A Fissile Material (Cutoff) Treaty and its Verification

Progress Report from the International Panel on Fissile Materials

IPFM
INTERNATIONAL PANEL
ON FISSILE MATERIALS

Geneva, May 2, 2008

Revision 7

The Verification Challenge

"'Effective verification' of an FMCT cannot be achieved ... even with ... verification mechanisms and provisions ... so extensive that they could compromise the core national security interests of key signatories, and so costly that many countries will be hesitant to accept them."

Bush Administration at Conference on Disarmament, May 17, 2006

But the FMCT would require of the weapon states the same thing that the IAEA is supposed to verify in NPT non-weapon states

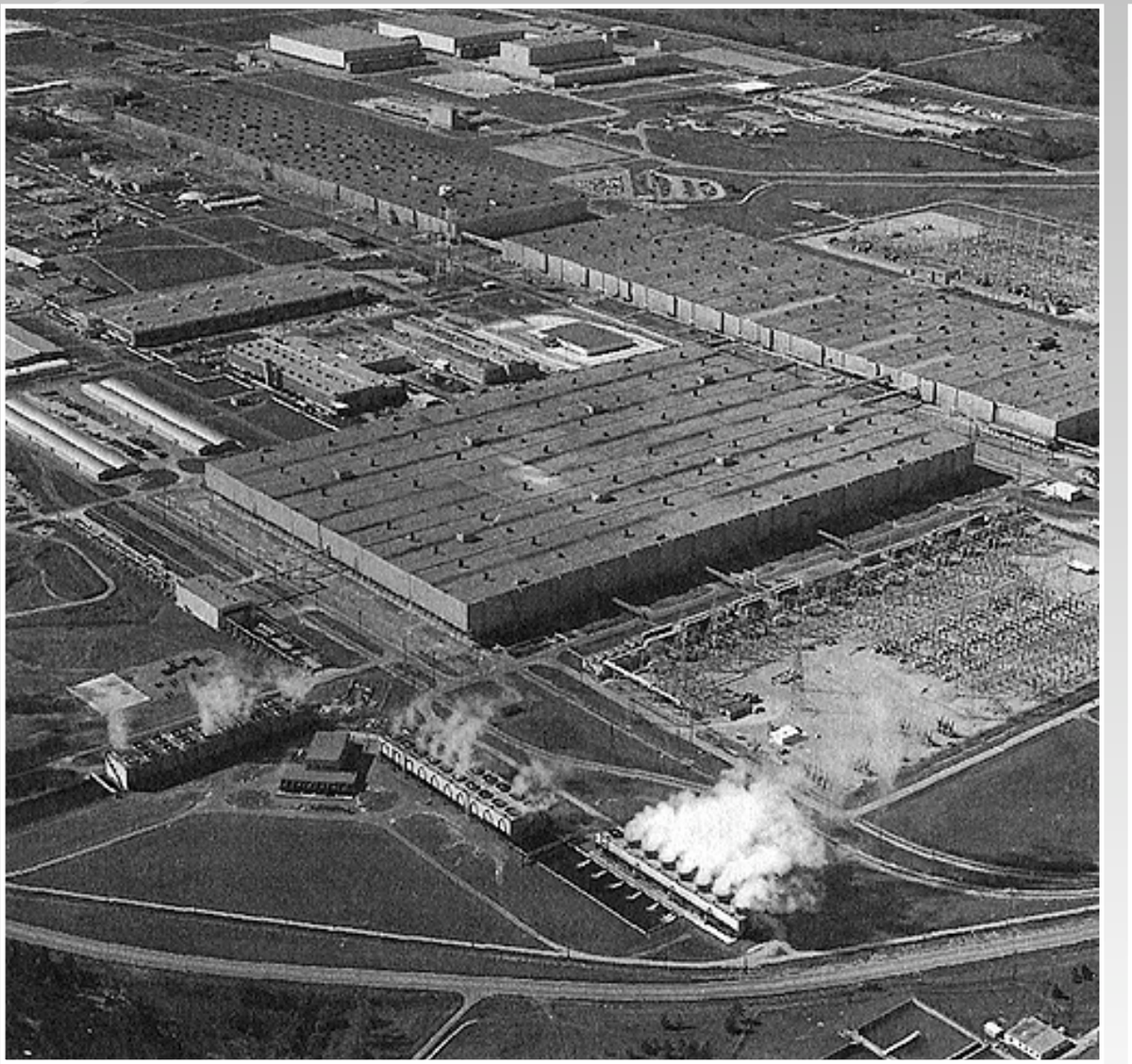
Five Verification Challenges in Nuclear Weapon States

1. Shutdown status of enrichment & reprocessing plants
2. No undeclared enrichment or reprocessing in military nuclear facilities
3. Non-diversion of plutonium at previously operating reprocessing plants
   (not designed for safeguards and without verified design information)
4. Non-production of HEU at previously operating enrichment plants
5. Non-diversion of material declared excess for weapons purposes
   (plutonium and HEU in classified form, and HEU to be used as naval fuel)

Minimizing additional IAEA Safeguards costs

Challenge #1

Verifying Shutdown of Enrichment and Reprocessing Plants



The U.S. Portsmouth gaseous-diffusion uranium-enrichment plant stopped operating in 2001, but has not yet been decommissioned

- Satellite monitoring
- Remotely monitored video cameras and sensors and seals on key equipment
- Short-notice random inspections

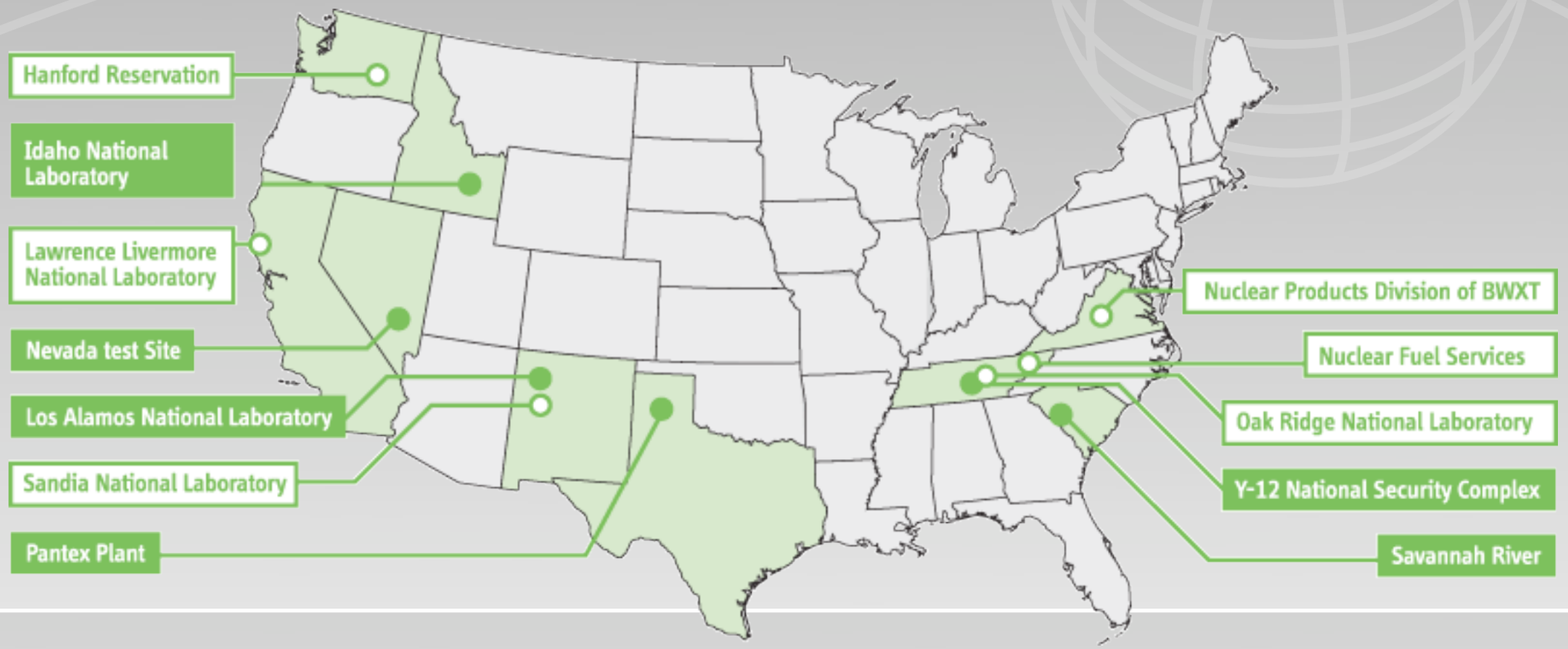
Cost would not be high

Potential sensitivities about qualitative indicators of past production *(e.g. HEU and plutonium isotopics)*

Challenge #2

Managed Access

(to confirm no undeclared enrichment or reprocessing in military nuclear facilities)

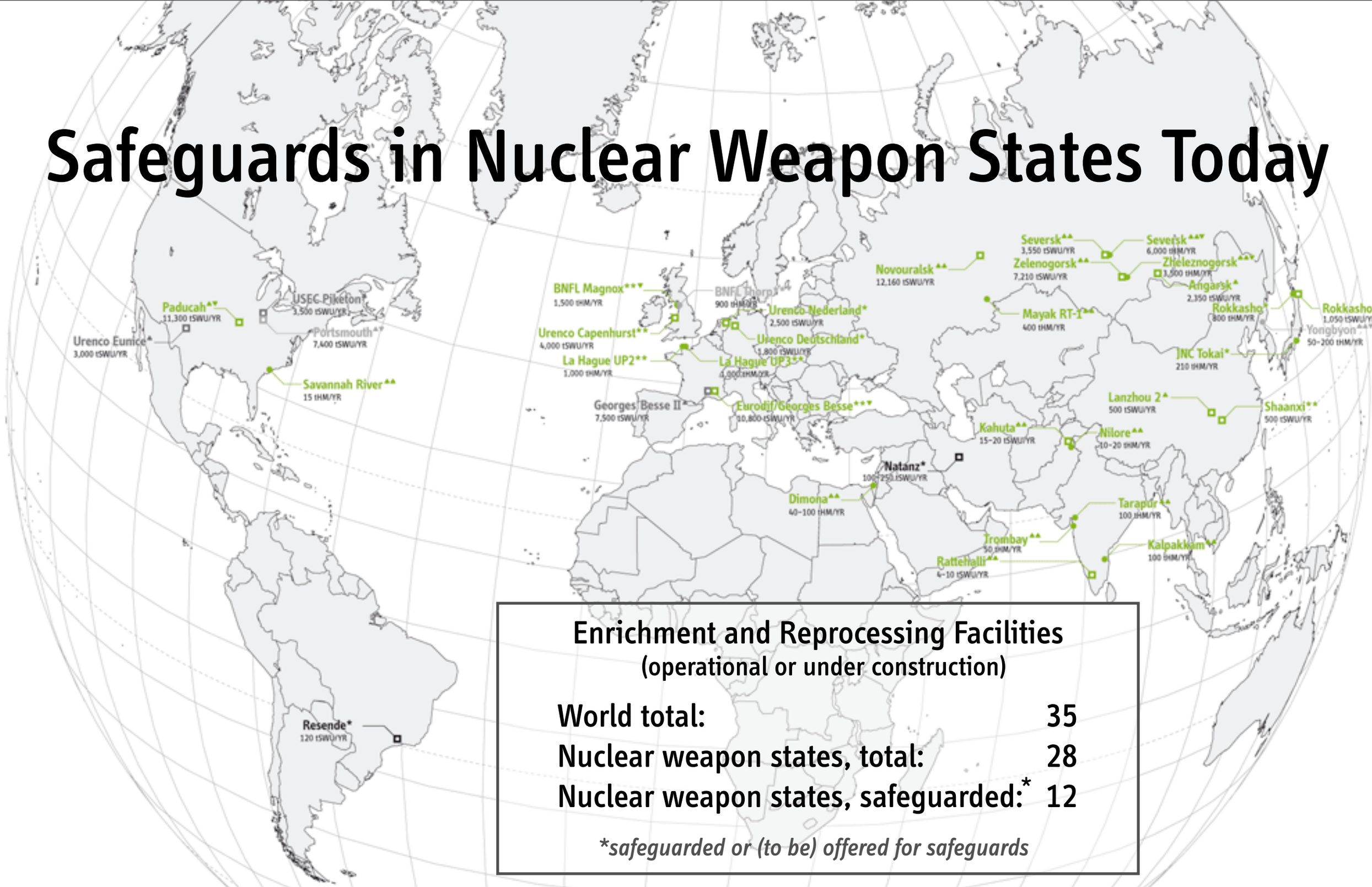


Managed-access procedures have been developed for OPCW inspections

U.S. DOE has instructed its facilities and U.S. NRC has instructed its licensees to prepare for managed access in connection with possible IAEA questions about the completeness and accuracy of U.S. Additional Protocol declarations

IPFM has been examining how managed access could be used to verify FM(C)T

Safeguards in Nuclear Weapon States Today



Enrichment and Reprocessing Facilities
(operational or under construction)

World total:	35
Nuclear weapon states, total:	28
Nuclear weapon states, safeguarded:*	12

**safeguarded or (to be) offered for safeguards*

Many reprocessing and enrichment plants in the nuclear weapon states already are subject to international safeguards (Global Fissile Material Report 2007)

Challenge #3

Non-Diversion at Operating Reprocessing Plants

Design information cannot be verified for operating unsafeguarded facilities
By far, most costly facilities to safeguard

Country	Facility	Safeguards Status	Capacity [tons/yr]
France	UP2/UP3	Yes (Euratom)	1000/1000
India	Trombay/Tarapur/Kalpakkam	No	50/100/100
Japan	Tokai/Rokkasho	Yes	210/800
Russia	Mayak	No	400
United Kingdom	B205/Thorp	Yes (Euratom)	1500/900
United States	Savannah River	No	15

Measure plutonium flow at strategic points and random short-notice inspections

Annual cleanout and inventory

$20 million investment and $1 million/plant-year. Much less costly than Rokkasho safeguards because no resident inspectors and no on-site safeguards laboratory

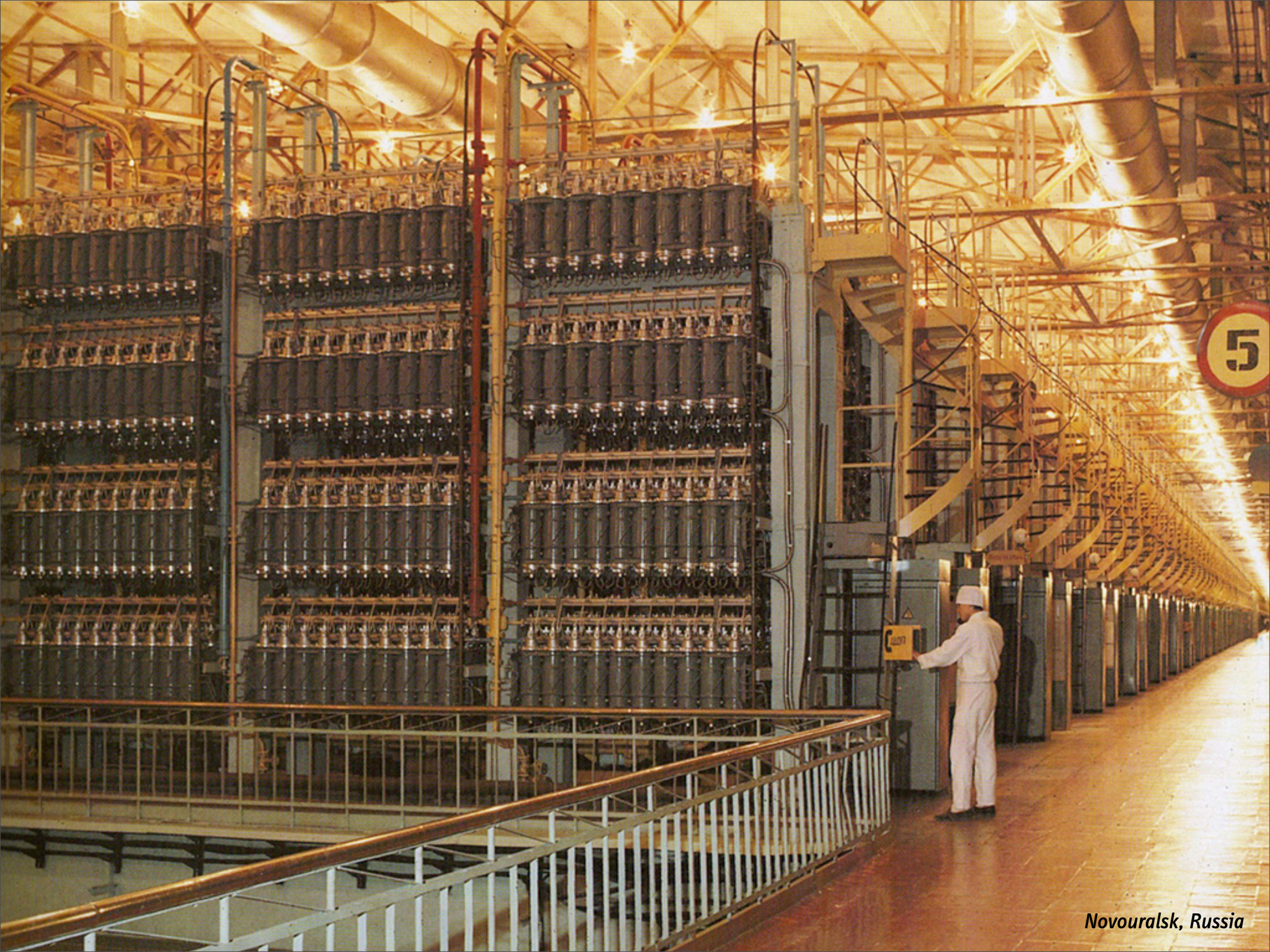
Challenge #4

Centrifuge Enrichment Facilities

(as currently expected for the year 2015)

	Country	Facility	Safeguards Status	Capacity [tSWU/yr]
Non-weapon states	Brazil	Resende	Yes	120
	Germany	Gronau	Yes (IAEA/Euratom)	4,500
	Iran	Natanz	Yes	250*
	Japan	Rokkasho	Yes	1,050
	The Netherlands	Almelo	Yes (IAEA/Euratom)	3,500
Weapon states	France	George Besse II	Yes (IAEA/Euratom)	7,500
	U.K.	Capenhurst	Yes (IAEA/Euratom)	4,000
	United States	Piketon, Ohio	Likely	3,500
		Eunice, NM	Possible	3,000
		TBD (Areva)	Possible	3,000
	China	Shaanxi	Yes (IAEA)	500
		Lanzhou II	Offered?	500
	Russia	Angarsk II	Offered?	5,000*
		4 others	No	30,000*
	India	Rattehalli	No	4-10
	Pakistan	Kahuta	No	15-20

**uncertain values*



Novouralsk, Russia

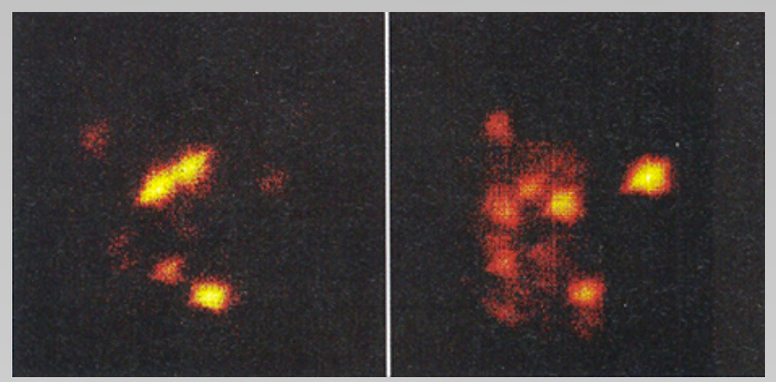
Challenge #4

Verifying Non-Production of HEU in Previously Operating Enrichment Facilities

Installation/use of continuous (or portable) enrichment monitors

Already added to centrifuge facilities in the United Kingdom and in China

Swipe sampling techniques to detect HEU particles



Images of micron-sized uranium particles made with a Secondary Ion Mass Spectrometer

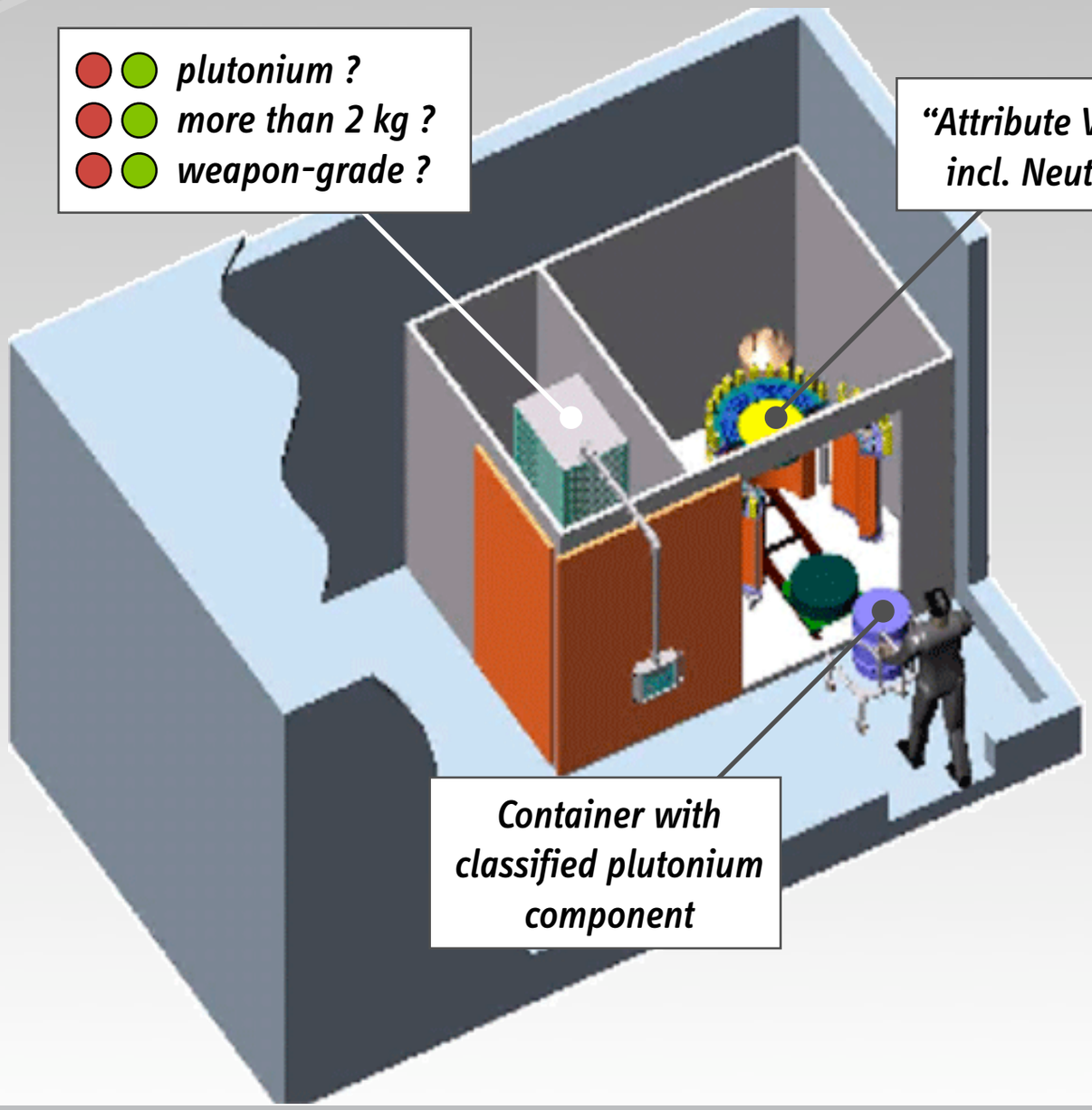
Left: U-235 Concentration
Right: U-238 Concentration

Pre-FM(C)T HEU particles may be identified with age-dating techniques (and isotopic analysis)

Challenge #5

Verifying Non-Diversion of Material Declared Excess for Weapon Purposes

(while in classified form)



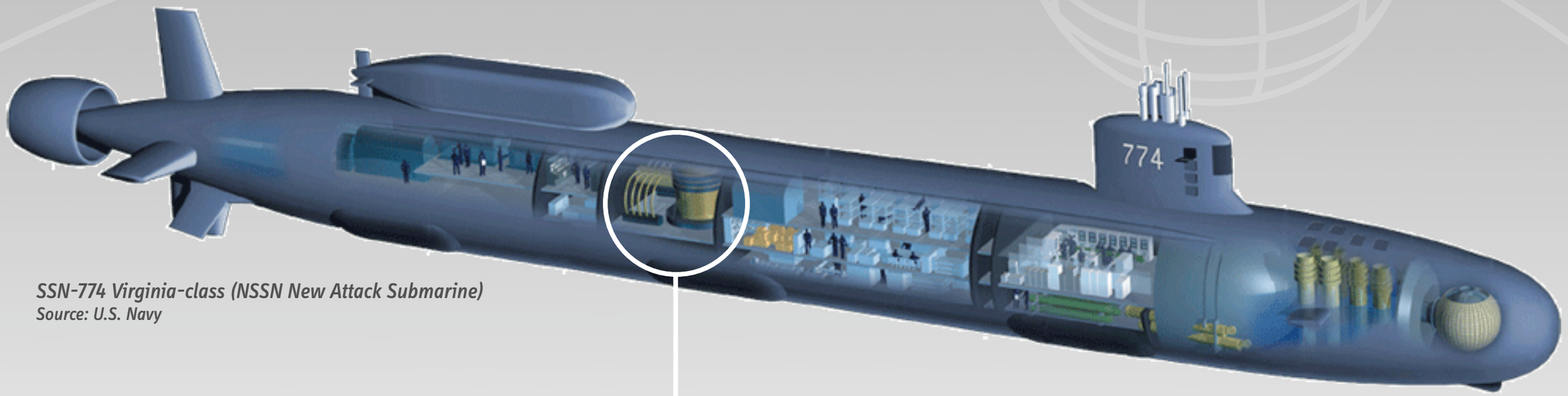
1996-2002 Trilateral Initiative developed approach to determine that a container holds more than a threshold amount of weapon-grade plutonium

Results communicated by red or green lights through information barrier

IPFM is working on corresponding approach for HEU components

Challenge #5

HEU Stockpiles for Naval Fuel



SSN-774 Virginia-class (NSSN New Attack Submarine)
Source: U.S. Navy

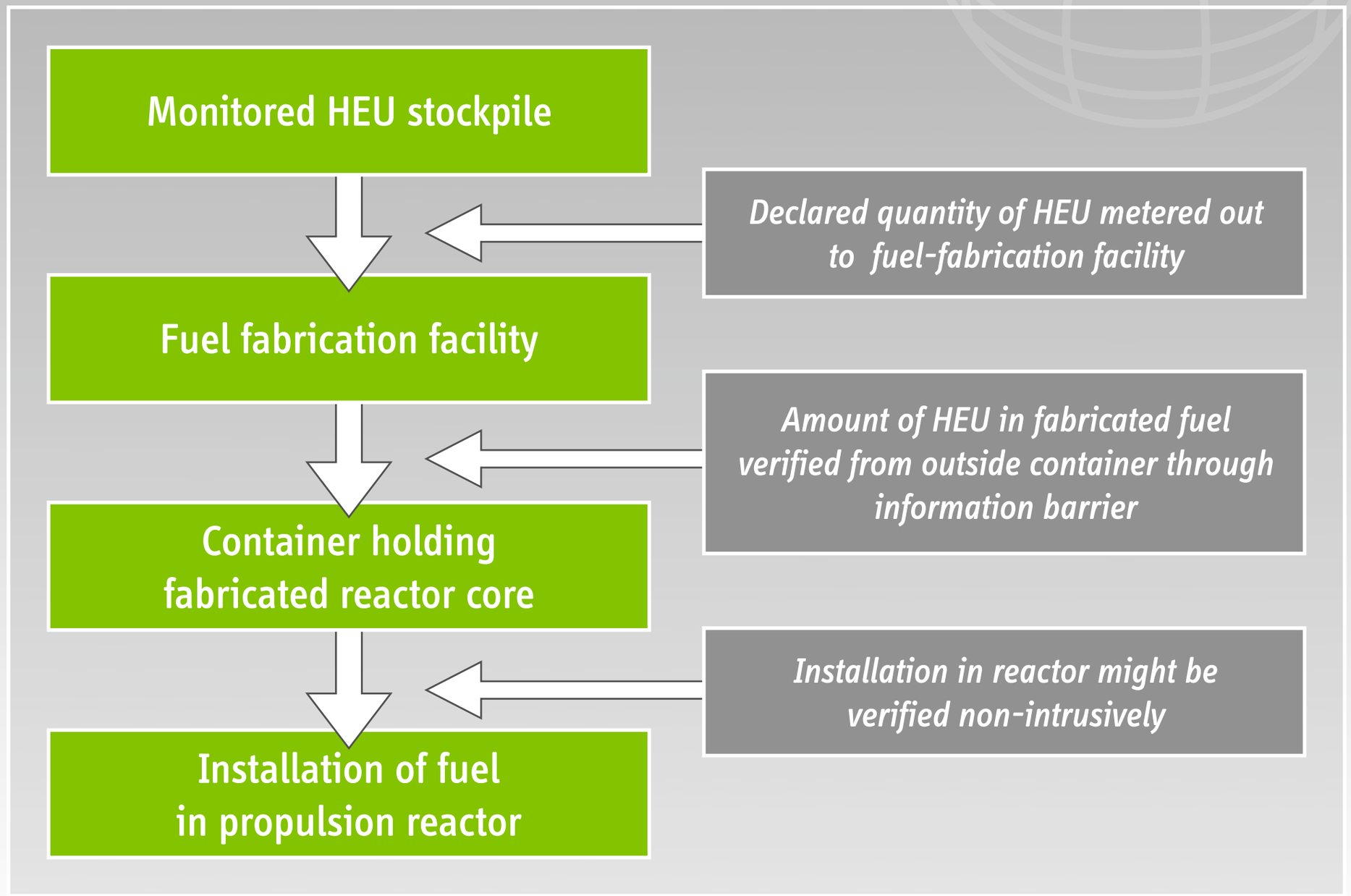
The United States, Russia, and the United Kingdom use HEU to fuel naval vessels
(mostly submarines; the U.S. and U.K. vessels are fueled with weapon-grade uranium)

The U.S. fleet currently requires about 2000 kg of weapon-grade uranium per year

The United States has reserved 128 tons of excess weapon-grade uranium (enough for 5,000 nuclear weapons) for future use in naval reactors

Challenge #5

Non-Diversion of HEU Set Aside For Naval (and Tritium Production) Reactors



Conclusion

The technical challenges of FM(C)T verification are significant
but probably not as significant as
the political challenges of FM(C)T negotiation

The costs of FM(C)T verification could be
less than the current IAEA safeguards budget

The technical challenges and costs will come down
as former military production facilities are
shut down and dismantled

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