



SOLUTIONS_{for} SECURE NUCLEAR FUTURE

Eliminating Civilian HEU

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Highly enriched uranium (HEU) has several important civil applications. HEU is used to fuel research reactors, critical assemblies, pulsed reactors, and a few fast reactors, and is used as targets to produce medical isotopes. HEU is also used as fuel for several naval propulsion programs and in space propulsion research.

However, HEU is also a key ingredient in nuclear weapons. The fact that HEU is the material used in a simpler nuclear weapon, namely a “gun-type” weapon, makes it very attractive for terrorists or non-state actors with a nuclear weapon-development intent. These characteristics make it one of the most dangerous materials in existence. As a result, governments have taken extraordinary measures to secure HEU against theft or diversion and to reduce the inventories of HEU worldwide.

HEU is a material that is not only present in the nuclear weapon states. Starting in the 1950s, many countries bought research and test reactors to pursue peaceful nuclear activities, and many of these reactors were fueled with HEU. At the peak of HEU use, almost 60 countries used HEU fuels and tonnes of HEU were in international commerce.

So far, measures to reduce worldwide inventories of HEU have been successful. Since the late 1970s, the United States and other countries have worked to convert these reactors from HEU to low enriched uranium (LEU) fuels and discouraged the construction of new reactors that require HEU fuel. Both the United States and Russia also launched “take-back” programs to retrieve HEU they provided to these countries for use in their nuclear programs. Finally, efforts have been made to promote the use of LEU for medical isotope production. A sign of the success of these programs is that the number of countries possessing HEU has more than halved. As of 2015, only 26 countries possessed more than one kilogram (kg) this material.

However, as table 1 shows, much remains to be done. Although most worldwide HEU is designated for nuclear weapons purposes, significant amounts remain in civilian programs and non-weapons applications.

	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

Although the five acknowledged nuclear weapon states possess most of the world's civil HEU, many non-nuclear weapon states also possess significant HEU inventories. Table 2 below shows the largest stocks of HEU in non-nuclear weapon states as of the end of 2014.

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

The number of countries with HEU is expected to decrease further as Russia is set to take back more of the HEU that it provided to other countries and to reprocess and blend down the recovered HEU. The United States also will continue seeking to repatriate U.S.-origin HEU and accept additional priority stocks during the next several years. However, what more can be done to minimize, and possibly eliminate, the use of civilian HEU worldwide? What can be done better? What obstacles, technical and/or political, lie in the way of completely eliminating the civilian use of HEU? Are the technical challenges surmountable? Why are several countries reluctant to eliminate their HEU?

ANNEX I

Civil HEU (initial mass) per country, end 2014 ¹		
Country	HEU(tonnes) end of 2014, initial mass	
<i>Nuclear Weapon States (NWS)</i>		
United States	93	
Russia	15-20	
Britain	1.398	
France	4.653	
China	1	
Subtotal	115.051-120.051 tonnes (115,051-120,051 kg)	
<i>Non-Nuclear Weapon States (NNWS) that received US-origin HEU</i>		
Argentina	0.002-0.006	
Australia	0.002	
Belgium	0.555-0.605	
Canada	1.035	
Germany	1.26	
Indonesia	0.003	
Iran	0.006	
Israel	0.022	
Italy	0.115-0.130	
Japan	1.8	
Netherlands	0.55-0.65	
Norway	0.004	
Pakistan	0.016	
South Africa	0.7-0.75	
Others	0.0004-0.001	
	<i>Countries that received US-origin HEU that reached "Zero" HEU through DOE's GTRI Program</i>	Austria, Brazil, Chile, Colombia, Denmark, Greece, Mexico, Philippines, Portugal, Rep. of Korea, Romania, Slovenia, Spain, Sweden, Taiwan, Thailand, Turkey (and Iraq)
Subtotal	6.073-6.300 tonnes (6,073-6,300 kg)	
<i>Non-Nuclear Weapon States (NNWS) that received Russian-origin HEU</i>		
Belarus	0.280	
China		
DPRK	0.042	
Germany		
India	0.005	
Kazakhstan	10 (BN-350) + (0.043-0.058) (R&D)	
Poland	0.0604	
Uzbekistan	0.005 (All removed in 2015)	
	<i>Countries that received Russian-origin HEU that reached "Zero" HEU</i>	Bulgaria, Czech Republic, Georgia, Hungary, Iraq, Latvia, Libya, Romania, Serbia, Ukraine, Vietnam
Subtotal	10.435-10.450 tonnes (10,435-10,450 kg)	
<i>Countries with Chinese Supplied Research Reactors</i>		
Ghana	0.001	
Syria	0.001	
Iran	0.001	
Nigeria	0.001	
Pakistan	0.001	
Subtotal	0.005 tonnes (5 kg)	

¹ David Albright and Serena Kelleher-Vergantini, *Civil HEU Watch: Tracking Inventories of Civil Enriched Uranium. National and Global Stocks as of the end of 2014*, Institute for Science and International Security, October 7, 2015, http://isis-online.org/uploads/isis-reports/documents/Civil_Stocks_of_HEU_Worldwide_October_7_2015_Final.pdf.

