Appendix 8A. Global stocks and production of fissile materials, 2024

FRIEDERIKE FRIESS, MORITZ KÜTT, ZIA MIAN AND PAVEL PODVIG
INTERNATIONAL PANEL ON FISSILE MATERIALS

Materials that can sustain an explosive fission chain reaction are essential for all types of nuclear explosives, from first-generation fission weapons to advanced thermonuclear weapons. The most common of these fissile materials are highly enriched uranium (HEU) and plutonium. This section gives details of military and civilian stocks, as of the beginning of 2024, of HEU (table 8A.1) and separated plutonium (table 8A.2)—including in weapons—and details of the capacity to produce these materials (tables 8A.3 and 8A.4). The information in the tables is based on estimates prepared for the International Panel on Fissile Materials (IPFM). The most recent annual declarations on civilian plutonium and HEU stocks to the International Atomic Energy Agency (IAEA) give data for 31 December 2023 (INFCIRC/549). China stopped reporting under this scheme in 2016. The United Kingdom and the United States had not submitted their 2023 declarations as of March 2025.

The production of both HEU and plutonium starts with natural uranium. Natural uranium consists almost entirely of the non-chain-reacting isotope uranium-238 (U-238) and is only about 0.7 per cent uranium-235 (U-235). The concentration of U-235 can be increased through enrichment—typically using gas centrifuges. Uranium that has been enriched to less than 20 per cent U-235 is known as low-enriched uranium (LEU). Most current power reactors use LEU with enrichment of up to 5 per cent in their fuel. High-assay low-enriched uranium (HALEU), defined as having an enrichment range of 5–20 per cent U-235, has been proposed as fuel in some small modular reactor concepts and there is interest in HALEU production. In theory, HALEU enriched to more than 10 per cent U-235 could be used to make a practical weapon. The IAEA historically has taken the position, however, that uranium should contain at least 20 per cent U-235 to be considered a material that can be directly used in weapons. This approach is also adopted by most international and national regulations governing the physical protection of nuclear materials. To minimize the mass of the nuclear explosive, weapon-grade uranium is usually enriched to over 90 per cent U-235.

Plutonium is produced in nuclear reactors when U-238 in the fuel is exposed to neutrons. The plutonium is subsequently chemically separated from spent fuel in a reprocessing operation. Plutonium comes in a variety of isotopic mixtures, most of which are weapon-usable. Weapon designers prefer to work with a mixture that predominantly consists of plutonium-239 (Pu-239) because of its relatively low rate of spontaneous emission of neutrons and gamma rays and the low level of heat generation from alpha decay. Weapon-grade plutonium usually contains more than 90 per cent Pu-239. The plutonium in typical spent fuel from power reactors (reactor-grade plutonium) contains 50–60 per cent Pu-239 but is weapon-usable, even in a first-generation weapon design.

All states that have a civil nuclear industry (i.e. that operate a nuclear reactor or a uranium-enrichment plant) have some capability to produce fissile materials that could be used for weapons. The categories for fissile materials in tables 8A.1 and 8A.2 reflect the availability of these materials for weapon purposes. Material described as 'Not directly available for weapons' and 'Unsafeguarded' is either material produced outside weapon programmes or weapon-related material that states have pledged not to use in weapons. This material is not placed under international safeguards (e.g. IAEA or Euratom) or under bilateral monitoring. The category 'Safeguarded/monitored' includes material that is subject to such controls. The data presented in tables 8A.1 and 8A.2 accounts only for unirradiated fissile material, a category that corresponds to the IAEA definition of 'unirradiated direct use material'.

Table 8A.1. Global stocks of highly enriched uranium, 2024

All figures are tonnes and are for unirradiated highly enriched uranium (HEU) as of the beginning of 2024. Most of this material is 90–93% enriched uranium-235 (U-235), which is typically considered weapon-grade. Important exceptions are noted. Final totals are rounded to the nearest 5 tonnes.

			Not directly available for weapons		
State	Total stock	In or available for weapons	Unsafeguarded	Safeguarded/ monitored	Production status
China	14	14 ± 3	–[a]	–	Stopped 1987–89
France[b]	29	25 ± 6	–	3.8	Stopped 1996
India[c]	5.7	–	5.7 ± 2.3	–	Continuing
Iran[d]	0.1	–	–	0.12	Continuing
Israel[e]	0.3	0.3	–	–	Unknown
Korea, North[f]	Uncertain	Uncertain	–	–	Uncertain
Pakistan[g]	5.3	5.3 ± 1.5	–	–	Continuing
Russia[h]	680	672 ± 120	6[i]	–	Continuing[j]
UK[k]	23	22	0.5[l]	–	Stopped 1962
USA[m]	481	361	120	–	Stopped 1992
Other states[n]	>3.9	–	–	>3.9	
Total	**1 240**	**1 100**	**130**	**10**	

[a] China receives HEU in fuel for its fast-neutron reactors from Russia. Since it is assumed that this fuel is irradiated soon after the delivery, it is not included here.

[b] A 2014 analysis offers grounds for a significantly lower estimate of France's stockpile of weapon-grade HEU (between 6 ± 2 tonnes and 10 ± 2 tonnes) based on evidence that the Pierrelatte enrichment plant may have had both a much shorter effective period of operation and a smaller capacity to produce weapon-grade HEU than previously assumed.

[c] It is believed that India is producing HEU (enriched to 30–45%) for use as naval reactor fuel. The estimate is for HEU enriched to 30%.

[d] The data for Iran is the estimate by the International Atomic Energy Agency (IAEA) as of 10 Feb. 2024 (123.5 kilogrammes). Iran started enriching uranium up to 20% on 4 Jan. 2021 and started enriching HEU up to 60% enrichment level on 17 Apr. 2021. A newer estimate by the IAEA states that, as of 8 Feb. 2025, the stockpile of HEU was 274.8 kg.

[e] Israel may have acquired *c.* 300 kg of weapon-grade HEU illicitly from the USA in or before 1965. Some of this material may have been consumed in the process of producing tritium.

[f] North Korea is known to have a uranium-enrichment plant at Yongbyon and possibly others elsewhere. Independent estimates of uranium-enrichment capability and possible HEU production extrapolated to the beginning of 2024 suggest a potential accumulated HEU stockpile in the range 300–1700 kg.

[g] This estimate for Pakistan assumes total HEU production of 5.4 tonnes, of which *c.* 100 kg was used in nuclear weapon tests.

[h] This estimate assumes that the Soviet Union stopped all HEU production in 1988. It may therefore understate the amount of HEU in Russia (see also note j).

[i] This material is believed to be in use in various research facilities, civilian as well as military-related.

[j] The Soviet Union stopped production of HEU for weapons in 1988 but kept producing HEU for civilian and non-weapon military uses. Russia continues this practice. It is assumed that the HEU for naval and other reactors is newly produced material.

[k] The estimate for the UK reflects a declaration of 21.9 tonnes of military HEU as of 31 Mar. 2002, the average enrichment of which was not given.

[l] This figure (499 kg) is from the UK's Office for Nuclear Regulation website. As of Mar. 2025, no INFCIRC/549 declaration to the IAEA for the end of 2023 had been made. As the UK has left the European Union, the material is no longer under Euratom safeguards.

[m] The amount of US HEU is given in actual tonnes, not 93%-enriched equivalent. The material not available for weapons as of the end of 2023 is estimated to include 87.5 tonnes of HEU in naval reserve and 14.3 tonnes reserved for research reactors. It is also estimated to include 18.4 tonnes of HEU that will be down-blended, based on an updated estimate of the down-blending rate.

[n] The IAEA's 2023 annual report lists 156 significant quantities of HEU under comprehensive safeguards in non-nuclear weapon states as of the end of 2023. Without knowing the exact enrichment levels, that means these states hold at least 3.9 tonnes of HEU because, for HEU, a significant quantity is defined as 25 kg of U-235.

In INFCIRC/912 (from 2017) more than 20 states committed to reducing civilian HEU stocks and providing regular reports. So far, only 2 states have reported under this scheme. At the end of 2018 (time of last declaration), Norway held less than 4 kg of HEU for civilian purposes. As of 30 June 2019, Australia held 2.7 kg of HEU for civilian purposes

Sources: International Panel on Fissile Materials (IPFM), *Global Fissile Material Report 2022: Fifty Years of the Nuclear Non-Proliferation Treaty: Nuclear Weapons, Fissile Materials, and Nuclear Energy* (IPFM: Princeton, NJ, 2022). *China*: Zhang, H., *China's Fissile Material Production and Stockpile* (IPFM: Princeton, NJ, 2017). *France*: International Atomic Energy Agency (IAEA), 'Communication received from France concerning its policies regarding the management of plutonium', INFCIRC/549/Add.5/28, 23 Aug. 2024; and Philippe, S. and Glaser, A., 'Nuclear archaeology for gaseous diffusion enrichment plants', *Science & Global Security*, vol. 22, no. 1 (2014). *Iran*: IAEA, Board of Governors, 'Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015)', Report by the Director General, GOV/2024/7, 26 Feb. 2024; and IAEA, Board of Governors, 'Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015)', Report by the Director General, GOV/2025/8, 26 Feb. 2025. *Israel*: Myers, H., 'The real source of Israel's first fissile material', *Arms Control Today*, vol. 37, no. 8 (Oct. 2007), p. 56; Gilinsky, V. and Mattson, R. J., 'Revisiting the NUMEC affair', *Bulletin of the Atomic Scientists*, vol. 66, no. 2 (Mar./Apr. 2010); and Gilinsky, V. and Weiss, L., 'The US hypocrisy about Israel's nuclear weapons must stop', *Bulletin of the Atomic Scientists*, 21 Mar. 2025. *North Korea*: Hecker, S. S., Braun, C. and Lawrence, C., 'North Korea's stockpiles of fissile material', *Korea Observer*, vol 47, no. 4 (winter 2016). *Russia*: Podvig, P. (ed.), *The Use of Highly-Enriched Uranium as Fuel in Russia* (IPFM: Princeton, NJ, 2017). *UK*: British Ministry of Defence, 'Historical accounting for UK defence highly enriched uranium', Mar. 2006; and British Office for Nuclear Regulation, '2023 annual figures for holdings of civil unirradiated plutonium United Kingdom', 11 Oct. 2024. *USA*: US Department of Energy (DOE), National Nuclear Security Administration, *Highly Enriched Uranium, Striking a Balance: A Historical Report on the United States Highly Enriched Uranium Production, Acquisition, and Utilization Activities from 1945 through September 30, 1996* (DOE: Washington, DC, Jan. 2001); White House, 'Transparency in the US highly enriched uranium inventory', Fact sheet, 31 Mar. 2016; US DOE, *FY 2021 Congressional Budget Request*, vol. 1, *National Nuclear Security Administration* (DOE: Washington, DC, Feb. 2020), p. 593; and US DOE, *Tritium and Enriched Uranium Management Plan through 2060*, Report to Congress (DOE: Washington, DC, Oct. 2015). *Other states*: IAEA, *IAEA Annual Report 2023: Annex Information* (IAEA: Vienna, 2023), table A4, p. 5; IAEA, 'Communication dated 19 July 2019 received from the Permanent Mission of Norway concerning a joint statement on minimising and eliminating the use of highly enriched uranium in civilian applications', INFCIRC/912/Add.3, 15 Aug. 2019; and IAEA, 'Communication dated 23 January 2020 received from the Permanent Mission of Australia concerning the joint statement on minimising and eliminating the use of highly enriched uranium in civilian applications', INFCIRC/912/Add.4, 5 Mar. 2020.

Table 8A.2. Global stocks of separated plutonium, 2024

All figures are tonnes and are for unirradiated plutonium as of the beginning of 2024. Important exceptions are noted. Final totals are rounded to the nearest 5 tonnes.

State	Total stock	In or available for weapons	Not directly available for weapons[a]		Military production status
			Unsafeguarded	Safeguarded/ monitored	
China	2.9	2.9 ± 0.6	0.04[b]	–	Stopped in 1991
France	102	6 ± 1.0	–	96.25	Stopped in 1992
India	11	0.7 ± 0.16	9.9 ± 5.6[c]	0.4	Continuing
Israel[d]	0.9	0.86 ± 0.1	–	–	Continuing
Japan[e]	44.5	–	–	44.5	–
Korea, North[f]	0.04	0.04	–	–	Continuing
Pakistan[g]	0.58	0.58 ± 0.2	–	–	Continuing
Russia	193	88 ± 8	89.9[h]	15[i]	Stopped in 2010
UK[j]	120	3.2	116.8	–	Stopped in 1995
USA[k]	87.6	38.4	46.2	3[l]	Stopped in 1988
Total	**565**	**140**	**265**	**160**	

[a] The data for France, Japan and Russia is for the end of 2023, reflecting their most recent INFCIRC/549 declaration to the International Atomic Energy Agency (IAEA). As of Mar. 2025, the most recent declarations by the USA are for the end of 2022, but figures are unlikely to have changed. Some states with civilian plutonium stocks do not submit an INFCIRC/549 declaration. Of these states, the Netherlands, Spain and Sweden store their plutonium abroad, but the total amounts are too small to be noted in the table. Italy had 1.58 tonnes of plutonium in the UK, which took ownership of the material in 2025.

[b] These numbers are based on China's INFCIRC/549 declaration to the IAEA for the end of 2016. As of Mar. 2025, this is the most recent declaration.

[c] India's unsafeguarded civilian material is the plutonium separated from spent power-reactor fuel. While such reactor-grade plutonium can in principle be used in weapons, it is labelled as 'Not directly available for weapons' here since it is intended for breeder reactor fuel. It was not placed under safeguards in the 'India-specific' safeguards agreement signed by the Indian government and the IAEA on 2 Feb. 2009. India does not submit an INFCIRC/549 declaration to the IAEA.

[d] Israel is believed to be operating the Dimona plutonium-production reactor. The estimate assumes partial use of the reactor for tritium production from 1997 onwards. The estimate is for the beginning of 2024. Without tritium production, stockpiles could be as high as 1130 kilogrammes.

[e] Of Japan's plutonium stock, 35.8 tonnes are stored abroad in France (14.1 tonnes) and the UK (21.7 tonnes), the remaining 8.7 tonnes are under IAEA safeguards in Japan.

[f] North Korea reportedly declared a plutonium stock of 37 kg in June 2008. It is believed that it subsequently unloaded plutonium from its 5-MW(e) reactor 3 additional times, in 2009, 2016 and 2018. The stockpile estimate has been reduced to account for the 6 North Korean nuclear tests. North Korea's reprocessing facility operated again in 2021 for 5 months.

[g] At the beginning of 2024 Pakistan was operating 4 plutonium-production reactors at its Khushab site. This estimate assumes that Pakistan is separating plutonium from all 4 reactors.

[h] This material includes 64.9 tonnes of separated plutonium declared in Russia's 2023 INFCIRC/549 declaration as civilian. Russia does not make the plutonium it reports as civilian available to IAEA safeguards. This amount also includes 25 tonnes of weapon-origin plutonium stored at the Mayak Fissile Material Storage Facility, which Russia pledged not to use for military purposes.

[i] This material is weapon-grade plutonium produced between 1 Jan. 1995 and 15 Apr. 2010, when the last Russian plutonium-production reactor was shut down. It cannot be used for

weapon purposes under the terms of a 1997 Russian–US agreement on plutonium-production reactors. The material is currently stored at Zheleznogorsk and is subject to monitoring by US inspectors.

[j] The civilian data is based on a publication by the UK's Office for Nuclear Regulation for the end of 2023, which is in INFCIRC/549 format. Despite this publication, as of Mar. 2025, the UK had not yet submitted INFCIRC/549 declarations for the end of 2023 to the IAEA. In addition to the amounts listed above, the UK stores 24.1 tonnes of foreign plutonium. Japan owns 21.735 tonnes of this plutonium and, as at the end of 2023, Italy owned 1.58 tonnes.

[k] In 2012 the USA declared a government-owned plutonium inventory of 95.4 tonnes as of 30 Sep. 2009. In its INFCIRC/549 declaration of stocks as of 31 Dec. 2022, the USA declared 49.2 tonnes of unirradiated plutonium (both separated and in mixed oxide, MOX) as part of the stock identified as excess to military purposes.

[l] The USA has placed *c.* 3 tonnes of its excess plutonium, stored at the K-Area Material Storage Facility at the Savannah River Site, under IAEA safeguards.

Sources: International Panel on Fissile Materials (IPFM), *Global Fissile Material Report 2022: Fifty Years of the Nuclear Non-Proliferation Treaty: Nuclear Weapons, Fissile Materials, and Nuclear Energy* (IPFM: Princeton, NJ, 2022). *Civilian stocks (except for India)*: International Atomic Energy Agency (IAEA), 'Communication received from certain member states concerning their policies regarding the management of plutonium', INFCIRC/549, various dates. *China*: Zhang, H., *China's Fissile Material Production and Stockpile* (IPFM: Princeton, NJ, 2017). *Israel*: Glaser, A. and de Troullioud de Lanversin, J., 'Plutonium and tritium production in Israel's Dimona reactor, 1964–2020', *Science & Global Security*, vol. 29, no. 2 (2021). *North Korea*: Kessler, G., 'Message to US preceded nuclear declaration by North Korea', *Washington Post*, 2 July 2008; Hecker, S. S., Braun, C. and Lawrence, C., 'North Korea's stockpiles of fissile material', *Korea Observer*, vol 47, no. 4 (winter 2016); and IAEA, Board of Governors and General Conference, 'Application of safeguards in the Democratic People's Republic of Korea', Report by the acting Director General, GOV/2019/33-GC(63)/20, 19 Aug. 2019. *Russia*: Russian–US Agreement Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation (Plutonium Management and Disposition Agreement), signed 29 Aug. and 1 Sep. 2000, amendment signed 5 Sep. 2006, entered into force 13 July 2011. *UK*: Office for Nuclear Regulation, '2023 annual figures for holdings of civil unirradiated plutonium United Kingdom', 11 Oct. 2024. *USA*: US Department of Energy, National Nuclear Security Administration (NNSA), *The United States Plutonium Balance, 1944–2009* (NNSA: Washington, DC, June 2012); and Gunter, A., 'K-Area overview/update', US Department of Energy, Savannah River Site, 28 July 2015.

Table 8A.3. Significant uranium-enrichment facilities and capacity worldwide, 2024

With the exception of two facilities (marked *) that continue to use gaseous diffusion to enrich uranium in uranium-235 (U-235), all facilities use gas centrifuge isotope-separation technology.

State	Facility name or location	Type	Status	Capacity (thousands SWU/yr)[a]
Argentina[b]	Pilcaniyeu*	Civilian	Uncertain	20
Brazil[c]	Resende	Civilian	Operational	50–60
China[d]	Lanzhou	Civilian	Operational	4 400
	Hanzhong (Shaanxi)	Civilian	Operational	2 700
	Emeishan	Civilian	Operational	4 100–4 600
	Heping*	Dual-use	Operational	230
France	Georges Besse II[e]	Civilian	Operational	7 500
Germany	Urenco Gronau[f]	Civilian	Operational	3 600
India	Rattehalli	Military	Operational	17–31
Iran[g]	Natanz	Civilian	Expanding capacity	31–39
	Qom (Fordow)	Civilian	Expanding capacity	3–4
Japan	Rokkasho[h]	Civilian	Not operational	1 050
Korea, North	Yongbyon[i]	Uncertain	Operational	8–16
Netherlands	Urenco Almelo[j]	Civilian	Operational	5 100
Pakistan	Gadwal	Military	Operational	. .
	Kahuta	Military	Operational	30–45
Russia	Angarsk	Civilian	Operational	4 000
	Novouralsk	Civilian	Operational	13 300
	Seversk	Civilian	Operational	3 800
	Zelenogorsk[k]	Civilian	Operational	7 900
UK	Capenhurst[l]	Civilian	Operational	4 500
USA	Urenco Eunice[m]	Civilian	Operational	4 400
	American Centrifuge Plant[n]	Civilian	Operational	4.5

[a] Separative work units per year (SWU/yr) is a measure of the effort required in an enrichment facility to separate uranium of a given content of U-235 into two components, one with a higher and one with a lower percentage of U-235. Where a range of capacities is shown, the capacity is uncertain, or the facility is expanding its capacity.

[b] In Dec. 2015 Argentina announced the reopening of its Pilcaniyeu gaseous diffusion uranium-enrichment plant, which was shut down in the 1990s. There is no evidence of actual production.

[c] Brazil signed contracts for expansion in 2023.

[d] An assessment of China's enrichment capacity in 2023 suggested the addition of new enrichment plants, resulting in a larger total capacity compared with estimates of previous years.

[e] Plans for expanding George Besse II were announced in 2024.

[f] Capacities for Urenco Gronau are given for Mar. 2024. Plans for expanding the facility were announced in 2024.

[g] Figures for Iran are for Feb. 2024. Since the USA's withdrawal in 2018 from the Joint Comprehensive Plan of Action (JCPOA), which agreed limits on and made more transparent Iran's nuclear programme, Iran has continued to increase enrichment capacities and levels at its Natanz and Fordow facilities. In Feb. 2025 the installed capacity at Natanz was between 48 and 60 thousand SWU/yr.

[h] According to a Japan Nuclear Fuel Limited report from 31 Mar. 2024, no enriched uranium has been produced since 2019.

[i] North Korea revealed its Yongbyon enrichment facility in 2010. It appeared to be operational as of 2020. It is believed that North Korea is operating at least one other enrichment facility.

[j] Capacities for Urenco Almelo are given for Mar. 2024. Plans for expanding the facility were announced in 2024.

[k] Zelenogorsk operates a centrifuge cascade for HEU production of fuel for fast reactors and research reactors.

[l] Capacities for Urenco Capenhurst are given for Mar. 2024. Plans for expanding the facility were announced in 2024, including to produce high-assay low-enriched uranium (HALEU).

[m] Capacities for Urenco Eunice are given for Mar. 2024. Plans for expanding the facility were announced in 2024, including to produce HALEU.

[n] Plans for expanding the American Centrifuge Plant were announced in 2024, including to produce HALEU.

Sources: Indo-Asian News Service (IANS), 'Argentina president inaugurates enriched uranium plant', *Business Standard* (New Delhi), 1 Dec. 2015; Peachey, C., 'Brazil's INB launches new centrifuge cascade', Nuclear Engineering International, 25 Nov. 2021; Zhang, H., 'China's uranium enrichment complex', *Science & Global Security*, vol. 23, no. 3 (2015); Zhang, H., *China's Fissile Material Production and Stockpile* (International Panel on Fissile Materials, IPFM: Princeton, NJ, 2017); Zhang, H., 'China started operation of two new enrichment plants in 2023', IPFM Blog, 15 Dec. 2023; Orano, 'Laying of the foundation stone of the George Besse 2 plant extension', 10 Oct. 2024; International Atomic Energy Agency (IAEA), Board of Governors, 'Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015)', Report by the Director General, GOV/2024/7, 26 Feb. 2024; IAEA, Board of Governors, 'Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015)', Report by the Director General, GOV/2025/8, 26 Feb. 2025; Albright, D. et al., 'Analysis of IAEA Iran Verification and Monitoring Report: February 2024', Institute for Science and International Security, 4 Mar. 2024; Japan Nuclear Fuel Limited, 'Operational status at Uranium Enrichment Plant', 31 Mar. 2024; Hecker, S. S. and Carlin, R. L., 'A closer look at North Korea's enrichment capabilities and what it means', 18 Sep. 2024; British Government, 'UK first in Europe to invest in next generation of nuclear fuel', Press release, 8 May 2024; 'Enrichment operations start at US HALEU plant', World Nuclear News, 12 Oct. 2023; Urenco, 'Urenco USA selected for HALEU enrichment award by US Department of Energy', 17 Oct. 2024; and 'Centrus to restart centrifuge manufacturing, expand capacity', World Nuclear News, 21 Nov. 2024. Enrichment capacity data is further based on IAEA, Integrated Nuclear Fuel Cycle Information Systems (iNFCIS); Urenco, 'Global operations'; US Department of Energy (DOE), *Tritium and Enriched Uranium Management Plan through 2060*, Report to Congress (DOE: Washington, DC, Oct. 2015); and International Panel on Fissile Materials (IPFM), *Global Fissile Material Report 2022: Fifty Years of the Nuclear Non-Proliferation Treaty: Nuclear Weapons, Fissile Materials, and Nuclear Energy* (IPFM: Princeton, NJ, 2022).

Table 8A.4. Significant reprocessing facilities worldwide, 2024

State	Facility name or location	Fuel	Type	Status	Design capacity (tHM/yr)[a]
China[b]	Jiuquan pilot plant	LWR	Civilian	Operational	50
	Jinta Project I	LWR		Start expected for 2025	200
	Jinta Project II	LWR		Construction completed	200
France	La Hague UP2	LWR	Civilian	Operational	1 000
	La Hague UP3	LWR	Civilian	Operational	1 000
India[c]	Kalpakkam	HWR	Dual-use	Operational	100
	Tarapur	HWR	Dual-use	Operational	100
	Tarapur-II	HWR	Dual-use	Operational	100
	Trombay	HWR	Military	Operational	50
Israel	Dimona	HWR	Military	Operational	40–100
Japan	Rokkasho	LWR	Civilian	Start planned for 2027[d]	800
Korea, North	Yongbyon	GCR	Military	Operational	100–150
Pakistan	Chashma	HWR	Military	Starting up	50–100
	Nilore	HWR	Military	Operational	20–40
Russia	Mayak RT-1, Ozersk	LWR	Civilian	Operational	400
	EDC, Zheleznogorsk[e]	LWR	Civilian	Full capacity expected in 2026	220
UK	Sellafield[f]		Civilian	Shut down	
USA	H-canyon, Savannah River Site	LWR	Civilian	Operational	15

GCR = gas-cooled reactor; HWR = heavy water reactor; LWR = light water reactor.

[a] Design capacity refers to the highest amount of spent fuel the plant is designed to process and is measured in tonnes of heavy metal per year (tHM/yr), tHM being a measure of the amount of heavy metal—uranium in these cases—that is in the spent fuel. Actual throughput is often a small fraction of the design capacity. LWR spent fuel contains *c.* 1% plutonium; HWR and GCR fuel contain *c.* 0.4% plutonium.

[b] Near Jinta, Gansu province, China is constructing significant reprocessing facilities. Project I was started in 2015, Project II in *c.* 2020. Construction at both facilities appears to be complete. Operation for Project I is expected to start in 2025, Project II might start before 2030. Construction activities for a third facility (Project III) seem to have started in the same location.

[c] As part of the 2005 Indian–US Civil Nuclear Cooperation Initiative, India has decided that none of its reprocessing plants will be opened for International Atomic Energy Agency safeguards inspections.

[d] Construction of the facility started in 1993. Since then, the planned started date has been postponed regularly.

[e] Russia opened a 220 a tHM/yr reprocessing line in the Pilot Demonstration Centre (EDC) at Zheleznogorsk. A pilot reprocessing line with a capacity of 5 tHM/yr was launched in June 2018.

[f] The UK operated two large civilian reprocessing facilities, THORP and B205 at Sellafield. They were shut down in 2018 and 2022, respectively.

Sources: 'Japan approves 70-year plan to scrap nuclear reprocessing plant', Kyodo News, 13 June 2018; Suzuki, T., 'Japan's never ending reprocessing saga', International Panel on Fissile Materials (IPFM) Blog, 23 Nov. 2023; Japan Nuclear Fuel Limited, 'Change in schedule for completion of Rokkasho Reprocessing Plant and MOX Fabrication Plant', 29 Aug. 2024; [Rosatom ready to start 'green' processing of spent nuclear fuel], RIA Novosti, 29 May 2018 (in Russian); IPFM, 'Launch of the second reprocessing line in Zheleznogorsk,' IPFM Blog, 18 Nov. 2024;

Zhang, H., 'China starts construction of a third demonstration reprocessing plant', IPFM Blog, 24 Dec. 2024; and Sellafield Ltd and Nuclear Decommissioning Authority, 'Job done: Sellafield plant safely completes its mission', 19 July 2022. Data on design capacity is based on International Atomic Energy Agency, Integrated Nuclear Fuel Cycle Information Systems (iNFCIS); and International Panel on Fissile Materials (IPFM), *Global Fissile Material Report 2022: Fifty Years of the Nuclear Non-Proliferation Treaty: Nuclear Weapons, Fissile Materials, and Nuclear Energy* (IPFM: Princeton, NJ, 2022).