CADMIUM

(Data in metric tons of contained cadmium unless otherwise noted)

Domestic Production and Use: Two companies in the United States produced refined cadmium in 2021. One company, operating in Tennessee, recovered primary refined cadmium as a byproduct of zinc leaching from roasted sulfide concentrates. 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 produced zinc from recycled electric-arc-furnace dust obtained from steel mills. Domestic production and consumption of cadmium were withheld to avoid disclosing company proprietary data. Cadmium metal and compounds are mainly consumed for alloys, coatings, NiCd batteries, pigments, and plastic stabilizers. For the past 5 years, the United States has been a net importer of unwrought cadmium metal and cadmium metal powders and a net exporter of wrought cadmium products and of cadmium pigments and preparations based on cadmium compounds.

Salient Statistics—United States:	**2017**	**2018**	**2019**	**2020**	**2021[e]**
Production, refined[1]	W	W	W	W	W
Imports for consumption:					
Unwrought cadmium and powders	274	273	385	282	140
Wrought cadmium and other articles (gross weight)	2	1	21	3	1
Cadmium waste and scrap (gross weight)	20	20	86	90	150
Cadmium pigments and preparations based on cadmium compounds (gross weight)	158	310	108	69	90
Exports:					
Unwrought cadmium and powders	223	40	32	4	80
Wrought cadmium and other articles (gross weight)	205	99	84	480	210
Cadmium waste and scrap (gross weight)	(2)	(2)	6	(2)	(2)
Cadmium pigments and preparations based on cadmium compounds (gross weight)	617	565	795	2,120	560
Consumption, reported, refined	W	W	W	W	W
Price, metal, annual average,[3] dollars per kilogram	1.75	2.89	2.67	2.29	2.49
Net import reliance[4] as a percentage of apparent consumption	<25	<50	<50	<50	<50

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 (2017–20):[5] Australia, 29%; China,[6] 20%; Germany, 19%; Peru, 11%; and other, 21%.

Tariff: Item	**Number**	**Normal Trade Relations 12–31–21**
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.
Unwrought cadmium and powders	8107.20.0000	Free.
Cadmium waste and scrap	8107.30.0000	Free.
Wrought cadmium and other articles	8107.90.0000	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, polyvinyl chloride (PVC) stabilizers, and semiconductors for solar cells and for radiation-detecting imaging equipment.

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CADMIUM

The average monthly cadmium price began 2021 averaging $2.12 per kilogram in January and trended upward to about $2.85 per kilogram in April and May before decreasing to $2.13 per kilogram in August. The resurgence of the delta variant of the COVID-19 virus in April through July in India affected economic activity and was likely a factor in the decrease in price. As a major consumer of cadmium but without significant production, India was an important determinant of cadmium prices in the spot market.

In March 2021, the U.S. Department of Energy Solar Energy Technologies Office initiated the Cadmium Telluride Photovoltaics (PV) Accelerator program, intended to enhance U.S. technology leadership and competitiveness in the CdTe PV industry. Program goals included achieving cell efficiencies above 26%, decreasing module costs to below $0.15 per watt before 2030, and increasing domestic CdTe PV material and module production. The National Renewable Energy Laboratory would provide resources and support for a consortium to bring together academic institutions, industry, and government to accomplish the program goals.

A major United States-based CdTe thin-film solar-cell producer began building a third manufacturing facility in Ohio. The new facility, to be completed in 2023, would add 3.3 gigawatts (GW) to the company's annual production capacity for a total of 6 GW and make it the largest vertically integrated solar manufacturing complex outside of China.

World Refinery Production and Reserves:

	Refinery production[e]		Reserves[7]
	2020	2021	
United States[1]	W	W	Quantitative estimates of reserves are not available. The cadmium content of typical zinc ores averages about 0.03%. See the Zinc chapter for zinc reserves.
Australia	348	300	
Canada	1,800	1,800	
China	10,000	10,000	
Germany	450	500	
Japan	1,880	1,900	
Kazakhstan	1,500	1,500	
Korea, Republic of	3,000	3,000	
Mexico	978	800	
Netherlands	880	900	
Norway	400	400	
Peru	700	600	
Russia	1,000	1,000	
Uzbekistan	400	400	
Other countries	520	600	
World total (rounded)[8]	24,000	24,000	

World Resources:[7] 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: Lithium-ion and nickel-metal hydride batteries can replace NiCd batteries in many applications. Except where the surface characteristics of a coating are critical (for example, fasteners for aircraft), coatings of zinc, zinc nickel, aluminum, or tin 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 PVC applications. Amorphous silicon and copper-indium-gallium-selenide photovoltaic cells compete with CdTe in the thin-film solar-cell market. Research efforts continued to advance new thin-film technology based on perovskite material as a potential substitute.

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

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

[2]Less than ½ unit.

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

[4]Defined as imports of unwrought metal and metal powders – exports of unwrought metal and metal powders.

[5]Includes data for the following Harmonized Tariff Schedule of the United States code: 8107.20.0000.

[6]Includes Hong Kong.

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

[8]Excludes U.S. production.