

Plutonium & Highly Enriched Uranium, 2015

Institute for Science and International Security

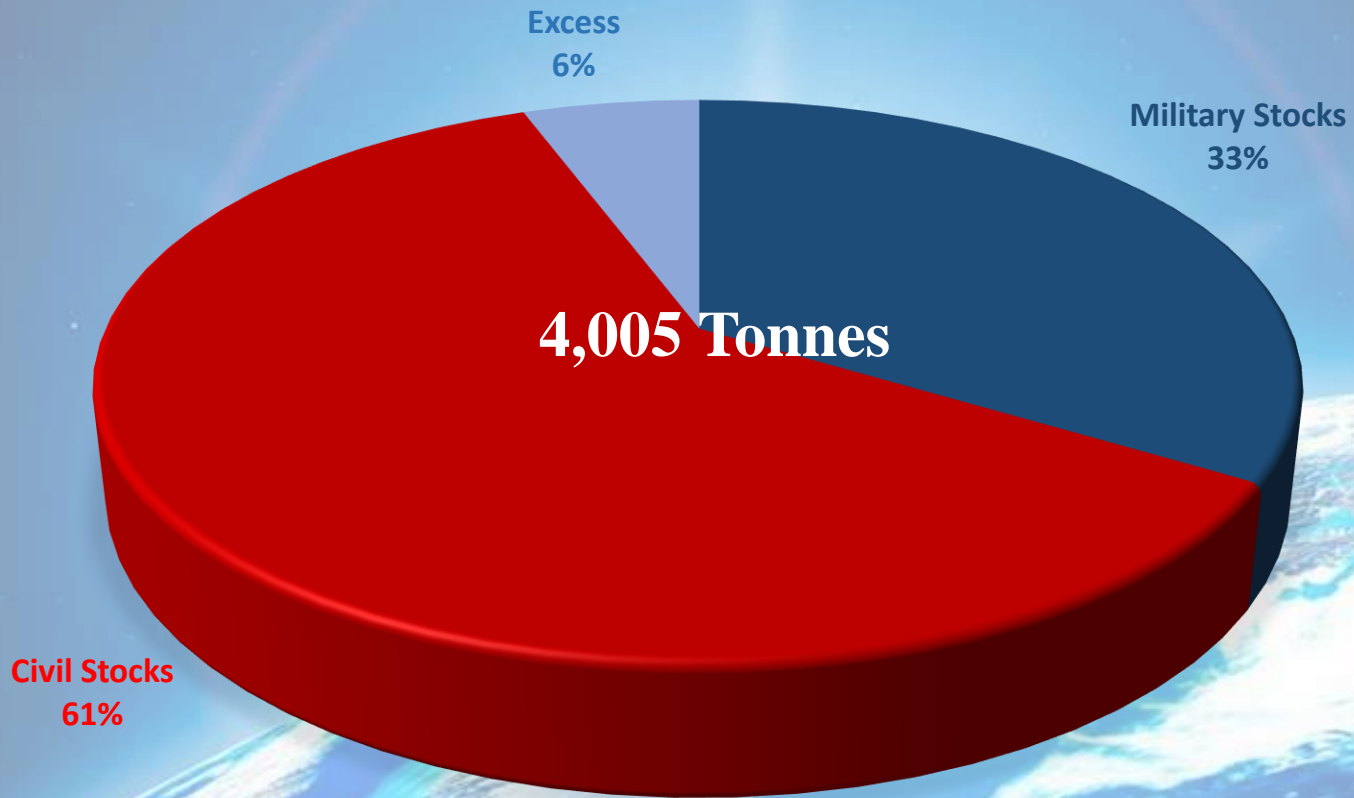


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Serena Kelleher-Vergantini

This work was generously funded by a grant from the Nuclear Threat Initiative (NTI) and builds on earlier work done at ISIS by one of the authors.

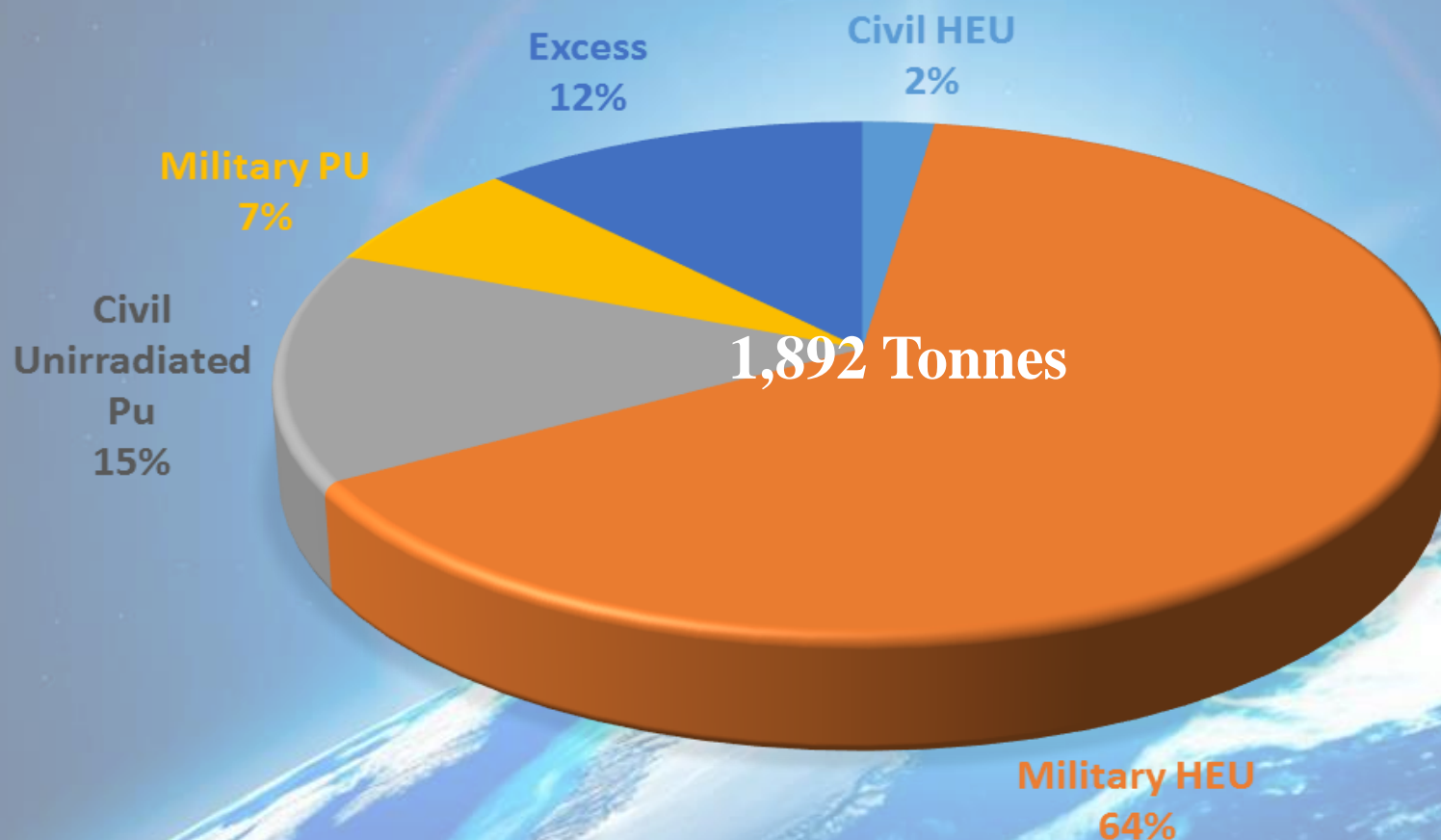
HEU and Plutonium Worldwide

End of 2014



Global Inventory of Unirradiated Plutonium and HEU

End of 2014



Civil irradiated plutonium stocks are not represented here

HEU and Plutonium Worldwide, End 2014

(tonnes)

		Plutonium	HEU	Total
Civil Stocks	Irradiated	2,113	42	
	Unirradiated	275		
<i>Subtotal</i>		2,388	42	2,430
Military Stocks	Military Stocks and Reserves	129	1,061	
	Naval		152.5	
	Excess	111	116	
	Reactors		5.5	
<i>Subtotal</i>		240	1,335	1,575
Total		2,627	1,377	4,005



Civil HEU and Plutonium
National and Global Stocks, as of End 2014

Civil HEU

Table 1. Civil HEU (initial mass) in NWS and NNWS, end 2014

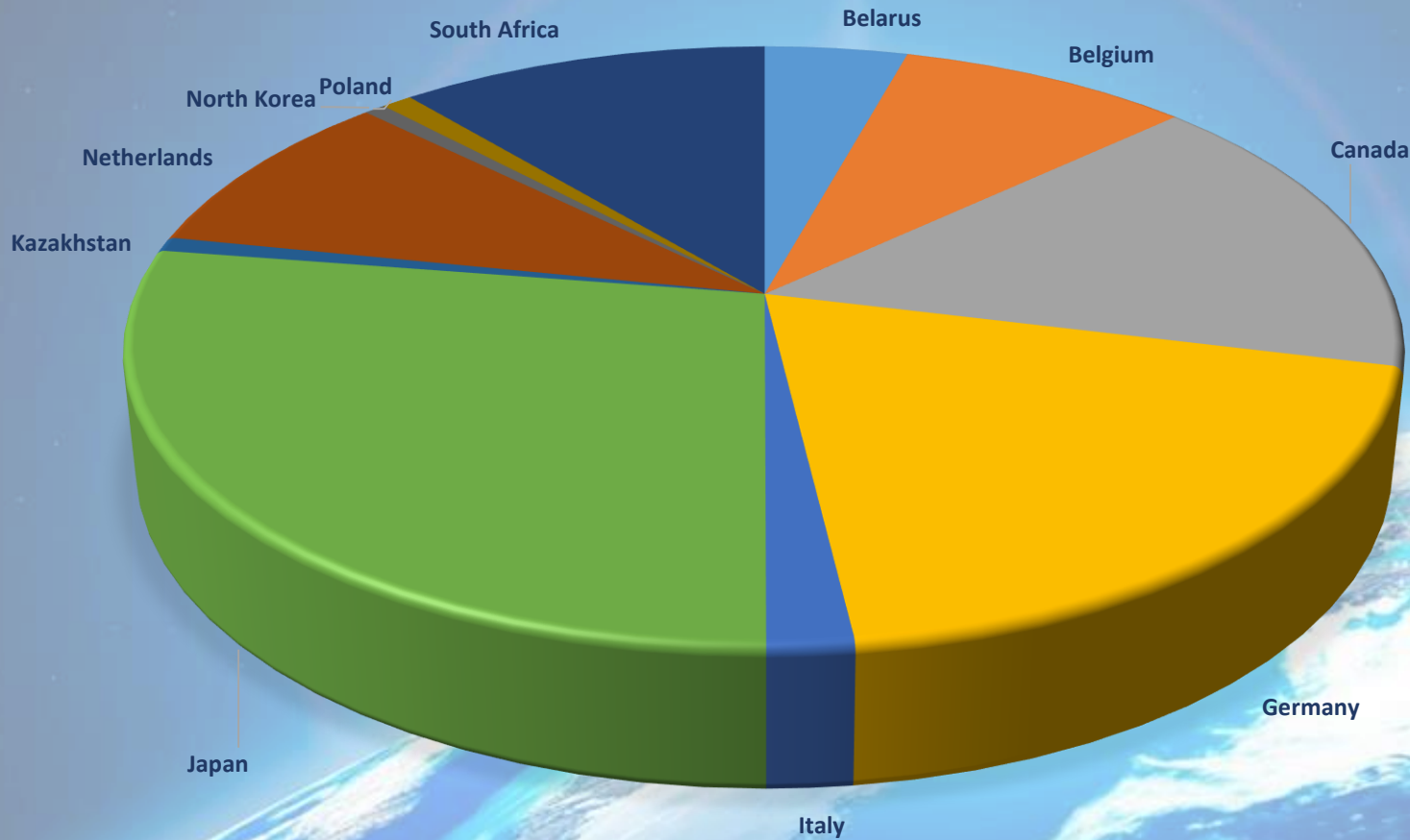
	HEU(tonnes)	HEU(kg)
Nuclear Weapon States (NWS)	115.051-120.051	115,051-120,051
Non-Nuclear Weapon States (NNWS)	16.513-16.775	16,513-16,775
TOTAL HEU	131.564-136.807	131,564-136,807

Table 2. Largest Civil HEU Stocks in NNWS, end 2014

Country	HEU(tonnes)	HEU(kg)
Belarus	0.280	280
Belgium	0.555-0.605	555-605
Canada	1.035	1,035
Germany	1.260	1,260
Italy	0.115-0.130	115-130
Japan	1.8	1,800
Kazakhstan*	0.043-0.058	43-58
Netherlands	0.55-0.65	550-650
North Korea	0.042	42
Poland	0.060	60
South Africa	0.7-0.75	700-750
TOTAL HEU	6.44-6.67	6,440-6,670

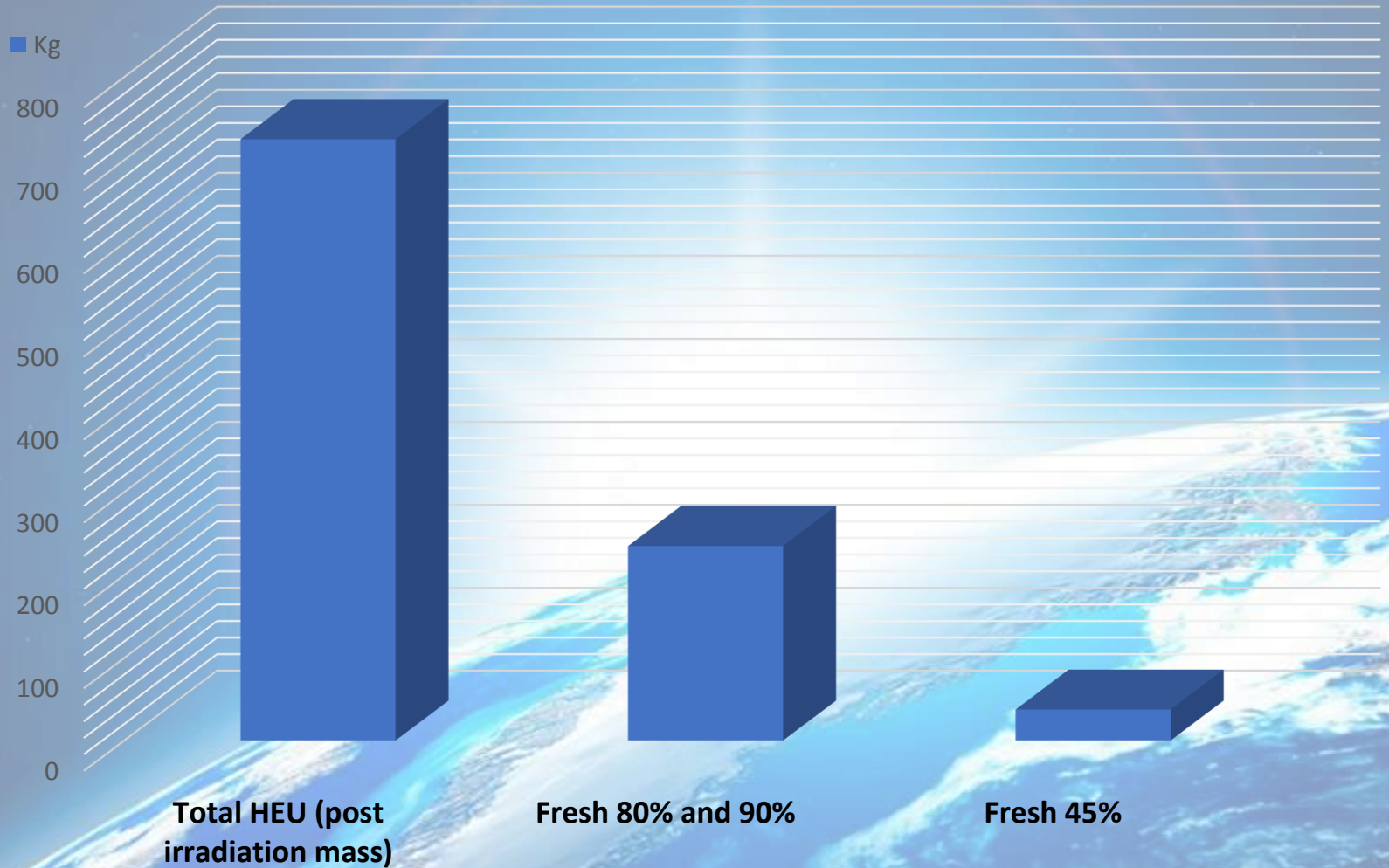
*This table only accounts for Kazakhstan's HEU used for R&D purposes and excludes 10 tonnes of HEU in spent fuel from its breeder reactor.

Largest Civil HEU Stocks in NNWS, end 2014



This table only accounts for Kazakhstan's HEU used for R&D purposes and excludes 10 tonnes of HEU in spent fuel from its breeder reactor.

South Africa



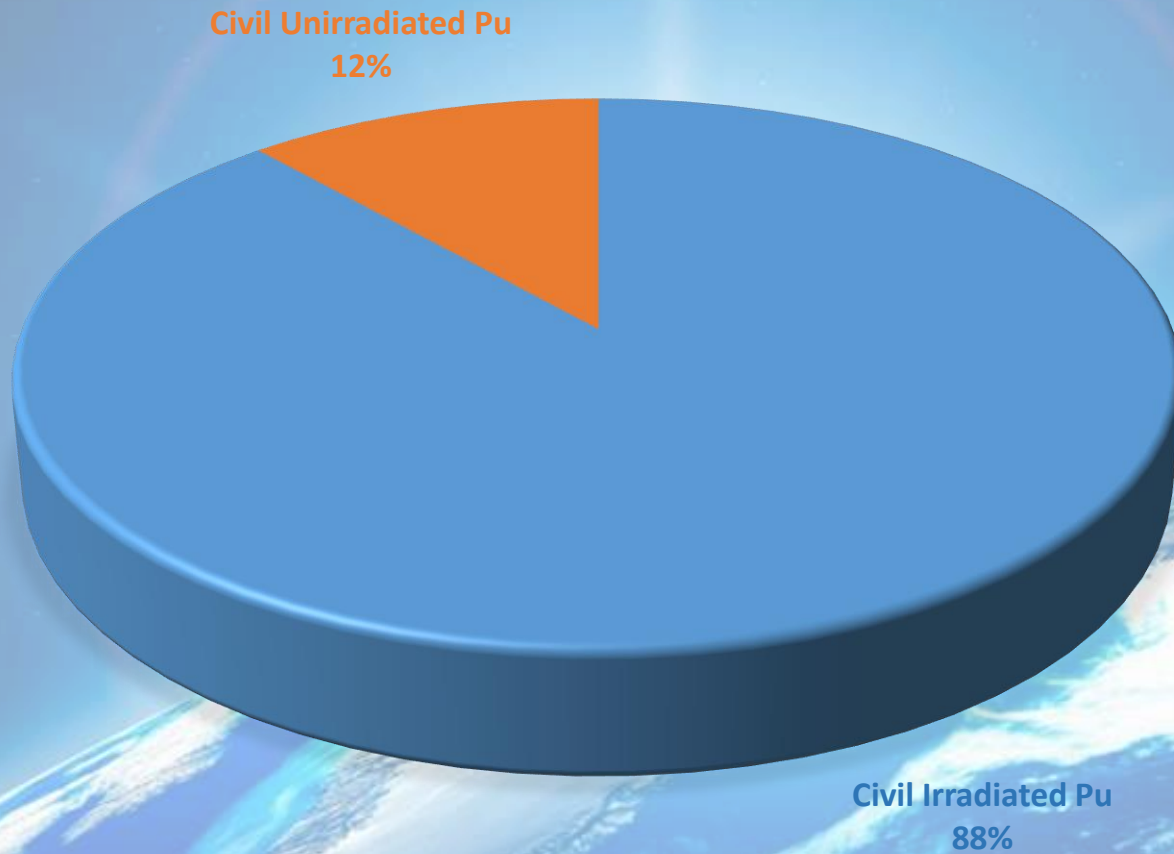
Civil Plutonium

Civil Power Reactor Plutonium Held by Country, end 2014

Country	Irradiated Plutonium in spent fuel (tonnes)	Unirradiated Plutonium (tonnes)
Argentina	17.6	
Armenia	2.1	
Belgium	40	0.9
Brazil	5.9	
Bulgaria	8.8	
Canada	213	
China	32.5	0.025
Czech Rep.	16.8	
Finland	17.6	
France	275.6	78.8
Germany	113	2.1
Hungary	10.8	
India	31.9	2.9
Italy	<0.4	
Japan	161	10.8
Kazakhstan	3	
Lithuania	12.3	
Mexico	5.2	
Netherlands	1.4	0-0.3
Pakistan	2.17	
Romania	10.4	
Russia (b)	146.5	About 52.7
S. Africa	9.46	
S. Korea	97.9	
Slovakia	14.3	
Slovenia	4.3	
Spain	44.4	
Sweden	54.4	
Switzerland	18.0	<50kg
Taiwan	32.4	
Ukraine	50.6	
U.K.	30.0	126.3
U.S.A (c)	629	(u)
Totals (rounded)	2113	275
Grand Total	2,388 tonnes	

Civil Irradiated and Unirradiated Plutonium Worldwide

End 2014

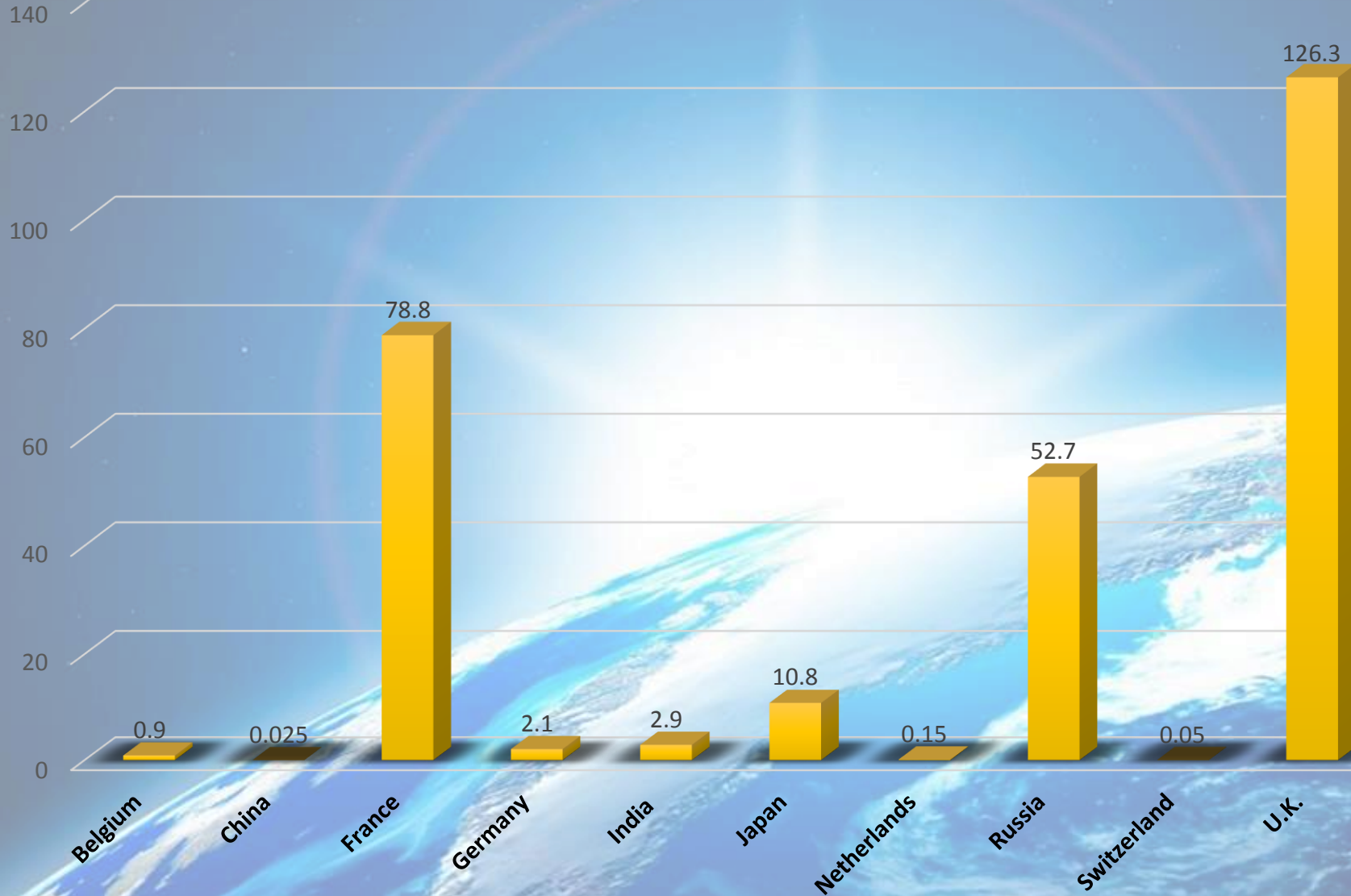


Unirradiated Civil Power Reactor Plutonium, end 2014 (tonnes)

Country	A: Holdings in-country	B: Holdings in other countries	C: Tonnes of A that are foreign-owned	D: Plutonium owned by a country (A+B-C)
Britain	126.3	0	23	103.5
France	78.8	less than 0.05	16.9	61.9
Belgium	0.95	0	0.9	<0.05
Germany	2.1	1-1.5(b)	0	3.1-3.6(b)
Japan	10.8	37	0	47.8
Switzerland	<0.05	0	0	<0.05
Russia	52.7	0	0	52.7
China	0.025	0	0	0.025
United States	(c)	0	0	(c)
India	2.9	0	0	2.9
Netherlands	0-0.03	0.32-1.12	0	0.62-1.12
Italy	0	0.45-0.68	0	0.45-0.68
Sweden	0	0	0	0
Spain	0	0.55-0.6	0	0.55-0.6
Total (rounded)	275	39.6-41	40.8	274-275

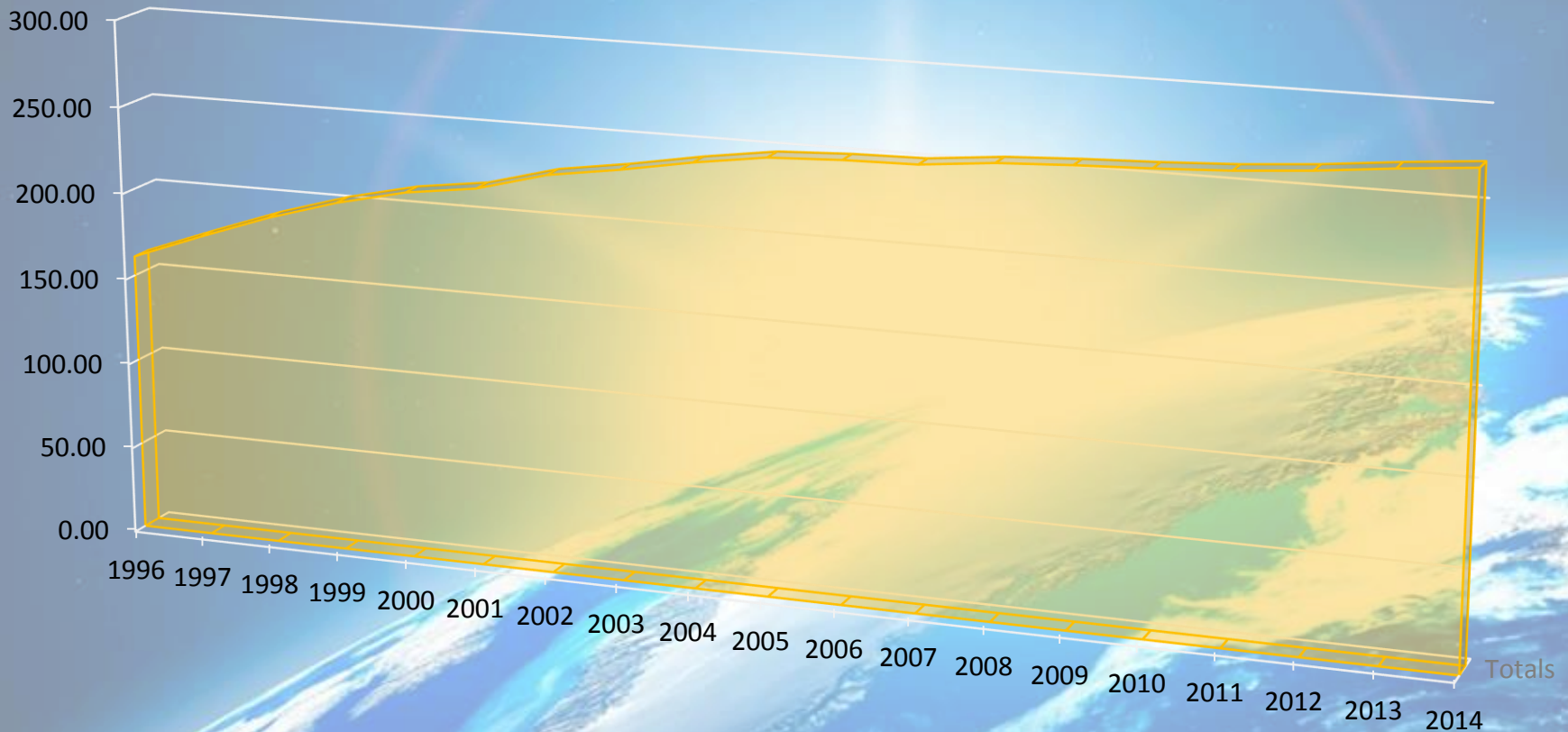
Civil Unirradiated Plutonium, end 2014

Tonnes




Tonnes

Civil Unirradiated Plutonium in INFCIRC/549 States

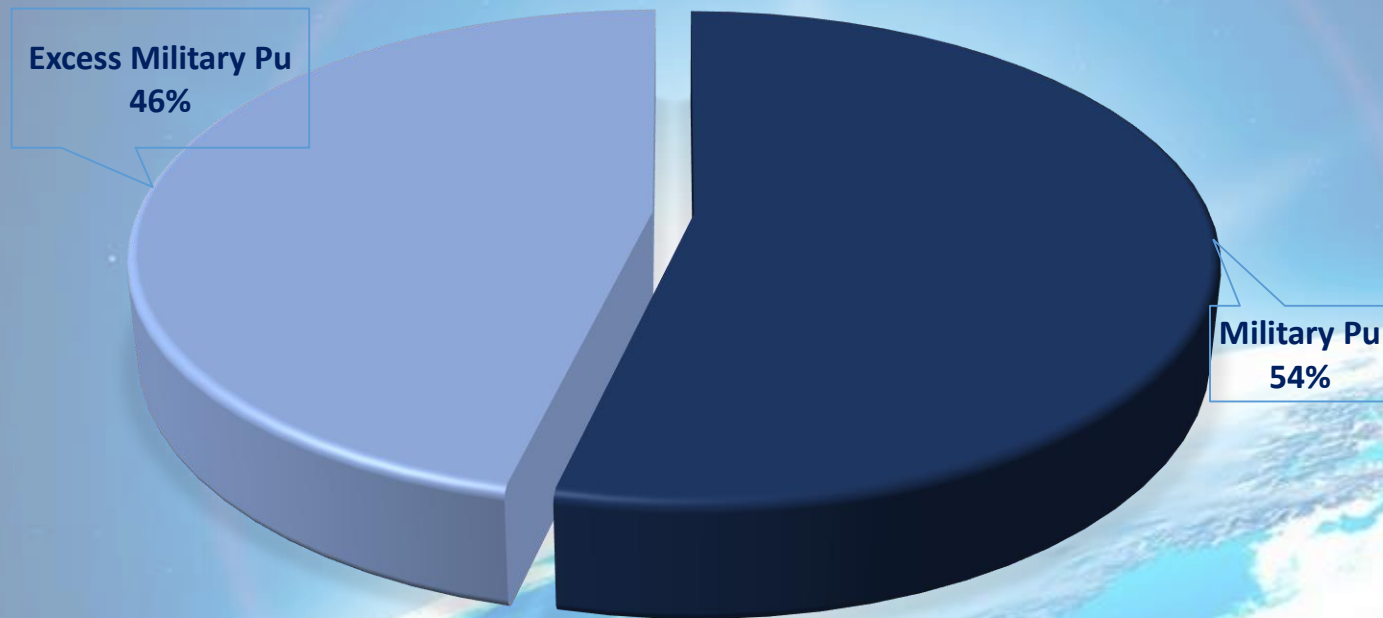


Civil Unirradiated Plutonium in the countries that submit INFCIRC/549 declarations to the International Atomic Energy Agency

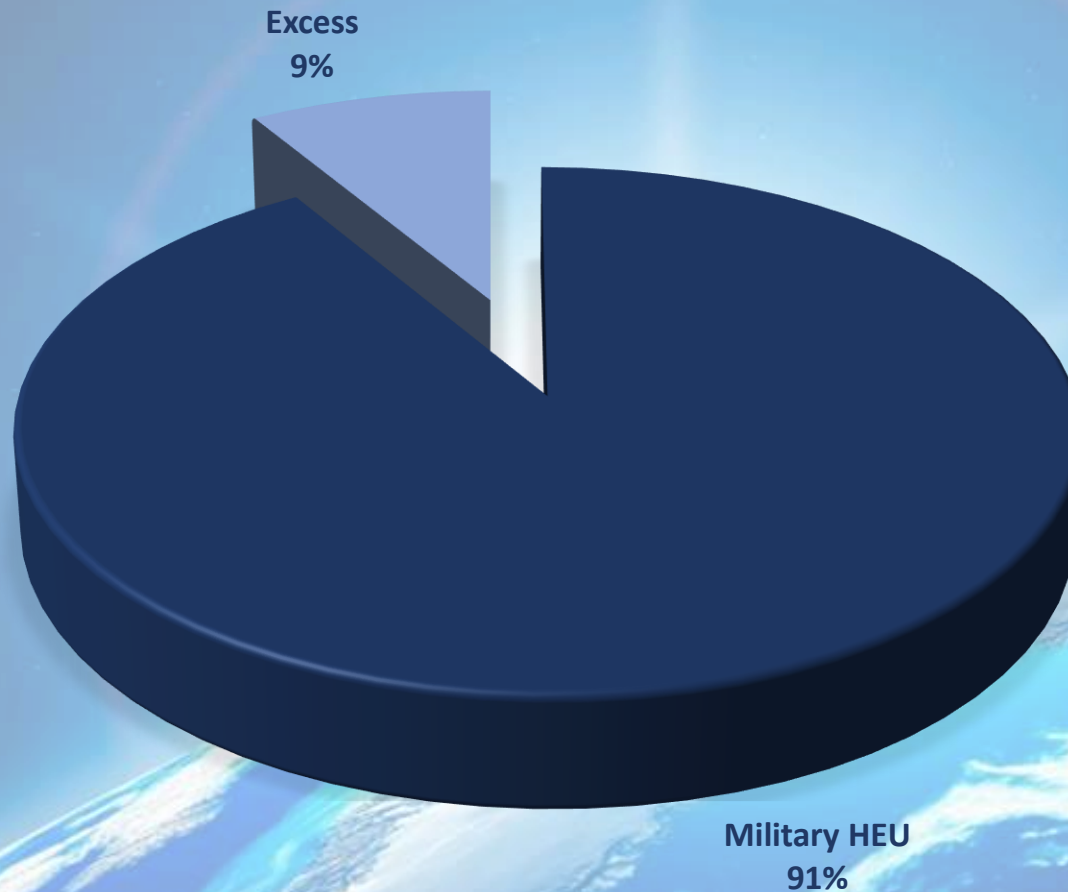


*Military HEU and Pu Stocks
in Acknowledged
Nuclear Weapon States
End of 2014*

Military Plutonium in NWS, end 2014



Military HEU in NWS, end 2014



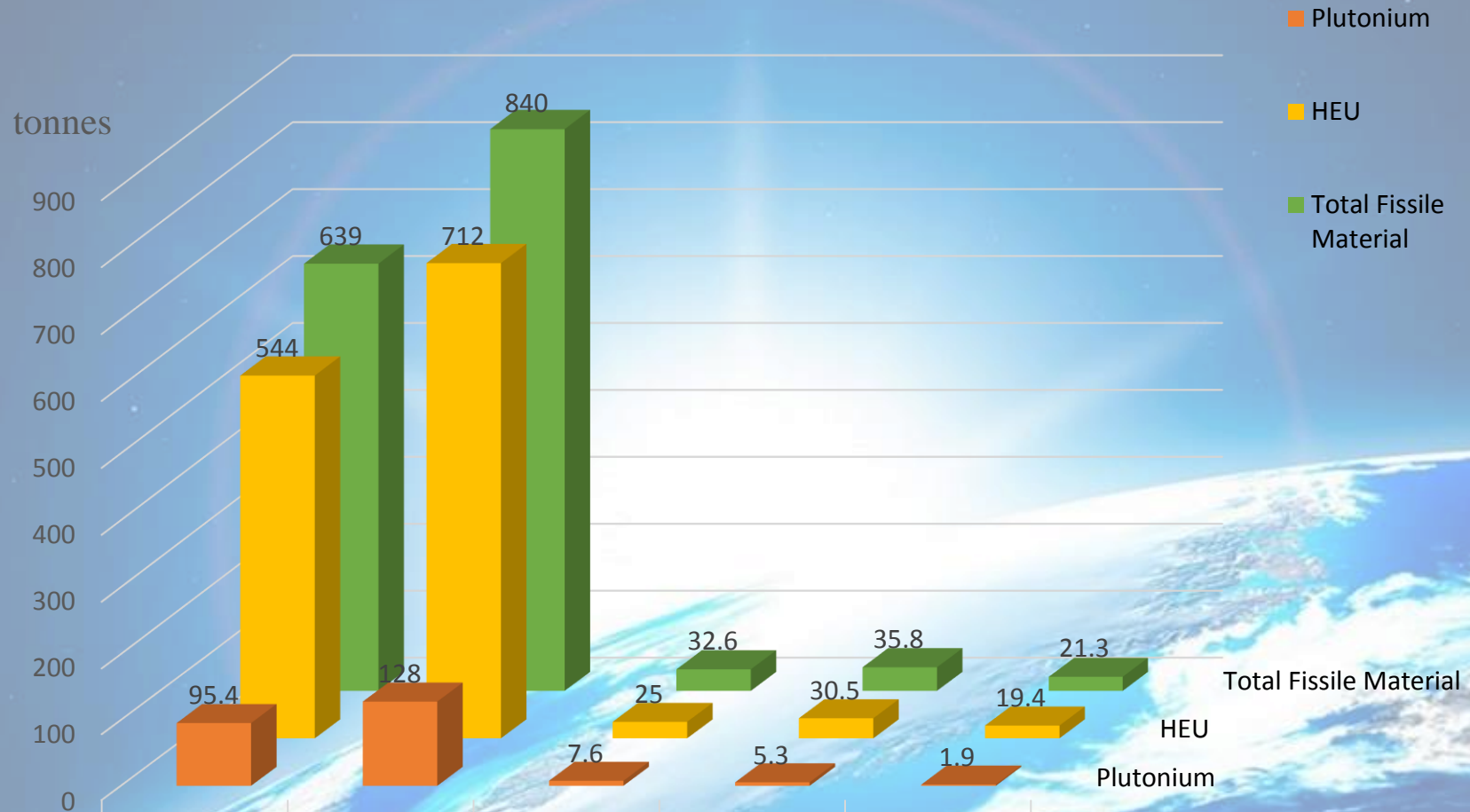
**Military and Excess Stocks of Plutonium in the Acknowledged Nuclear Weapon States
End of 2014 (tonnes)**

Country	Total^a	Military Stock^b	Declared Excess
<i>State Declarations</i>			
United Kingdom^c	7.6	3.2	4.4
United States^d	95.4	33.9	61.5 ^e
<i>ISIS Estimates of Stocks</i>			
China^f	1.9 (1.6-2.4)	1.9	0
France^g	5.3 (4.1-6.4)	5	0
Russia^h	128 (120-136)	78-88 ⁱ	40-50 ^j
Total	238 (229-248)	127 ±5	111 ±5^k

Estimated Military and Excess Stocks of Highly Enriched Uranium (HEU) in the Acknowledged Nuclear Weapon States, end of 2014 (in tonnes)¹

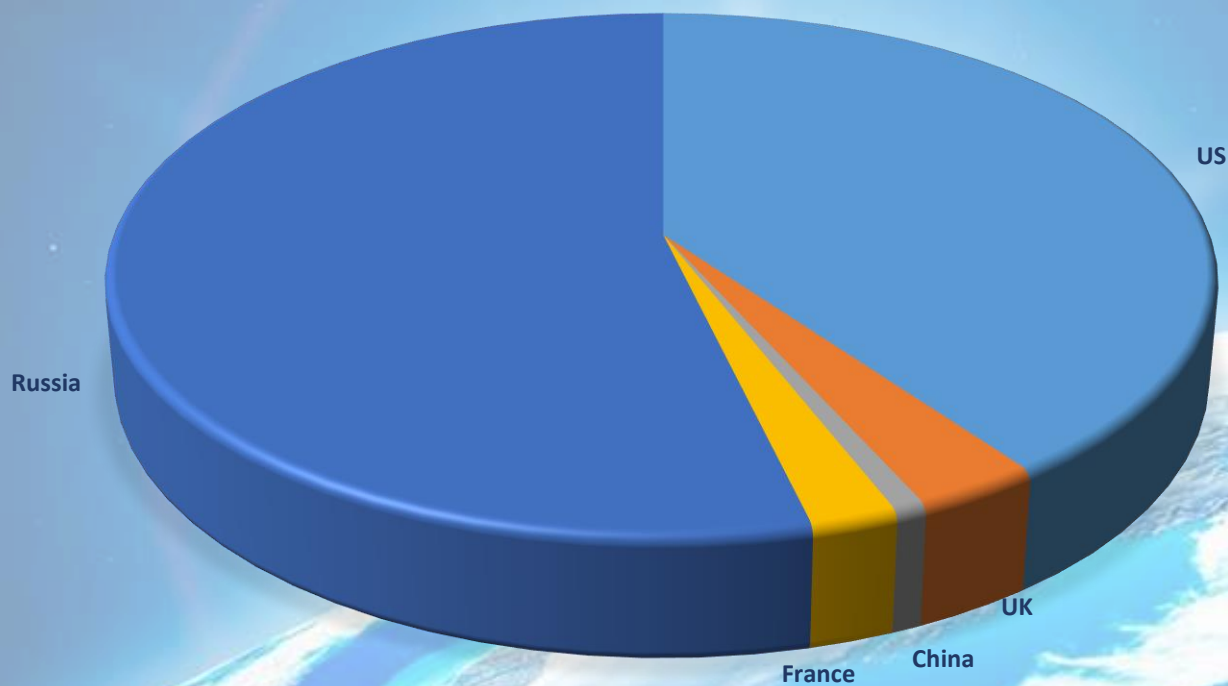
Country	Military Stocks, in Weapons, Reserves, including naval reserves ^m	Naval Programs, Military Reactors ⁿ	Production Reactors ^o	Excess for Disposition, via Downblending or Disposal ^p		Total (median)
				Original	Remaining	
United Kingdom^q	19-20	5.5-6.2	0	0	n.a.	25
China^r	19.4 (\pm 5)	Small	none?	0	n.a.	19.4
France^s	24 (\pm 6)	1 ^t	5.5 ^u	0	n.a.	30.5
Russia	660 (\pm 100) ^y	40-60 ^w	? ^x	500 ^v 15.2 ^v	0 2	712
U.S.	335 (\pm 10) ^y Subset of total in nuclear weapons program: 225 (\pm 5) ^y	90-100 ^z	-- ^{aa}	239 ^{bb} Naval spent fuel: 28 ^z (7 tonnes overlap)	93 ^{bb,cc} Naval spent fuel: 28 ^z (7 tonnes overlap)	544^{cc}
Total (median)	1,058	152	5.5		116^p	1,331

Military HEU and Plutonium Stocks in NWS, end 2014

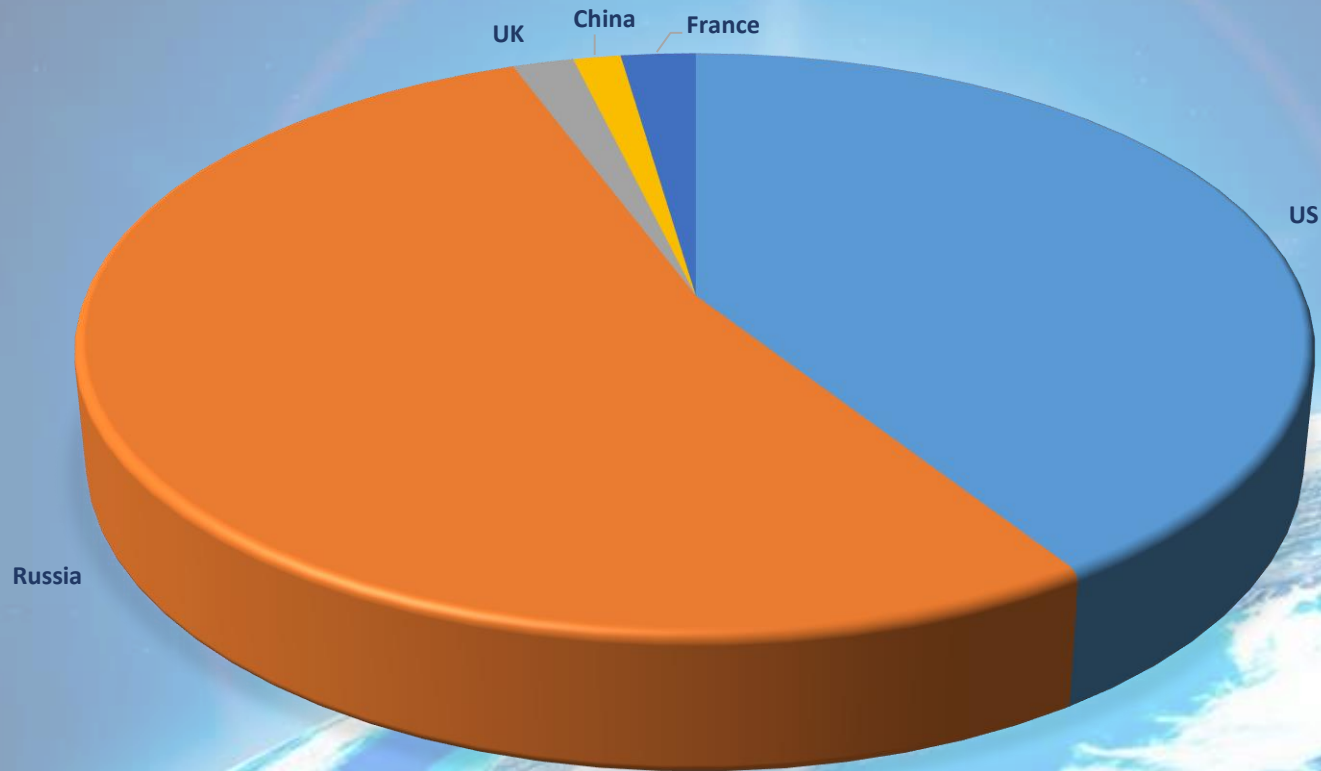


	USA	Russia	UK	France	China
Plutonium	95.4	128	7.6	5.3	1.9
HEU	544	712	25	30.5	19.4
Total Fissile Material	639	840	32.6	35.8	21.3

Military Plutonium in NWS end 2014



Military HEU in NWS, end 2014

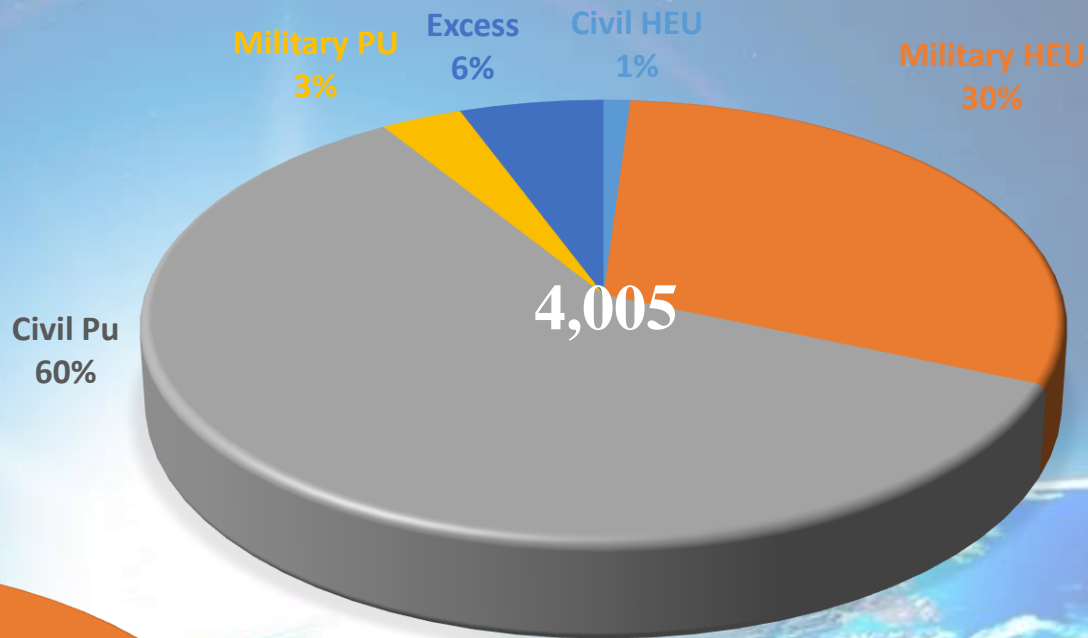


A view of Earth from space, showing the curvature of the planet and the blue atmosphere. A bright light source, likely the sun, is visible in the upper center, creating a lens flare effect. A faint, rainbow-like arc is visible in the sky above the horizon.

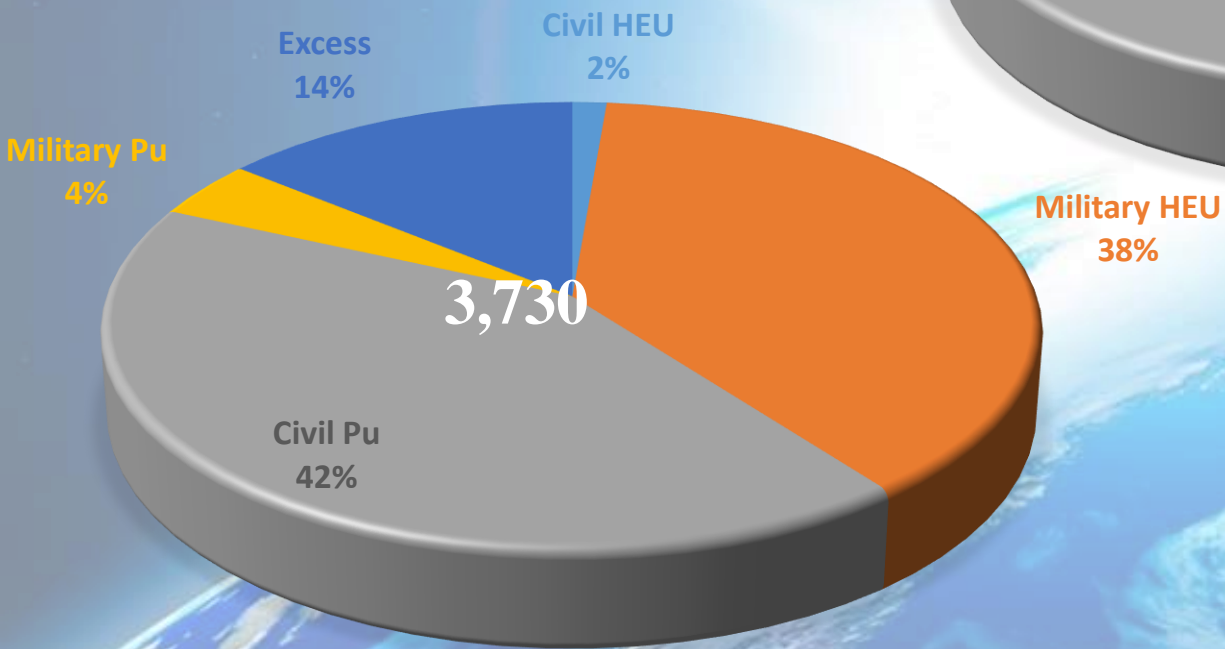
Global Stocks 2005
vs.
Global Stocks 2015

Global Inventory of Plutonium and HEU

2015

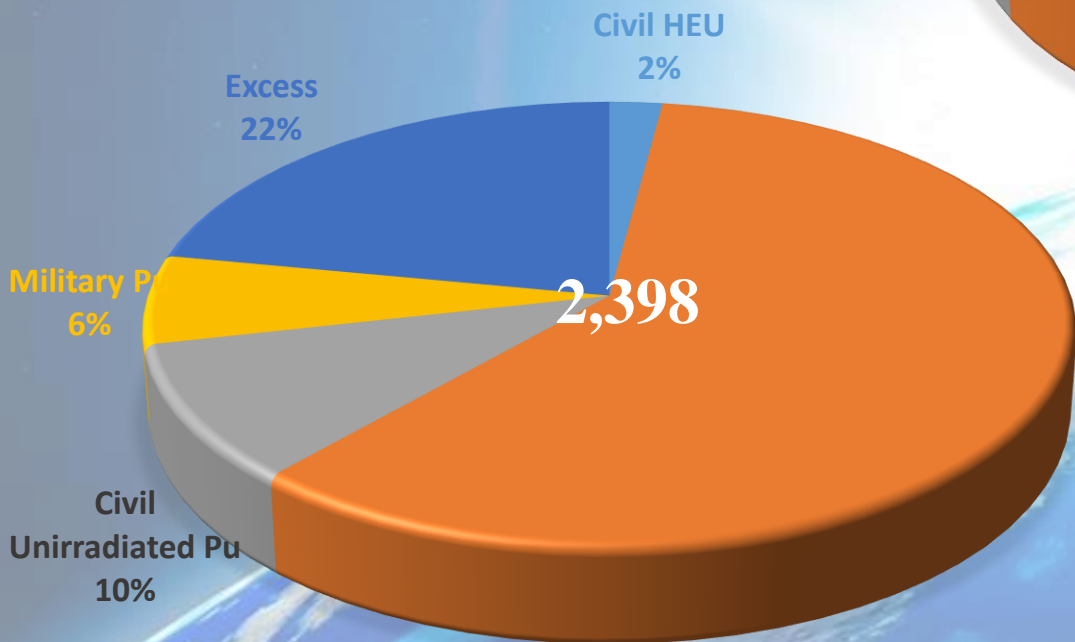


2003

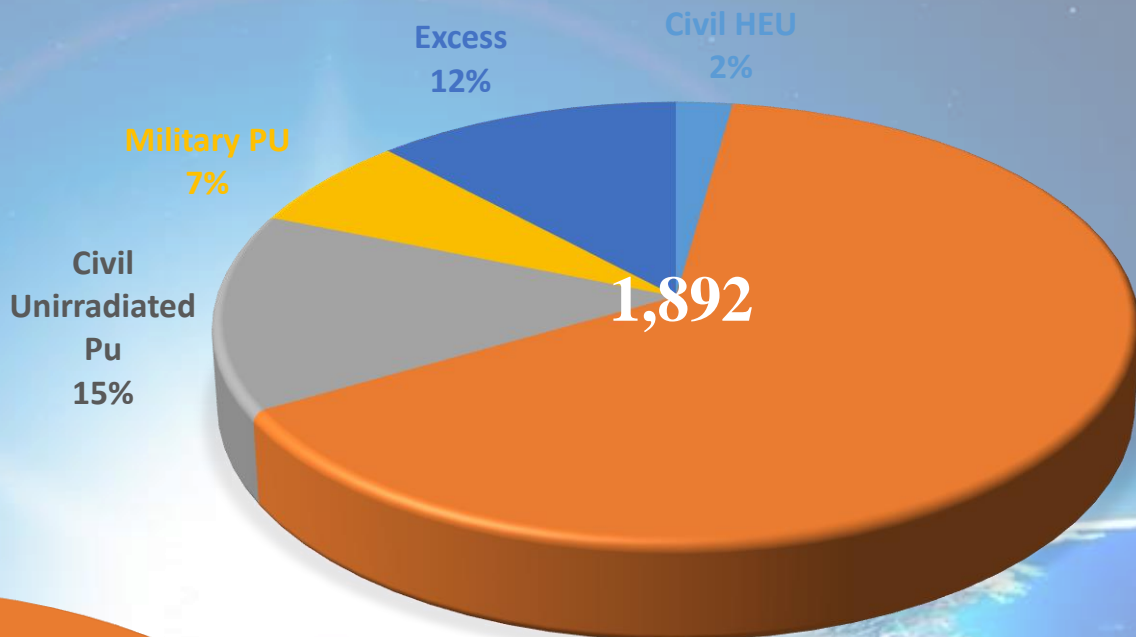


Global Inventory of Unirradiated Plutonium and HEU

2003



2015



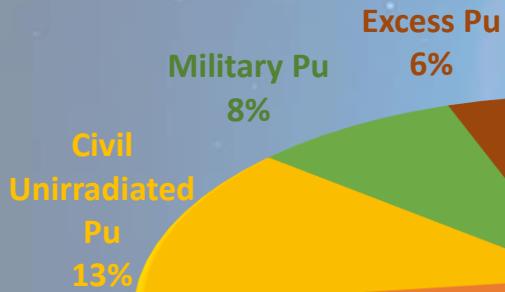
Civil irradiated plutonium stocks are not represented here.

Plutonium

2015



2003

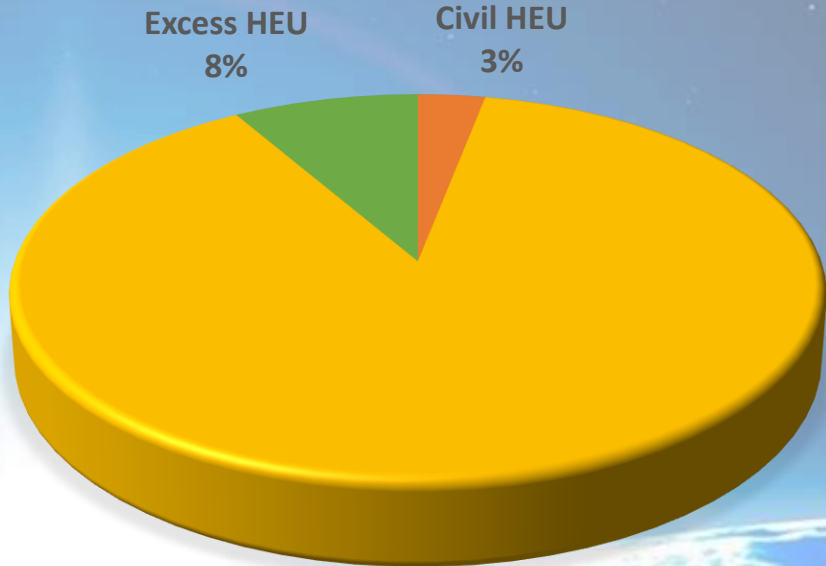


Civil
Irradiated Pu
73%

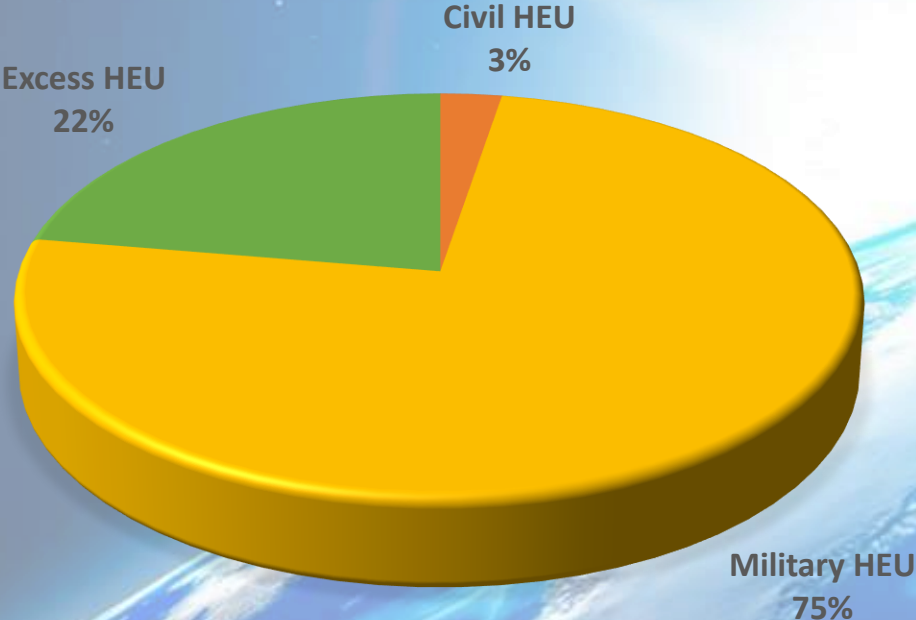
Civil
Irradiated Pu
80%

HEU

2015



2003



India

Pakistan

North Korea

South Africa

Israel

*Other States
With
Nuclear Weapons*



India

India's HEU and Plutonium Stocks, end 2014

HEU

Naval Reactors

	Cores	HEU (kg)	Range
	4-5 containing HEU	440-880	180-1,800

Thermonuclear Weapons

	Material	WGU (kg)	Range
	Weapon-grade Uranium (WGU)	150	100-200

Research Reactors

Apsara	HEU	5 kg	
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TOTAL		440-990	280-1,900
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Plutonium

Military Plutonium (separated)

	Weapon-grade	Median Value (kg)	Range
		550 kg	375-750

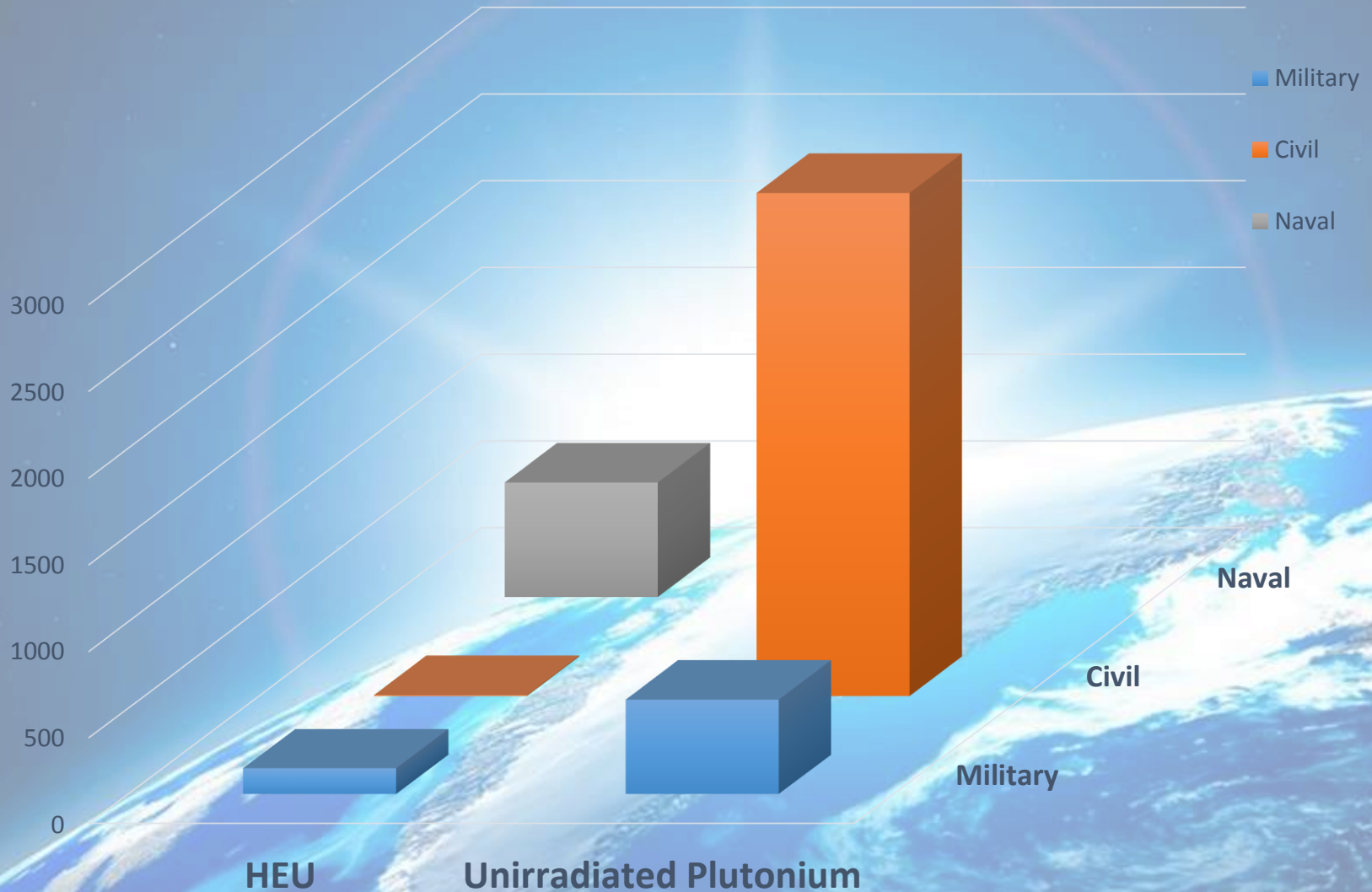
Civil Plutonium in spent fuel

	Reactor- and fuel-grade	31,900 kg	
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Civil Separated Plutonium

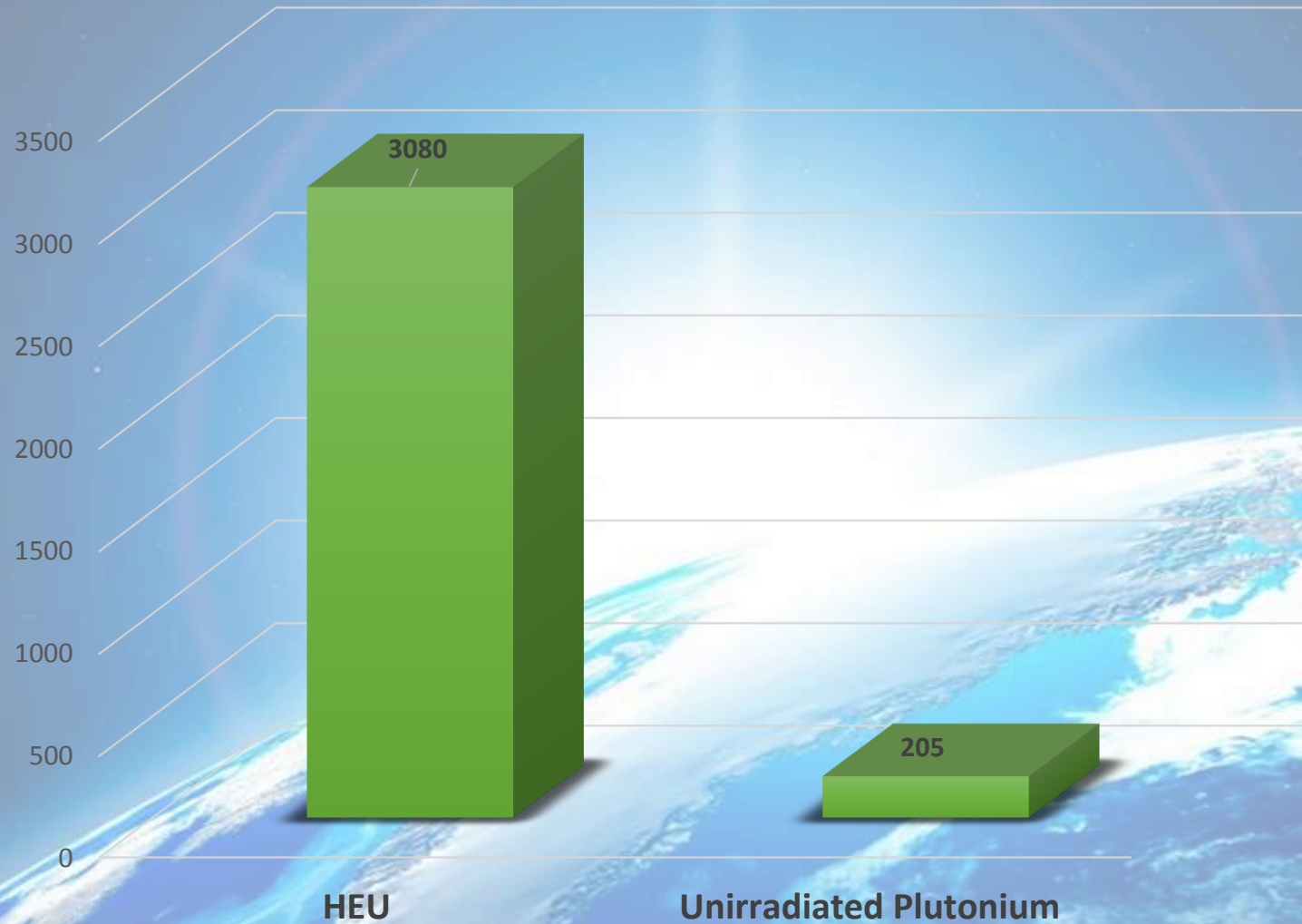
	Fuel- or reactor-grade	2,900 kg	
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India's HEU and Plutonium Stocks, end 2014

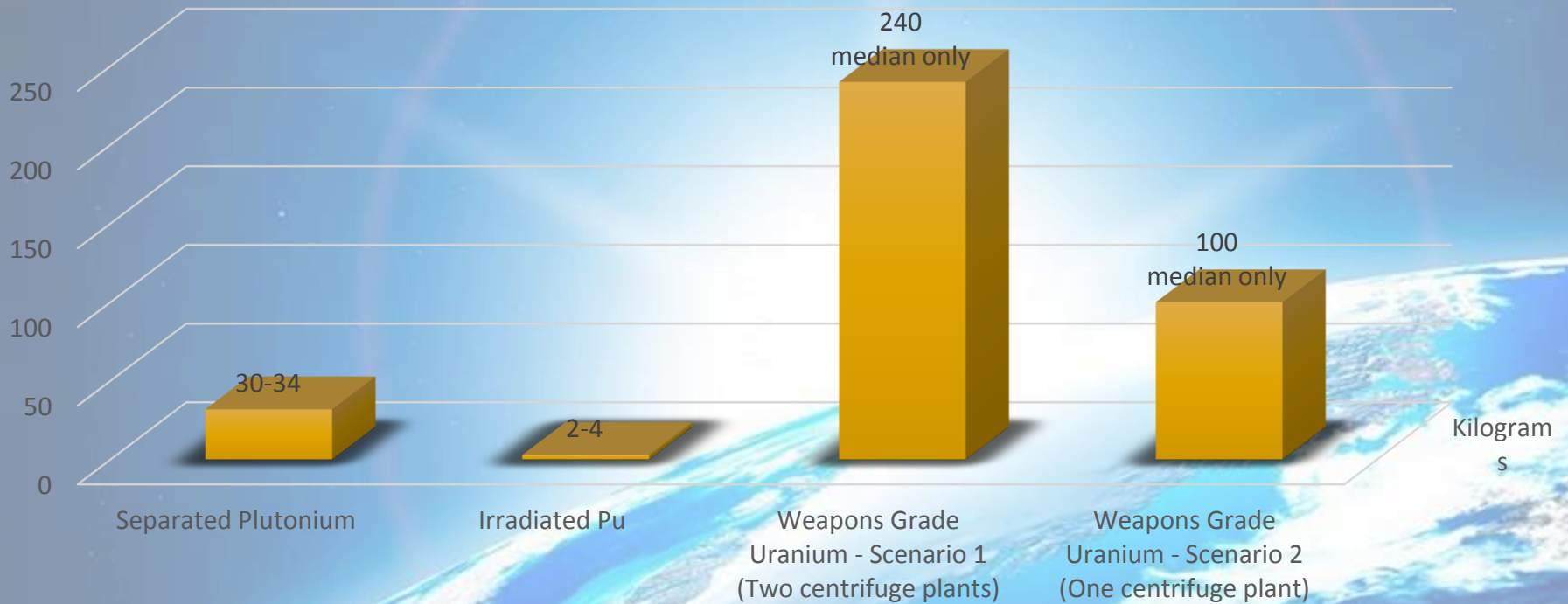


Pakistan

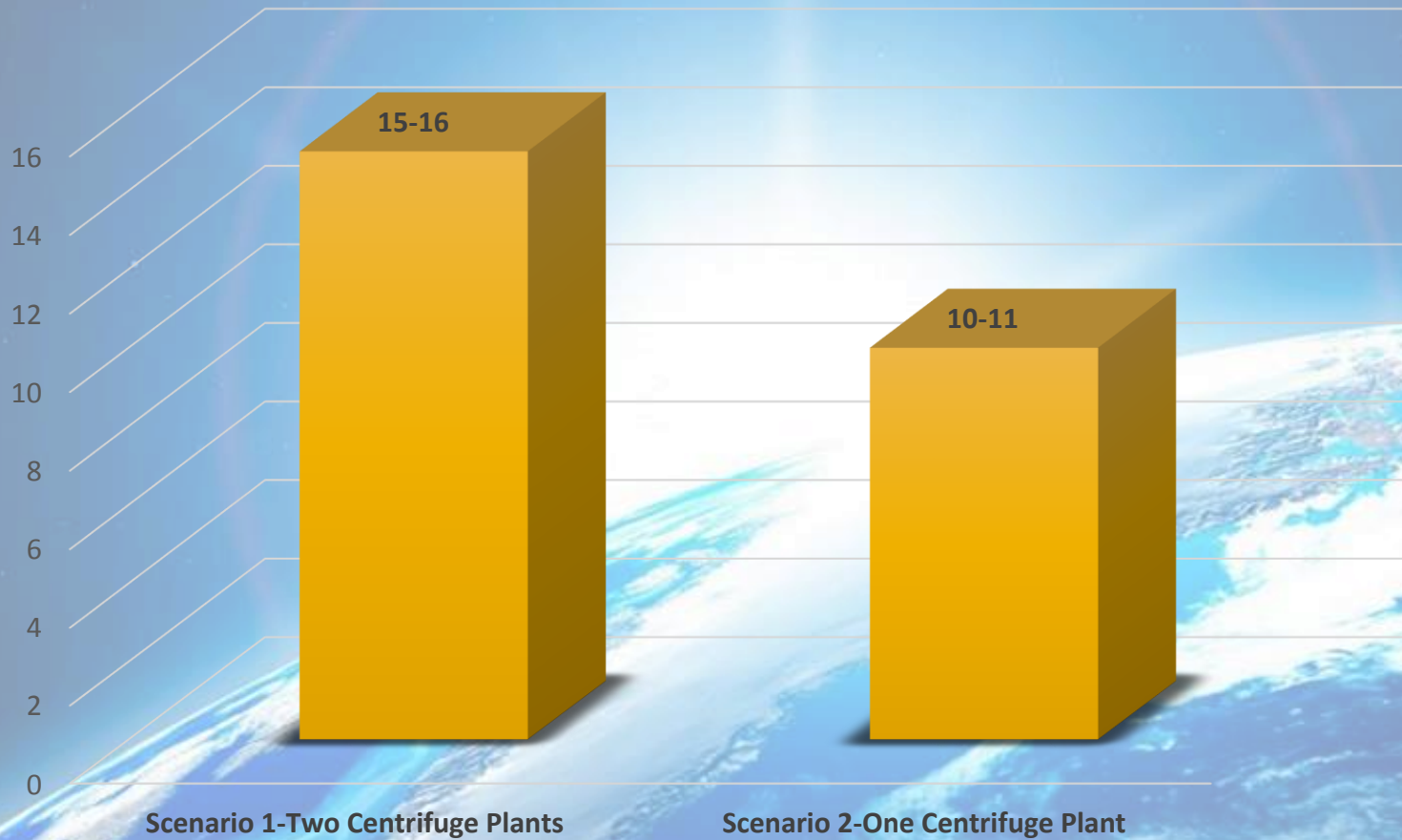
(medians only)



North Korea's Military Fissile Material Stocks End of 2014 (Kilograms)



Estimated Number of Nuclear Weapons Built through 2014 (medians only)

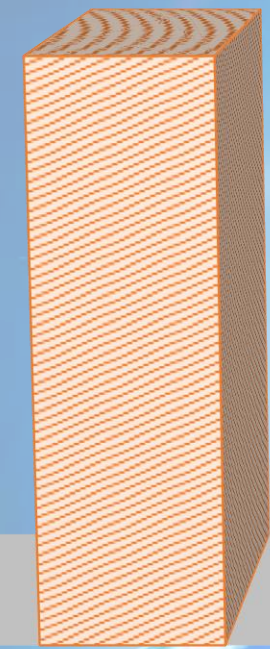


Israel

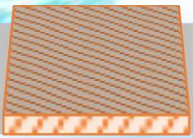
(medians only)

Kg

700
600
500
400
300
200
100
0



Military Plutonium



Civil HEU



Military HEU

Kg

Thank You

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