

### It's time for a Global HEU Bailout

According to President Obama, 50 tons of loosely guarded highly enriched uranium (HEU) remains in 40 countries around the world. He wants to negotiate agreements to eliminate them in four years.<sup>i</sup> A laudable goal to prevent catastrophic nuclear terrorism – how can we achieve this? Will all other countries willingly give up their HEU stocks? Will they decommission or convert their HEU-based operating reactors?

There are two types of sources of HEU worldwide:

1. Existing HEU stocks in most of the 40 countries who are friendly to the US. (> 95% of the problem).
2. HEU stocks in adversarial nations with emerging HEU production capability like Iran or North Korea, or loose nukes in Pakistan if the state collapses. (exceptional cases)

All proposals to address HEU stocks have not taken full advantage of the power of monetary incentives, and in cases of wealthy nations there are monetary dis-incentives to return HEU of US origin.<sup>ii</sup> The "Highly Enriched Uranium Purchase Agreement"<sup>iii</sup> with Russia signed in 1993 and originally proposed in 1991 may have been the most successful policy in history at keeping HEU away from terrorists. The problem of HEU stocks worldwide can be solved if purchase agreements can be reached with a significant fraction of the 40 countries in a bounded time-frame.<sup>iv</sup>

An article by Glaser & Von Hippel outlined the vision for a "global HEU cleanout" but also points out that there is bureaucratic opposition involving conversion of HEU-based research reactors to LEU.<sup>v</sup> For example, "Unfortunately, Russia's security services increasingly have been blocking collaboration between Russia's nuclear institutes and U.S. Government programs working on HEU cleanout."<sup>vi</sup>

According to a report by the Government Accountability Office, Russia receives \$12B for 500 tons = 24 million per ton = \$24,000 per kilogram over 20 years<sup>vii</sup> but there have been delays in HEU-conversion because Russia has not been satisfied by the price they were receiving for their HEU. There exists some ceiling on the price per kilogram that would at once be sufficient to cover the opportunity cost of holding onto the HEU, including any future revenue they may be derived from down-blending and selling it as LEU in the global uranium market.

Negotiating one-off agreements with each nation may be subject to fluctuations in market price, create "delays" due to inequities in price paid for each nation's HEU, and therefore may be prone to bumps, roadblocks, or stalls which then fail to meet the security objective. If a one-time, fixed-price, attractive monetary incentive was offered to all 40 nations that required that each nation also guarantee not to produce new HEU in the future, it would spur these nations into action and make it worth their time to convert HEU reactors to LEU-based. The US should assemble a coalition of allies to fund a single-price initiative, and then down-blend the HEU to LEU for power generation just like with the Russian deal.

At the price of \$50,000 per kg of HEU, the total price-tag is only \$5 billion if you exclude stocks in the US, Russia, and the UK – there are only 100 tons of HEU in the rest of the world.<sup>viii</sup> If we increased the offer price to \$250,000 per kg, it still would not change the value proposition by a whole lot since eliminating HEU = freedom from nuclear terrorism. A figure well under \$5B is what is likely needed to jump start the process and reach the tipping point for worldwide HEU elimination.<sup>ix</sup>

Compared to Plutonium, attribution of the source of HEU used in an attack is more complex and fraught with greater degree of ambiguity.<sup>x</sup> Taking steps to eliminate HEU across the forty friendly countries has the benefit of simplifying attribution/intelligence by unambiguously narrowing the source to uncooperative rogue nations in the event that HEU is used in an actual attack. In turn, this will act as an incentive for adversarial nations to eliminate their reliance on HEU.

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<sup>i</sup> <http://www.washingtonpost.com/wp-dyn/content/article/2008/07/15/AR2008071501311.html>

<sup>ii</sup> P. 143, Securing the Bomb 2008, *"Wealthy countries must pay a hefty fee to get rid of their HEU, either by sending it to the United States or by sending it to France for reprocessing—with the result that only a tiny fraction of their U.S.-origin HEU is likely to be returned to the United States."*

[http://www.nti.org/e\\_research/Securing\\_the\\_bomb08.pdf](http://www.nti.org/e_research/Securing_the_bomb08.pdf)

<sup>iii</sup> [http://www.nti.org/e\\_research/cnwm/reducing/heudeal.asp](http://www.nti.org/e_research/cnwm/reducing/heudeal.asp)

<sup>iv</sup> "The United States, Russia, United Kingdom, France, China, Germany and Japan account for more than 90 percent of the global civilian HEU inventories and demand" according to

[http://www.fissilematerials.org/ipfm/pages\\_us\\_en/projects/global\\_cleanout/global\\_cleanout.php](http://www.fissilematerials.org/ipfm/pages_us_en/projects/global_cleanout/global_cleanout.php).

The remaining countries who own HEU include a long list such as Australia, Canada, Czech Republic, Greece, Hungary, India, Italy, Kazakhstan, Latvia, Netherlands, Pakistan, Poland, Portugal, Romania, Serbia, South Africa, Switzerland, Ukraine, Uzbekistan, and Vietnam according to [http://www.isis-online.org/global\\_stocks/end2003/summary\\_global\\_stocks.pdf](http://www.isis-online.org/global_stocks/end2003/summary_global_stocks.pdf).

Total 53 countries have > 1kg of HEU and 24 countries have 1 bomb's worth -- 1900 tons total according to

<http://www.carnegieendowment.org/publications/index.cfm?fa=view&id=17788&prog=zgp&proj=znp>

<sup>v</sup> [http://www.armscontrol.org/act/2006\\_01-02/JANFEB-heuFeature.asp](http://www.armscontrol.org/act/2006_01-02/JANFEB-heuFeature.asp)

<sup>vi</sup> [http://www.fissilematerials.org/ipfm/pages\\_us\\_en/projects/global\\_cleanout/global\\_cleanout.php](http://www.fissilematerials.org/ipfm/pages_us_en/projects/global_cleanout/global_cleanout.php)

<sup>vii</sup> <http://www.gao.gov/new.items/d01148.pdf>

<sup>viii</sup> [http://www.isis-online.org/global\\_stocks/end2003/summary\\_global\\_stocks.pdf](http://www.isis-online.org/global_stocks/end2003/summary_global_stocks.pdf)

<sup>ix</sup> We would achieve three goals as soon as a few countries began to accept our offer. First, the first countries who accepted would influence governments/bureaucracies in other countries to rethink their own rigid policy on HEU ownership. By offering a single-price for HEU as a uniform policy rather than striking one-off agreements with each nation, we can remove any hesitation on part of one nation that another nation may be striking a better deal with the US. Second, in the unfortunate event that HEU was stolen and used by terrorists in the future, we would be able to narrow down the attribution of HEU from 53 nations to however many countries have not yet accepted our offer – which itself is an incentive for countries to take the deal. If 90% of the countries end up accepting it, that brings the hold-out list down to 4-5 countries -- only the most uncooperative and rigid regimes. Finally, the more countries that accept our offer, the greater the pressure on hold-out countries to eliminate their own HEU stocks to avoid being implicated in the future – a positive feedback loop that can cause a tipping point.

<sup>x</sup> Nuclear Forensics: Role, State of the Art, and Program Needs, AAAS, *"The situation is even more complex in the case of highly enriched uranium due to a greater degree of flexibility in the HEU production process. Here, it may even be difficult to identify the particular enrichment process that was used in the production of a given HEU sample with purely theoretical approaches. Still, some important observations are possible without additional knowledge about the origin of a sample. Beyond its age, it is straightforward to determine whether or not an HEU sample was produced from reprocessed uranium, which would point to a parallel plutonium production program and narrow down the potential origin significantly. At the same time, however, new uncertainties are introduced because additional factors related to the history of the uranium have to be considered for a complete assessment."*

<http://cstsp.aas.org/files/Complete.pdf>