CADMIUM

(Data in metric tons unless otherwise noted)

Domestic Production and Use: Two companies in the United States produced cadmium metal in 2022. One company, operating in Tennessee, recovered primary refined cadmium as a byproduct of zinc leaching from roasted sulfide concentrates that would otherwise need to be disposed of as waste. The other company, operating in Ohio, recovered secondary cadmium metal from spent nickel-cadmium (NiCd) batteries. A cadmium concentrate was produced by one company in North Carolina that in late 2019 restarted zinc production from recycled electric-arc-furnace dust obtained from steel mills. Cadmium metal and compounds are mainly consumed for NiCd batteries, but also for alloys, coatings, and pigments. For the past 5 years, the United States has been a net exporter of wrought cadmium products and of cadmium pigments and preparations based on cadmium.

Salient Statistics—United States:	2018	2019	2020	2021	2022[e]
Production:					
Primary, refined[1]	73	131	211	241	250
Secondary	W	W	W	W	W
Imports for consumption:					
Unwrought cadmium and powders	273	385	282	155	21
Wrought cadmium and other articles	1	21	3	2	1
Cadmium waste and scrap	20	86	90	85	35
Cadmium oxide	51	33	28	14	21
Cadmium pigments and preparations based on cadmium compounds	310	108	69	101	170
Exports:					
Unwrought cadmium and powders	40	32	4	51	2
Wrought cadmium and other articles	99	84	482	217	90
Cadmium waste and scrap	(2)	6	(2)	—	4
Cadmium pigments and preparations based on cadmium compounds	565	795	2,120	550	510
Consumption of metal, apparent[3]	W	W	W	W	W
Price, metal, annual average,[4] dollars per kilogram	2.89	2.67	2.29	2.56	3.3
Net import reliance[5] as a percentage of apparent consumption	<75	<75	<75	<50	<25

Recycling: Secondary cadmium is mainly recovered from spent consumer and industrial NiCd batteries. Other waste and scrap from which cadmium can be recycled includes copper-cadmium alloy scrap, some complex nonferrous alloy scrap, cadmium-containing dust from electric-arc furnaces, and cadmium telluride (CdTe) solar panels.

Import Sources (2018–21):[6] Australia, 27%; Germany, 23%; China,[7] 20%; Peru, 12%; and other, 18%.

Tariff: Item	Number	Normal Trade Relations 12–31–22
Cadmium oxide	2825.90.7500	Free.
Cadmium sulfide	2830.90.2000	3.1% ad valorem.
Pigments and preparations based on cadmium compounds	3206.49.6010	3.1% ad valorem.
Cadmium waste and scrap	8112.61.0000	Free.
Unwrought cadmium and powders	8112.69.1000	Free.
Wrought cadmium and other articles	8112.69.9000	4.4% ad valorem.

Depletion Allowance: 22% (domestic), 14% (foreign).

Government Stockpile: None.

Events, Trends, and Issues: Most of the world's primary cadmium metal was produced in Asia, and leading global producers, in descending order of production, were China and the Republic of Korea, followed by Japan and Canada. A smaller amount of secondary cadmium metal was recovered from recycling NiCd batteries. Although detailed data on the global consumption of primary cadmium were not available, NiCd battery production was thought to have continued to account for most global cadmium consumption. Other end uses for cadmium and cadmium compounds included alloys, anticorrosive coatings, pigments, and semiconductors for solar cells and for radiation-detecting imaging equipment; research into substitutions for cadmium in uses such as coatings continued.

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CADMIUM

The average monthly cadmium price was $2.92 per kilogram in January and increased to $3.58 per kilogram in May and $3.60 per kilogram in September after a decrease earlier in the year. The average prices reflected seasonal buying patterns in India; as a major consumer of cadmium but without significant production, India was an important determinant of cadmium prices in the spot market.

In August 2022, the U.S. Department of Energy announced the formation of a 3-year consortium among academic institutions, industry, and Government in support of the goals of its Cadmium Telluride Photovoltaics (PV) Accelerator program that was initiated in 2021. These goals included enabling solar cell efficiencies above 24% by 2025 and above 26% by 2030, while steadily reducing the per-watt cost of manufacturing by 60% within 10 years.

In response to the Inflation Reduction Act of 2022, which included incentives for transitioning to renewable energy sources, a major United States-based CdTe thin-film solar-cell producer announced plans to build a fourth domestic manufacturing facility by 2025 and expand capacity at its two existing plants and at a third facility which was scheduled to begin production in 2023. According to the consortium, administered by the National Renewable Energy Laboratory, CdTe solar panels supply 40% of the U.S. utility-scale solar market and 5% of the world market.

World Refinery Production and Reserves:

	Refinery production[e]		Reserves[8]
	2021	2022	
United States[1]	241	250	Quantitative estimates of reserves were not available. The cadmium content of typical zinc ores averages about 0.03%. See the Zinc chapter for zinc reserves.
Australia	402	400	
Bulgaria	310	310	
Canada	1,800	1,800	
China	10,000	10,000	
Germany	417	420	
Japan	1,900	1,900	
Kazakhstan	1,200	1,200	
Korea, Republic of	4,000	4,000	
Mexico	859	1,200	
Netherlands	854	500	
Norway	350	350	
Peru	600	300	
Poland	500	500	
Russia	1,000	1,000	
Uzbekistan	300	300	
World total (rounded)	24,700	24,000	

World Resources:[8] Cadmium is generally recovered from zinc ores and concentrates. Sphalerite, the most economically significant zinc ore mineral, commonly contains minor amounts of cadmium, which shares certain similar chemical properties with zinc and often substitutes for zinc in the sphalerite crystal lattice. The cadmium mineral greenockite is frequently associated with weathered sphalerite and wurtzite.

Substitutes: Batteries with other chemistries, particularly lithium-ion, can replace NiCd batteries in many applications. Except where the surface characteristics of a coating are critical (for example, fasteners for aircraft), coatings of aluminum, zinc, or zinc alloys such as tin-zinc and zinc-nickel can be substituted for cadmium in many plating applications. Cerium sulfide is used as a replacement for cadmium pigments, mostly in plastics. Barium-zinc or calcium-zinc stabilizers can replace barium-cadmium stabilizers in flexible polyvinyl chloride (PVC) applications. Amorphous silicon and copper-indium-gallium-selenide photovoltaic cells compete with CdTe in the thin-film solar-cell market. A new thin-film technology based on perovskite material continued to be researched as a potential substitute.

[e]Estimated. W Withheld to avoid disclosing company proprietary data. — Zero.

[1]Cadmium metal produced as a byproduct of zinc refining.

[2]Less than ½ unit.

[3]Defined as primary production + secondary production + imports of unwrought cadmium and powders – exports of unwrought cadmium and powders.

[4]Average free market price for 99.95% purity in 10-ton lots; cost, insurance, and freight; global ports. Source: Fastmarkets MB.

[5]Defined as imports of unwrought cadmium and powders – exports of unwrought cadmium and powders.

[6]Unwrought cadmium and powders; Harmonized Tariff Schedule of the United States code 8107.20.0000 prior to 2022 and 8112.69.1000 in 2022.

[7]Includes Hong Kong.

[8]See Appendix C for resource and reserve definitions and information concerning data sources.