# Civilian HEU: Who Has What?

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The following information was compiled by researchers at the James Martin Center for Nonproliferation Studies (CNS) for the Nuclear Threat Initiative (NTI) as part of a project on Minimization of Highly Enriched Uranium (HEU) in Civilian Use.

***For more information, visit NTI's Civilian HEU Reduction & Elimination Database***

| Quantity of Civilian HEU (In Kilograms) | COUNTRIES | |
|---|---|---|
| More than 10,000 kg | ***United States***: 86,000 kg, 💦[1]<br>***Russia***: 49,000 kg (high uncertainty), of which 29,000 kg have been declared in excess; in addition, some of the available 20,000 kg fresh dual-use naval HEU and 10,000 kg irradiated dual-use naval HEU are for use in nuclear-powered ships 💦[2]<br>***Kazakhstan***: 10,427-10,777 kg, most of which is irradiated[3] | |
| 1,000-10,000 kg | ***France***: 4,806 kg, of which 1,593 kg are irradiated 💦[4]<br>***United Kingdom***: 742 kg, of which 137 are irradiated 💦[5]<br>***Canada***: 1,038 kg[6] | ***Japan***: 1,750 kg[7]<br>***China***: 1,000 kg 💦[8] (high uncertainty)<br>***Germany***: 1,270 kg, of which approximately 940 kg are irradiated[9] |
| 100-1,000 kg | ***Netherlands***: 550-650 kg[10]<br>***Belgium***: 700-727 kg[11]<br>***South Africa***: 700-750 kg[12] (high uncertainty) | ***Italy***: 100-119 kg, all of which is irradiated fuel[13]<br>***Belarus***: 80-280 kg, with perhaps as much as 40 kg enriched at 90% or higher[14] |
| 10-100 kg | ***North Korea***: 42 kg (high uncertainty) 💦[15]<br>***Israel***: 22 kg 💦[16] | ***Pakistan***: 17 kg 💦[17] (high uncertainty) |
| 1-10 kg | ***Iran:*** 6 kg, all irradiated[18]<br>***India:*** 4.5 kg 💦[19] (high uncertainty) | ***Norway***: 1-9 kg[20]<br>***Australia***: 2 kg[21] |
| Less than 1 kg | ***Syria***: 1 kg[22] | |
| Cleared of HEU | Argentina,[23] Austria,[24] Brazil, Bulgaria, Chile, Colombia, Czech Republic,[25] Denmark, Georgia, Ghana,[26] Greece, Hungary,[27] Indonesia,[28] Iraq, Jamaica,[29] Latvia, Libya, Mexico,[30] Nigeria,[31] Philippines, Poland,[32] Portugal, Romania, Serbia,[33] Slovenia, South Korea, Spain, Sweden, Switzerland,[34] Taiwan, Thailand, Turkey, Ukraine,[35] Uzbekistan,[36] Vietnam[37] | |

💦 - Indicates presence of additional military-use HEU stocks, not included in present estimates.

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## Sources

[1] The United States does not regularly release information on fissile material stockpile size. The United States publicly released HEU stockpile figures (as of 2013) in conjunction with the 2016 Nuclear Security Summit, but no more recent comprehensive figures have been released. The amount of civil HEU in the United States is highly variable, as the United States exports HEU to designated licensees for the operation of HEU reactors, downblends HEU, and is a destination for repatriated HEU. See: Office of the Press Secretary, "Fact Sheet: Transparency in the U.S. Highly Enriched Uranium Inventory," 31 March 2016, *http://obamawhitehouse.archives.gov*.

[2] International Panel on Fissile Material, "Global Fissile Material Report 2013: Increasing Transparency of Nuclear Warhead and Fissile Material Stocks as a Step toward Disarmament," 22 October 2013, p. 11, *http://fissilematerials.org/library/gfmr13.pdf*. Russia, unlike the United States, does not count military materials declared excess as civilian material. See: William C. Potter, "Nuclear Terrorism and the Global Politics of Civilian HEU Elimination," *The Global Politics of Combating Nuclear Terrorism: A Supply-Side Approach,* William C. Potter, Cristina Hansell, eds., (Abingdon: Routledge, 2010), p. 17, fn. 17. Russia is the only country with civilian nuclear-powered vessels. Current list of active nuclear-powered civilian ships extracted from Fleetmon, *http://www.fleetmon.com*, September 2018.

[3] At the 2014 Nuclear Security Summit in The Hague, Kazakhstan and the United States released a fact sheet noting that the two countries moved 10,000 kg HEU "from the Kazakhstan BN-350 facility in Aktau to a secure facility in the northeastern part of the country." See, Office of the Press Secretary, "FACT SHEET: U.S. – Kazakhstan Cooperative Activities in Nuclear Security," The White House, 25 March 2014, *http://www.whitehouse.gov/the-press-office/2014/03/25/fact-sheet-uskazakhstan-cooperative-activities-nuclear-security*. The VVR-K Reactor completed conversion to LEU fuel in 2017; see "NNSA partners with Kazakhstan Research Institute to Remove All of Its Highly Enriched Uranium," National Nuclear Security Administration, 29 September 2017, *https://nnsa.energy.gov/mediaroom/pressreleases/nnsa-partners-kazakhstan-researchinstitute-remove-all-its-highlyenriched*.

[4] Declaration made 29 September 2017, data as of 31 December 2016, reported in: International Atomic Energy Agency, "Communication Received from France Concerning Its Policies Regarding the Management of Plutonium: Statements on the Management of Plutonium and of High Enriched Uranium," INFCIRC/549/Add.5/21, 29 September 2017, *https://www.iaea.org/sites/default/files/infcirc549a5-19.pdf*.

[5] Data as of 31 December 2018, as reported by the Office for Nuclear Regulation, *http://www.onr.org.uk/safeguards/civilplut18.htm*.

[6] Michelle Cann, Kelsey Davenport, Sarah William, "The Nuclear Security Summit: Progress Report," July 2013, p. 20, *http://www.armscontrol.org/files/Nuclear_Security_Summit_Report_2013.pdf*. At the 2013 NSS, Canada pledged to repatriate U.S.-origin HEU by 2018. It is unclear if this has taken place. Canada decommissioned the National Research Universal (NRU) reactor in 2018, and is decommissioning its only HEU-fueled research reactor. The U.S. Nuclear Regulatory Commission approved a Canadian licensing application for the transfer of 3 kg of HEU to Chalk River Laboratories; see NRC License No. XSNM3777, 31 March 2018, *https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML17110A108*.

[7] In 2016, all un-irradiated HEU enriched to 93% was repatriated to the United States. "Japanese research reactor materials arrive in USA," *World Nuclear News,* 7 June 2016, *http://www.world-nuclear-news.org/WR-Japanese-research-reactor-*

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materials-arrive-in-USA-0706167.html. All remaining HEU in Japan is enriched to 20% U-235, located at the Jōyō fast reactor. Source: correspondence with National Nuclear Security Administration (NNSA) official, October 2018.

[8] China's naval reactors are LEU-powered. See dissenting opinions on the value in: Shing-Yao (Sandra) Feng, "China: Reactors and Nuclear Propulsion," *Nuclear Terrorism and Global Security: The Challenge of Phasing Out Highly Enriched Uranium,* ed. Alan J. Kuperman (Abingdon: Routledge, 2013), 102. This figure matches a 2003 estimate cited in an IPFM 2010 report. See: International Panel on Fissile Materials, "Global Fissile Material Report 2010, Balancing the Books: Production and Stocks," 17 December 2010, p. 100, http://fissilematerials.org/library/gfmr10.pdf.

[9] Declaration made 6 September 2018, data as of 31 December 2017, as reported in: International Atomic Energy Agency, "Communication Received from Germany Concerning Its Policies Regarding the Management of Plutonium: Statements on the Management of Plutonium and of High Enriched Uranium," INFCIRC/549/Add.2/21, 6 September 2018, https://www.iaea.org/sites/default/files/publications/documents/infcircs/1998/infcirc549a2-21.pdf.

[10] David Albright and Serena Kelleher-Vergantini, "Civil HEU Watch: Tracking Inventories of Civil Highly Enriched Uranium, National and Global Stocks as of End of 2014," 7 October 2015. In January 2018, Netherlands stopped use of HEU for medical isotope production.

[11] Michelle Cann, Kelsey Davenport, Sarah William, "The Nuclear Security Summit: Progress Report," July 2013, p. 18, http://www.armscontrol.org/files/Nuclear_Security_Summit_Report_2013.pdf. At the 2014 Nuclear Security Summit, the United States and Belgium announced the successful removal of "all excess fresh HEU and plutonium" from Belgium. See, National Nuclear Security Administration "Belgium Highly Enriched Uranium and Plutonium Removals," *NNSA Press Release,* 24 March 2014, https://nnsa.energy.gov/mediaroom/factsheets/belgiumremovals. In March 2017, the Nuclear Regulatory Commission issued an export license for the shipment of 144 kg of 93% enriched HEU for the BR-2 reactor in Belgium; see David Kramer, "US approves large export of bomb-grade uranium," *Physics Today,* 3 March 2017, www.physicstoday.scitation.org.

[12] South Africa does not disclose information regarding its reserve HEU amount. An approximate 600 kg figure is given in: Michelle Cann, Kelsey Davenport, Sarah William, "The Nuclear Security Summit: Progress Report," July 2013, p. 42, http://www.armscontrol.org/files/Nuclear_Security_Summit_Report_2013.pdf. But this appears to be rather high given that the stockpile for 2003 was estimated at 610-760 kg: David Albright and Kimberly Kramer, "ISIS Civil HEU Watch: Tracking Inventories of Civil Highly Enriched Uranium," August 2005, p. 5, http://isis-online.org/uploads/isis-reports/documents/civil_heu_watch2005.pdf. NNSA announced the repatriation of 6.3 kg of U.S.-origin spent HEU fuel from South Africa in August 2011. National Nuclear Security Administration, "NNSA announces return of U.S.-origin highly enriched uranium spent fuel from South Africa," 17 August 2011, http://nnsa.energy.gov/mediaroom/pressreleases/saheu81711. David Albright and Serena Kelleher-Vergantini. "Civil HEU Watch: Tracking Inventories of Civil Highly Enriched Uranium, National and Global Stocks as of End of 2014," 7 October 2015. The South African Nuclear Energy Corporation's NTP Radioisotopes SOC Ltd. completed conversion of their critical medical isotope Mo-99 production process from HEU to LEU, see "NNSA collaborates with South African firm on groundbreaking conversion to low enriched uranium-based molybdenum-99 production," National Nuclear Security Administration, 22 September 2017, www.nnsa.energy.gov.

[13] Michelle Cann, Kelsey Davenport, Sarah William, "The Nuclear Security Summit: Progress Report," July 2013, p. 30, http://www.armscontrol.org/files/Nuclear_Security_Summit_Report_2013.pdf. According to 2005 data from Albright et al., Italy holds 100 kg irradiated U.S.-origin HEU that are not eligible for return to the United States and cannot be recovered by Italy. See: David Albright and Kimberly Kramer, "ISIS Civil HEU Watch: Tracking Inventories of Civil Highly Enriched Uranium," August 2005, p. 12, http://isis-online.org/uploads/isis-reports/documents/civil_heu_watch2005.pdf. NNSA declared in

October 2008 that all eligible U.S.-origin HEU had been removed. See: National Nuclear Security Administration, "NNSA Completes Successful Year of U.S.-origin Nuclear Fuel Returns," *NNSA Press Release,* 7 October 2008, *http://nnsa.energy.gov/mediaroom/pressreleases/nnsa-completes-successful-year-u.s.-origin-nuclear-fuel-returns*. At the 2012 Nuclear Security Summit, Italy committed to working with the United States to eliminate or remove its remaining "gap" HEU. See: U.S. White House, "Italy Fact Sheet: 2012 Nuclear Security Summit," 26 March 2012, *http://www.whitehouse.gov/the-press-office/2012/03/26/italy-fact-sheet-nuclear-security-summit-2012*. At the 2014 Nuclear Security Summit, the United States and Italy announced "the successful removal of all eligible fresh HEU from Italy." See, "Italy Highly Enriched Uranium and Plutonium Removals," *NNSA Press Release,* 24 March 2014, *https://nnsa.energy.gov/mediaroom/factsheets/italyremovals*. A blog post from the International Panel on Fissile Materials puts this fresh HEU figure at 19 kg. See, Pavel Podvig, "HEU and plutonium removed from Italy," *IPFM Blog,* 24 March 2014, *http://fissilematerials.org/blog/2014/03/heu_and_plutonium_removed.html*.

[14] Belarus had approximately 250-370 kg of HEU in 2003, although only 22-135 kg of >20% HEU, according to: David Albright and Kimberly Kramer, "ISIS Civil HEU Watch: Tracking Inventories of Civil Highly Enriched Uranium," August 2005, p. 6, note ii on p. 12, *http://isis-online.org/uploads/isis-reports/documents/civil_heu_watch2005.pdf*. Belarus then returned 88.7 kg of HEU to Russia. See: S. Tozser, P. Adelfang and E. Bradley, "Ten Years of IAEA Cooperation with the Russian Research Reactor Fuel Return Programme," *ATW International Journal for Nuclear Power,* vol. 58 (January 2013): p. 26, *http://www.atomkraft.org/kernenergie-wAssets/docs/fachzeitschrift-atw/2013/atw2013_01_tozseriaea-fuel-return.pdf*. This would place Belarus at less than 161.3-281.3 kg. A 2008 estimate notes that Belarus still had "at least" 170 kg: William C. Potter, Robert Nurick, "The Hard Cases: Eliminating Civilian HEU in Ukraine and Belarus," *The Nonproliferation Review,* Vol. 15, No. 2 (July 2008): 252-253, *https://www.nonproliferation.org/wpcontent/uploads/npr/npr_15-2_potter_nurick.pdf*. Using this new lower bound gives a post-removal estimate of 81.3-281.3 kg, which rounds to 80-280 kg. Belarus had agreed to return all of its remaining HEU at Sosny to Russia before the 2012 Nuclear Security Summit. In August 2011, however, Minsk declared that it would suspend cooperation with HEU minimization efforts due to an imposition of sanctions by Washington. See: Michael Schwirtz, "Belarus Suspends Pact to Give Up Enriched Uranium," *The New York Times,* 19 August 2011, *http://www.nytimes.com/2011/08/20/world/europe/20belarus.html?_r=0*.

[15] This is an estimate by Kramer and Albright from 2015. The material in question is Russian-origin HEU provided for the IRT reactor at Yongbyon. Siegfried Hecker and Chaim Braun, "North Korea's Stockpiles of Fissile Material," *Korea Observer,* Vol. 47, Iss.4, (Winter 2016): 721-749; Note that North Korea may have increased its HEU stocks considerably; Hecker, et al estimated North Korea's HEU inventory at between 200 and 450 kg in 2016. Continued enrichment activity, as well as the 2018 revelation of a possible second enrichment facility at Kangson, suggest the need to revise estimates upward. However, it is unlikely that North Korean HEU production would be for civilian purposes. See Ankit Panda, "Exclusive: Revealing Kangson, North Korea's First Covert Uranium Enrichment Site," *The Diplomat,* 13 July 2018, *https://thediplomat.com/2018/07/exclusive-revealing-kangson-north-koreas-first-covert-uranium-enrichment-site/*.

[16] Note that the estimate for Israel's total HEU stockpile carries great uncertainty. This estimate is from: David Albright and Serena Kelleher-Vergatini, "ISIS Civil HEU Watch: Tracking Inventories of Civil Highly Enriched Uranium," 7 October 2015, *http://isis-online.org/uploads/isis-reports/documents/Civil_Stocks_of_HEU_Worldwide_October_7_2015_Final.pdf*. In January 2010, Israel reportedly returned some 5.4 kg of HEU spent fuel, presumably from the IRR-1, to the United States. "Final HEU Return from Turkey," *World Nuclear News,* 14 January 2010, *http://www.world-nuclear-news.org/RSFinal_HEU_return_from_Turkey-1401108.html*. Israel intends to replace the HEU-fueled IRR-1 research reactor with the Soreq Applied Research Accelerator Facility (SARAF), expected completion 2023. State of Israel Atomic Energy Commission, *http://soreq.gov.il/mmg/eng/Pages/SARAF-Facility.aspx*.

[17] Note that the estimate for Pakistan's total HEU stockpile carries great uncertainty. Pakistan's PARR-2 research reactor operates with HEU. The country does not utilize HEU for naval propulsion. IPFM estimated in 2010 Pakistan's total HEU stocks at 1,500-3,600 kg total, all of which are enriched to 90%. See: "Global Fissile Material Report 2010, Balancing the Books: Production and Stocks," *International Panel on Fissile Materials,* 17 December 2010, pp. 126-130, *http://fissilematerials.org/library/gfmr10.pdf*. IPFM estimated in 2014 Pakistan's total HEU stocks at 2,700 – 3,500kg.

[18] See: ISIS, "Nuclear Sites- Facilities, Tehran Research Reactor (TRR)," ISIS Nuclear Iran, *http://www.isisnucleariran.org/sites/facilities/tehran-research-reactor-trr/*. Iran had produced an estimated 447.8kg of 19.75% enriched uranium before suspending production pursuant to the Joint Plan of Action (JPOA) agreed to in November 2013 between Iran and the P5+1. All of this material has since been either downblended to a lower enrichment level or converted to uranium oxide. See, International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolution in the Islamic Republic of Iran," GOV/2014/43, 5 September 2014, p. 5. All irradiated fuel elements at the TRR at a dose of no less than 1 rem/hr. See: IAEA, "Verification and Monitoring in the Islamic Republic of Iran in Light of United Nations Security Council Resolution 2231 (2015), 30 August 2018, *https://www.iaea.org/sites/default/files/18/09/gov2018-33.pdf*. On July 7th, 2019 Iran announced it had begun enriching uranium above the 3.67% cap imposed by the JCPOA and might go as high as 20% in the future. See: "Iran's Uranium Enrichment Breaks Nuclear Deal Limit. Here's What That Means," *NPR,* July 7, 2019, *https://www.npr.org/2019/07/07/738902822/irans-uranium-enrichment-breaks-nuclear-deal-limit-here-s-what-that-means*.

[19] Note that the estimate for India's total HEU stockpile carries great uncertainty, particularly because most of it is intended for military submarine propulsion use. The 4.5 kg value is a very conservative estimate based on what was in India's remaining HEU core which was in its last HEU-using reactor in 2010; the core will remain on Indian soil. See: "Global Fissile Material Report 2010, Balancing the Books: Production and Stocks," International Panel on Fissile Materials, 17 December 2010, pp. 122-125, 198, *http://fissilematerials.org/library/gfmr10.pdf*. India is planning to build a civilian enrichment plant at Chitradurga, on which work began in 2011. See: Albright, David and Kelleher-Vergantini, Serena, "India's New Uranium Enrichment Plant in Karnataka," *ISIS,* July 1, 2014, available at *http://isis-online.org/isis-reports/detail/indias-new-uranium-enrichment-plant-in-karnataka1* and *http://fissilematerials.org/countries/india.html*.

[20] The size of the stock is unclear. Norway is believed to have imported a total of 9 kg of HEU in the 1990s, and the bulk of it is believed to have been blended down. See: "Global Fissile Material Report 2010, Balancing the Books: Production and Stocks," International Panel on Fissile Materials, 17 December 2010, p. 204, fn. 772, *http://fissilematerials.org/library/gfmr10.pdf*.

[21] Australia maintains its small HEU stockpile for "training, research, and nuclear detection purposes." Third International Symposium on HEU Minimisation, "Australian Statement on National Priorities," 5-7 June 2018, *http://heusymposium2018.org/pop.cfm?FuseAction=Doc&pAction=View&pDocumentId=75166*.

[22] See note 25 for reactor details. International Atomic Energy Agency, "IAEA Support of Research Reactor HEU to LEU Fuel Conversion," *IAEA.org,* 28 January 2013, *http://www.iaea.org/OurWork/ST/NE/NEFW/Technical_Areas/RRS/conversionmnsr.html*. "Global Fissile Material Report 2010, Balancing the Books: Production and Stocks," *International Panel on Fissile Materials,* 17 December 2010, p. 141, *http://fissilematerials.org/library/gfmr10.pdf*. The Syrian government has requested IAEA assistance for conversion and HEU core removal of the Chinese-designed MNSR research reactor, "Supporting Nuclear Non-Proliferation: Ghana Converts Reactor from HEU to LEU Fuel," International Atomic Energy Agency, 29 August 2017, *https://www.iaea.org/newscenter/news/supporting-nuclear-non-proliferation-ghana-converts-research-reactor-from-heuto-leu-fuel*.

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[23] At the 2016 Nuclear Security Summit Argentina announced the completion of down-blending the remainder of its HEU, resulting it now being HEU free. "National Progress Report: Argentina." Nuclear Security Summit, Washington 2016. 31 March 2016, *http://www.nss2016.org/document-center-docs/2016/3/31/national-progress-report-argentina*. As result the entire Latin America and Caribbean region is now considered HEU-free. "Fact Sheet: Eliminating All Highly Enriched Uranium from Argentina." The White Civilian HEU: Who Has What? Related content is available on the website for the Nuclear Threat Initiative, www.nti.org. This material is produced independently for NTI by the James Martin Center for Nonproliferation Studies at the Middlebury Institute of International Studies and does not necessarily reflect the opinions of and has not been independently verified by NTI or its directors, officers, employees, or agents. Copyright ©2018 by MIIS. House, Office of the Press Secretary, 1 April 2016, *https://www.whitehouse.gov/the-press-office/2016/04/01/fact-sheet-eliminatingall-highly-enriched-uranium-argentina*.

[24] The complete removal of all HEU nuclear reactor fuel from Austria was announced by the NNSA and the Government of Austria in December 2012. The material was sent back to the United States. See: National Nuclear Security Administration, "NNSA Completes Removal of All HEU from Austria," NNSA Press Release, 11 December 2012, *http://nnsa.energy.gov/mediaroom/pressreleases/austriaheu121112*.

[25] The NNSA announced on 5 April 2013 that the Czech Republic had moved 68 kilograms of HEU to Russia and was now HEU-free. The material is to be downgraded to LEU. See: National Nuclear Security Administration, "US Removes Last Remaining HEU from Czech Republic, Sets Nonproliferation Milestone," NNSA Press Release, 5 April 2013, *http://nnsa.energy.gov/mediaroom/pressreleases/czechheuremoval040513*.

[26] The NNSA, in cooperation with Ghana, China, and the IAEA, repatriated approximately 1kg of Chinese-origin HEU on 28 August 2017, "NNSA Removes All Highly Enriched Uranium from Ghana," National Nuclear Security Administration, 29 August 2017, *https://nnsa.energy.gov/mediaroom/pressreleases/nnsa-removes-all-highly-enriched-uranium-ghana*.

[27] International Atomic Energy Agency, "Hungary Completes High Enriched Uranium Research Reactor Fuel Removal," IAEA.org, 5 November 2013, *http://www.iaea.org/newscenter/news/2013/hungaryheu.html*.

[28] On 29 August 2016, the NNSA, in cooperation with Indonesian Nuclear Industry, LLC (PT INUKI) and the Indonesian nuclear regulatory authorities (BAPETEN and BATAN) announced that, through collaborative efforts, all of Indonesia's HEU is has been downblended to LEU. "NNSA Announces Elimination of Highly Enriched Uranium (HEU) from Indonesia," NNSA press release, 29 August 2016, *https://nnsa.energy.gov/mediaroom/pressreleases/nnsa-announces-eliminationhighlyenriched-uranium-heu-indonesia*.

[29] On 22 September 2015 the NNSA announced that it had successfully completed the removal of the last remaining HEU from Jamaica's "Safe Low-Power Kritical Experiment (SLOWPOKE) research reactor. The HEU has been returned to its country of origin, the Unites States, "NNSA Removes US-Origin HEU from Jamaica, Makes the Caribbean HEU Free, NNSA press release, 22 September 2015, *http://nnsa.energy.gov/mediaroom/pressreleases/nnsa-removes-u.s.-origin-heu-jamaicamakes-caribbean-heu-free*.

[30] The United States, Canada, and Mexico announced the removal of HEU from Mexico at the 2012 Nuclear Security Summit. See: Bureau of International Security and Nonproliferation, "Mexico HEU Removal," U.S. Department of State, NNSA Press Release, 22 March 2012, *http://www.state.gov/t/isn/rls/fs/186810.htm*.

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[31] The U.S. NNSA and the Nigerian Nuclear Regulatory Authority (NNRA) announced the repatriation of all HEU from Nigeria at the RERTR conference, November 2018. Source: Correspondence with conference attendee, 2018.

[32] On 26 September 2016, the NNSA, in cooperation with Poland, Russia, and the IAEA, announced that all of Poland's 61 kilograms of HEU had been repatriated to Russia, NNSA press release, 26 September 2016, *http://energy.gov/articles/secretary-moniz-announces-removal-all-highly-enriched-uranium-poland*.

[33] The NNSA announced on 22 December 2010 that Serbia did not possess any more HEU. See: National Nuclear Security Administration, "NNSA Announces Removal of All Highly Enriched Uranium (HEU) from Serbia," NNSA Press Release, 22 December 2010, *http://nnsa.energy.gov/mediaroom/pressreleases/serbiaheu122210*.

[34] Michelle Cann, Kelsey Davenport, Sarah William, "The Nuclear Security Summit: Progress Report," July 2013, p. 43, *http://www.armscontrol.org/files/Nuclear_Security_Summit_Report_2013.pdf*. As of 2012, Switzerland operates one reactor which uses HEU, AGN 211 P. It is a steady state reactor. See: Styrkaar Hustveit, "From HEU Minimization to HEU Elimination: The Case of Research and Test Reactors," paper presented at the 34th International Meeting on Reduced Enrichment for Research and Test Reactors, 14-17 October 2012, Warsaw, Poland, pp. 3, 7, *http://www.rertr.anl.gov/RERTR34/pdfs/S2-P1_Hustveit.pdf*. The NNSA announced in September 2015 that upon the removal of the final 2.2kg of HEU to the United States, that Switzerland has successfully removed all of its HEU, "Last HEU Removed from Switzerland under NNSA Collaboration," NNSA press release, 16 September 2015, *http://nnsa.energy.gov/mediaroom/pressreleases/last-heuremoved-switzerland-under-nnsa-collaboration*.

[35] The NNSA announced in September 2015 that upon the removal of the final 2.2kg of HEU to the United States, that Switzerland has successfully removed all of its HEU, "Last HEU Removed from Switzerland under NNSA Collaboration," NNSA press release, 16 September 2015, *http://nnsa.energy.gov/mediaroom/pressreleases/last-heuremoved-switzerland-undernnsa-collaboration*.

[36] Sandor Tozser, "Uzbekistan Becomes HEU-Free Following Shipment of Fuel to Russia," IAEA Department of Nuclear Energy, 28 September 2015, *https://www.iaea.org/newscenter/news/uzbekistan-becomes-heu%E2%80%93free-followingshipment-fuel-russia*.

[37] The NNSA announced on 2 July 2013 that Vietnam was now HEU-free. See: National Nuclear Security Administration, "US, International Partners Remove Last Remaining HEU from Vietnam, Set Nuclear Security Milestone," NNSA Press Release, 2 July 2013, *http://nnsa.energy.gov/mediaroom/pressreleases/heuvietnam7213*.