (not), Seversk (not), Zelenogorsk (not)
U.K.	B205, THORP (Euratom) (to shut down)	Capenhurst (Euratom)
U.S.	Savannah R., H canyon (to shut down)	<i>Eunice, Idaho Falls,</i> <i>Portsmouth, Wilmington</i> (offered), Paducah (to shut down)

4. No Undeclared production of HEU, chapter 4, *GFMR08* (HEU in dust detectable with swipes)

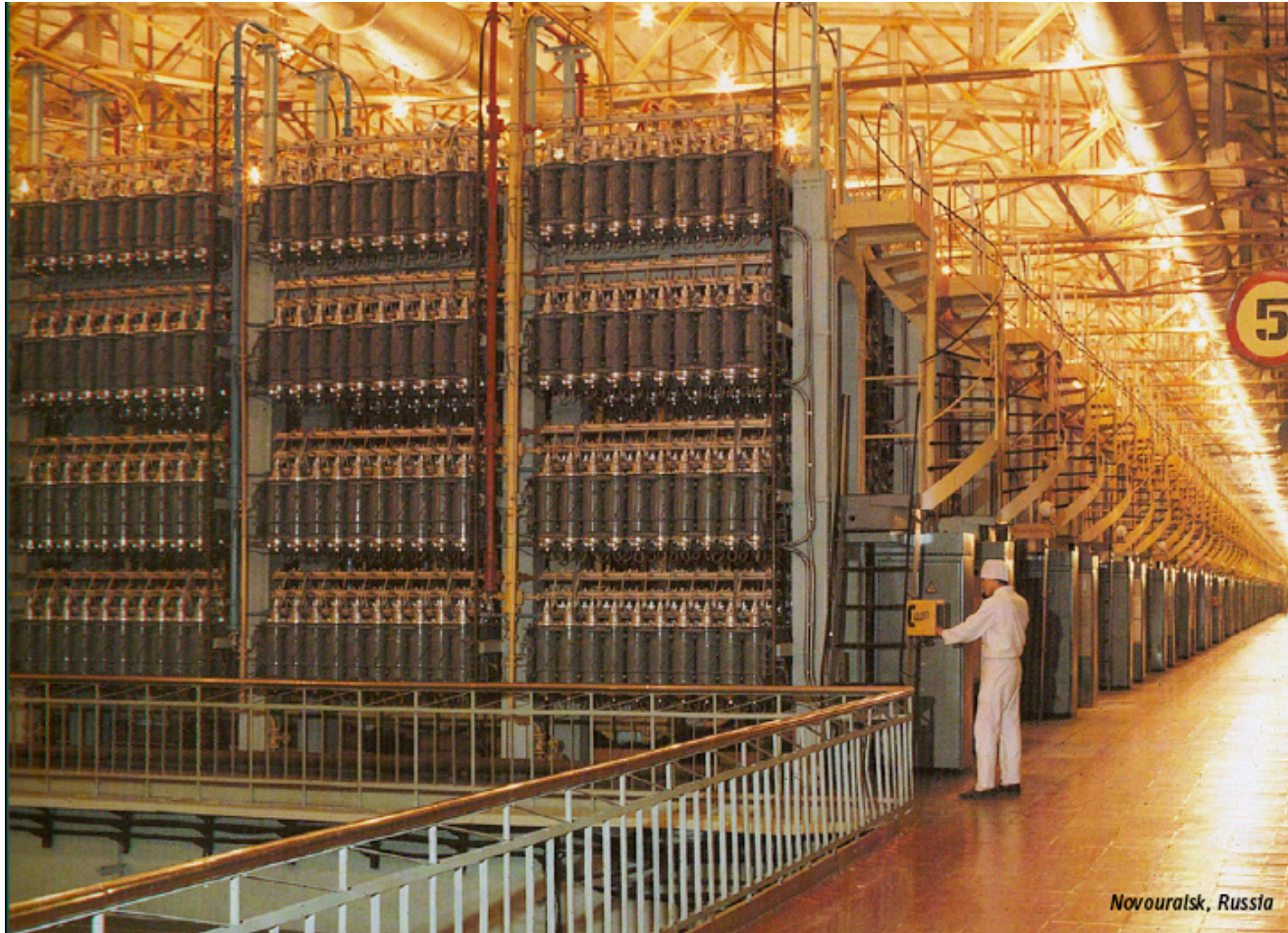


HEU LEU particles
U-235 concentration

HEU LEU
U-238 concentration

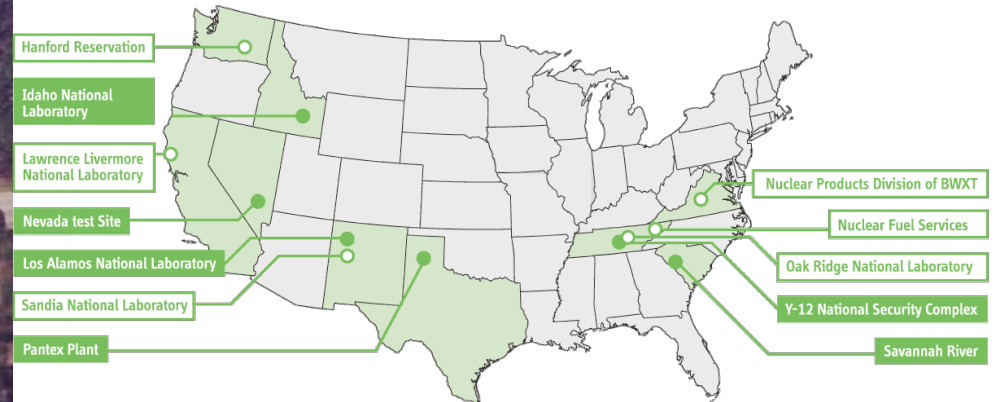
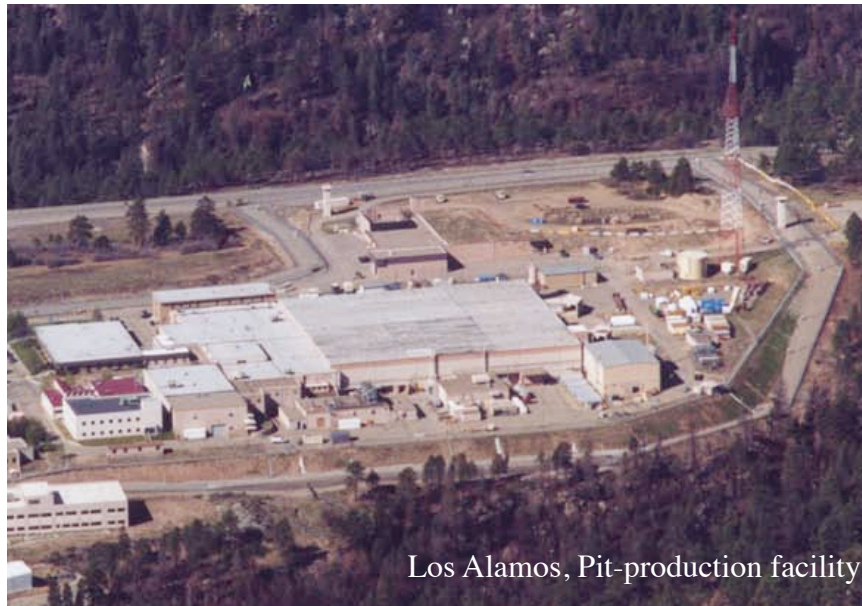
(secondary ion-mass spectrometry)

Russian facilities have produced HEU in the past,
huge and not amenable to conventional safeguards
but stopped producing HEU in 1988.
Could probably age-date old HEU particles (Alex Glaser).



5. No undeclared enrichment or reprocessing at military nuclear facilities

chapter 8, *GFMRO8*

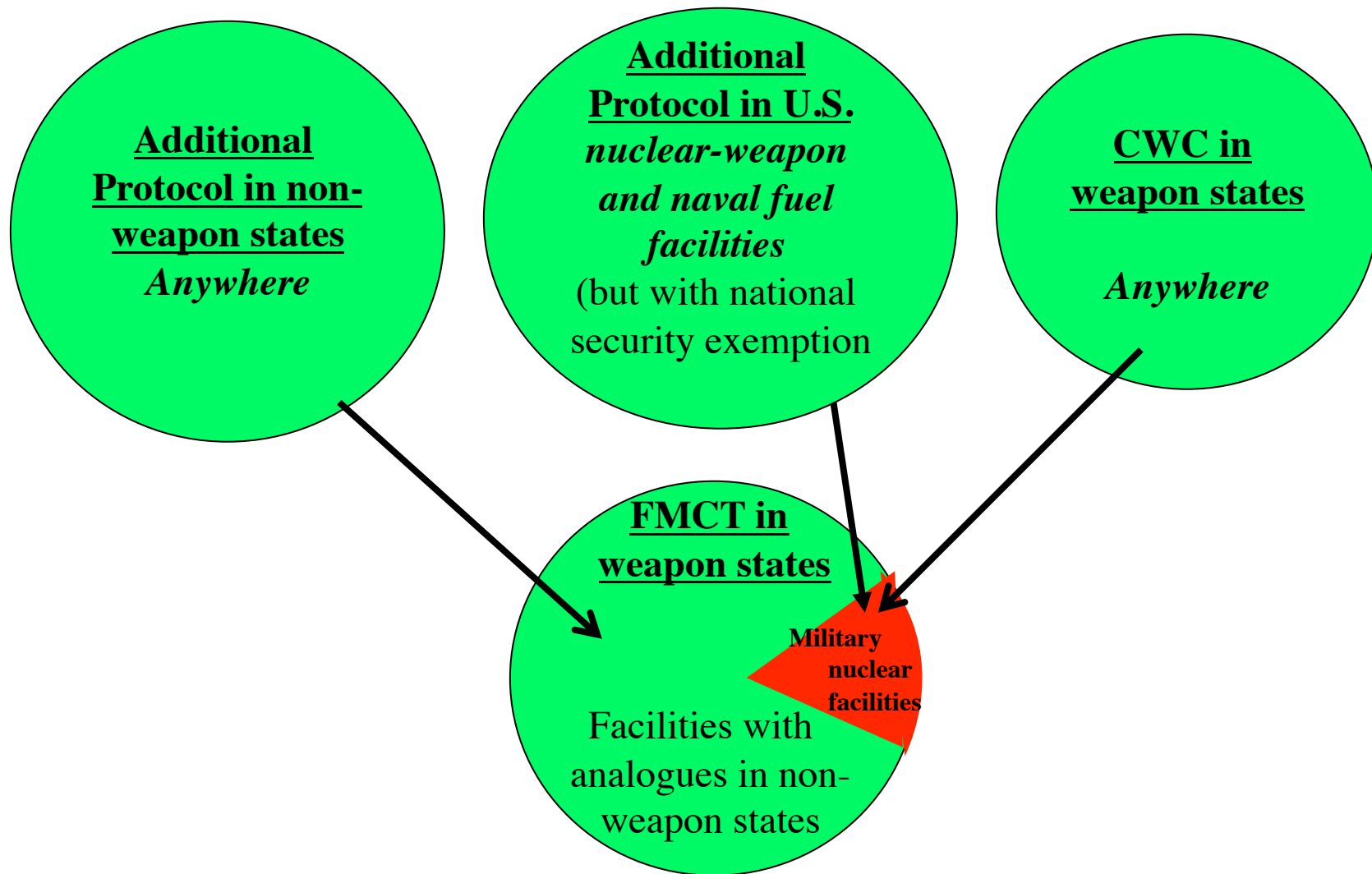


Ten U.S. DOE nuclear sites and 2 NRC-regulated naval-fuel fabrication sites
Global Fissile Material Report 2007

Managed-access at military nuclear facilities.

U.S. nuclear-weapon and and naval-fuel fabrication facilities have managed-access plans for IAEA verification of declarations under the U.S. Additional Protocol, *now in force*.

Managed-access precedents

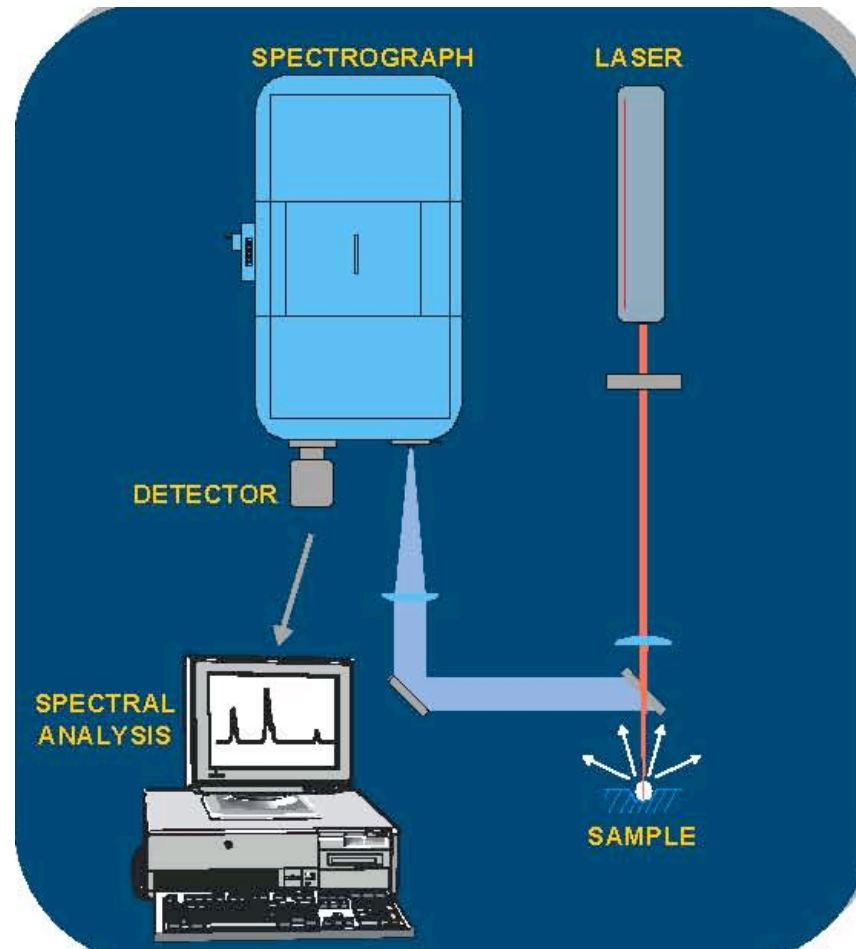


Example of non-intrusive instrumentation for detecting evidence of centrifuge enrichment at military nuclear sites (swipes unacceptable, too revealing chemically/isotopically)

Laser-induced breakdown spectroscopy with information barrier

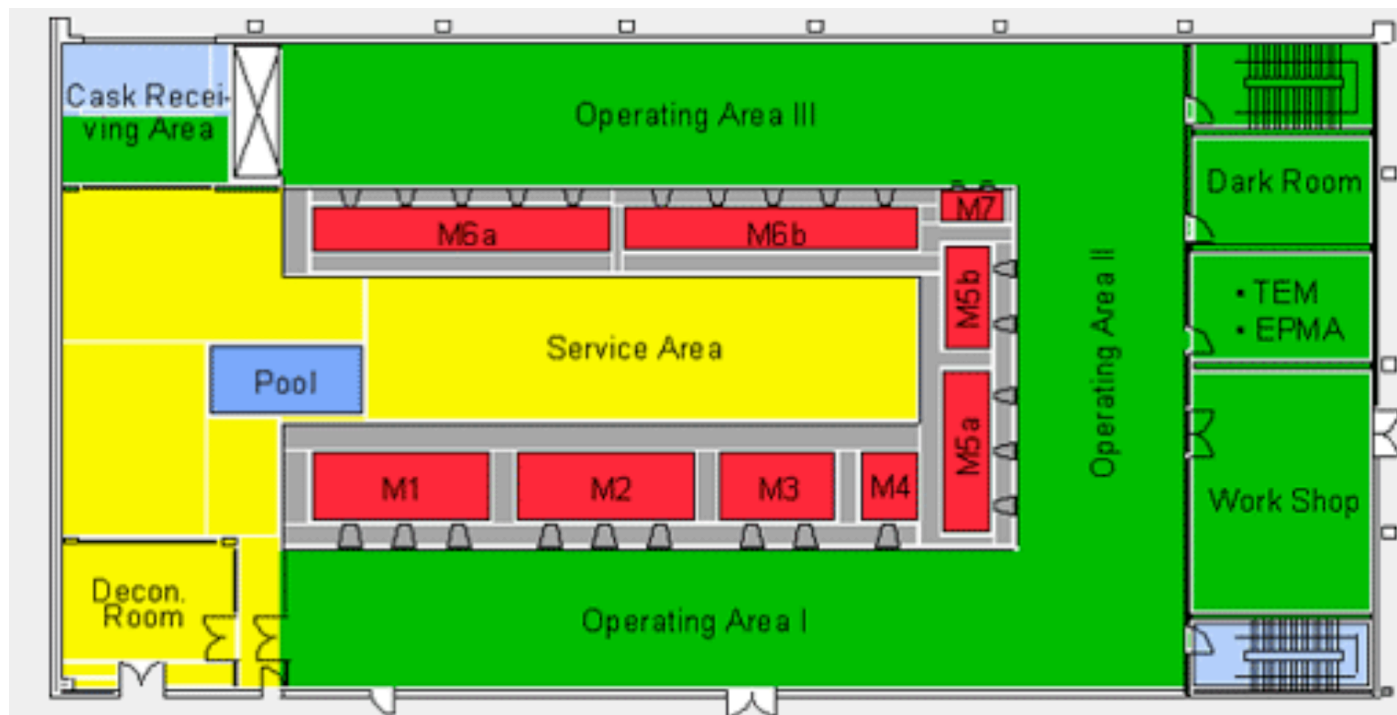
Could detecting deposits on of UO_2F_2 (from leaked UF_6) without detecting:

- Other elements or
- Isotopics of U or Pu.



Indicators of reprocessing that would not reveal U/Pu isotopics or chemical information

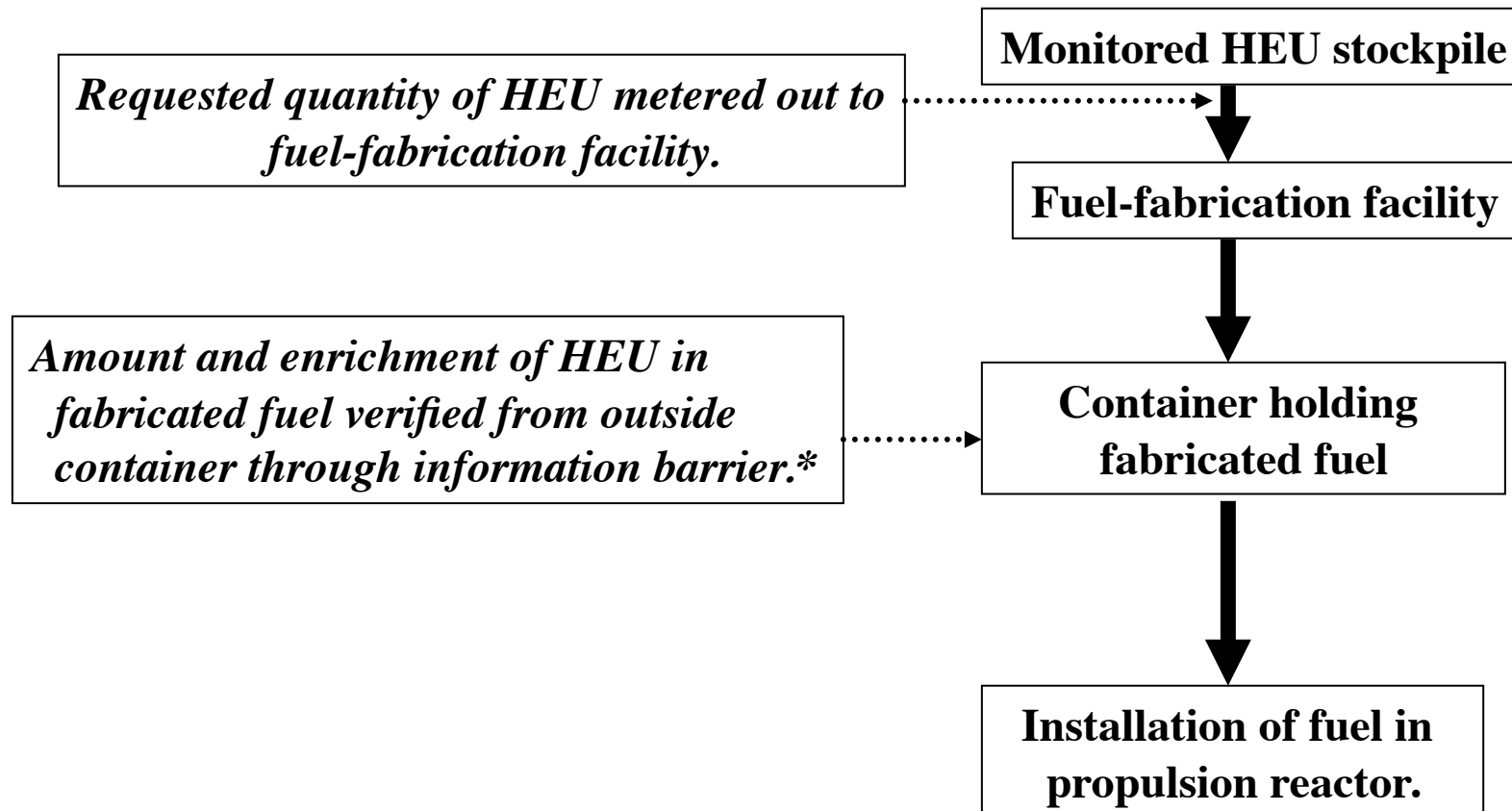
- Thick, dense walls for gamma shielding.
- High levels of gamma radiation (Geiger counter)
- Spent-fuel storage/transfer pools



**Irradiated Materials
Examination
Facility at the
Korean Atomic
Energy Research
Institute**

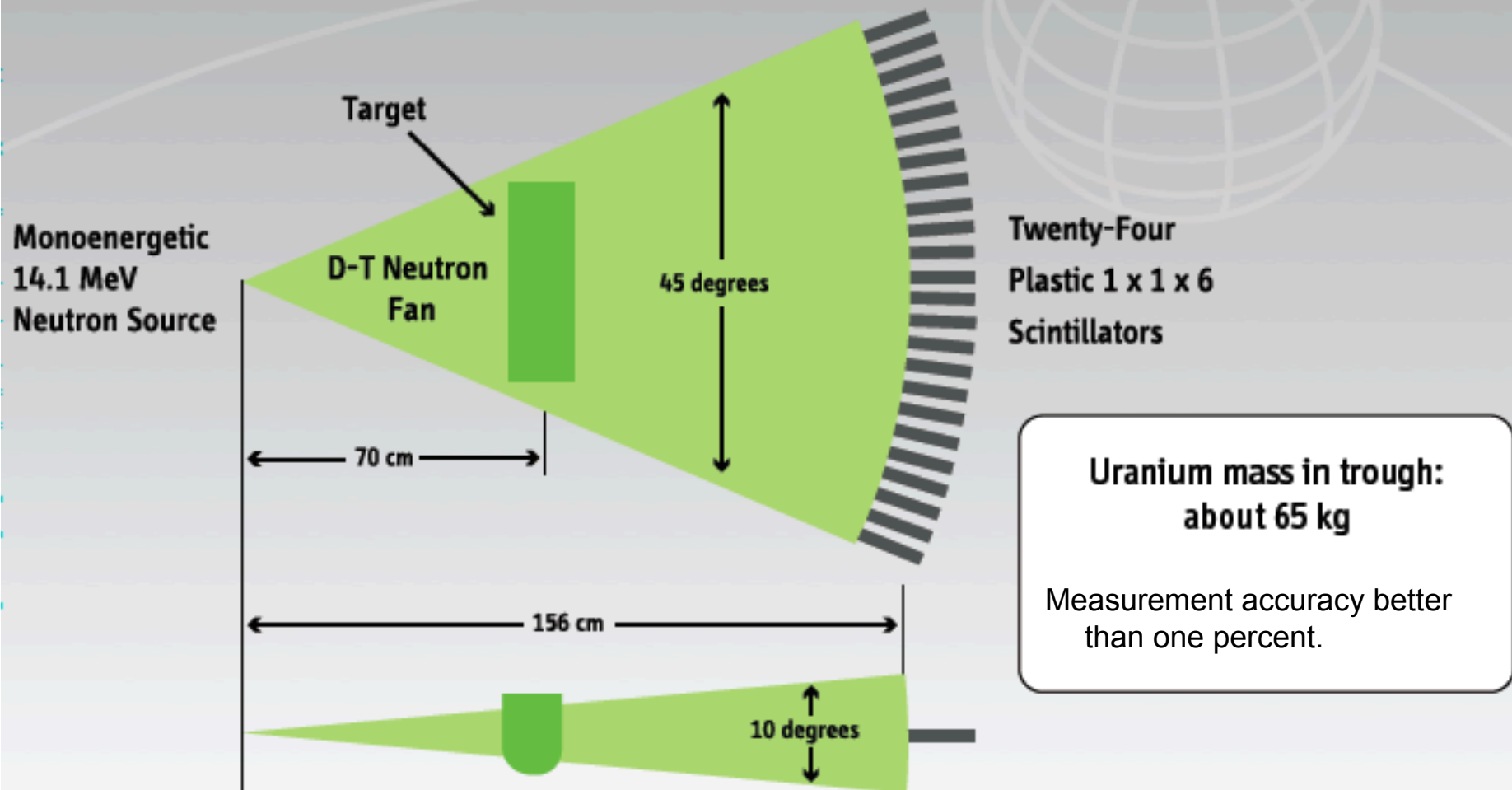
6. No diversion of HEU produced for naval propulsion reactors

(GFMR08, chapter 7, IPFM work in progress.)



Better would be to shift these reactors to LEU fuel

Nuclear Materials Identification System



B. R. Grogan, J. T. Mihalcz, and J. A. Mullens, *MCNP-PoliMi Simulation of Neutron Radiography Measurements for Mass Determination for a Trough of UO_2*
Institute for Nuclear Materials Management (INMM) 48th Annual Meeting, July 8-12, Tucson, Arizona, 2007

IPFM Conclusions

1. Placing pre-existing civilian, excess-military and naval stocks of fissile material under IAEA safeguards or monitoring would make weapon reductions much more difficult to reverse.
2. Challenges of verifying an FM(C)T to standards similar to the NPT are significant but manageable *if there is the political will*.
3. Impact on the IAEA safeguards budget might be a doubling but
 - 0.2% of U.S. nuclear-weapon budget or
 - 0.1% of the global cost of generating nuclear electricity.