

CADMIUM

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

Domestic Production and Use: Two companies in the United States produced refined cadmium in 2019. 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. 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 4 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 cadmium pigments.

<u>Salient Statistics—United States:</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019^e</u>
Production, refined ¹	W	W	W	W	W
Imports for consumption:					
Unwrought cadmium and powders	237	240	274	273	350
Wrought cadmium and other articles (gross weight)	18	(2)	2	1	20
Cadmium waste and scrap (gross weight)	71	52	20	20	70
Exports:					
Unwrought cadmium and powders	350	157	223	41	20
Wrought cadmium and other articles (gross weight)	246	371	205	99	70
Cadmium waste and scrap (gross weight)	(2)	12	(2)	(2)	6
Consumption, reported, refined	W	W	W	W	W
Price, metal, annual average, dollars per kilogram ³	1.47	1.34	1.75	2.89	2.60
Stocks, yearend, producer and distributor	W	W	W	W	W
Net import reliance ⁴ as a percentage of apparent consumption	E	<25	<25	<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 (2015–18):⁵ China, 25%; Australia, 22%; Canada, 21%; Peru, 10%; and other, 22%.

<u>Tariff: Item</u>	<u>Number</u>	<u>Normal Trade Relations</u>
		<u>12–31–19</u>
Cadmium oxide	2825.90.7500	Free.
Cadmium sulfide	2830.90.2000	3.1% ad val.
Pigments and preparations based on cadmium compounds	3206.49.6010	3.1% ad val.
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 val.

Depletion Allowance: 22% (Domestic), 14% (Foreign).

Government Stockpile: None.

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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, the Republic of Korea, and Japan. 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.

The average monthly cadmium price began 2019 averaging \$2.80 per kilogram in January and trended upward to about \$3.06 per kilogram in March. Prices began decreasing in May, falling to an average of about \$2.40 per kilogram in August.

In 2019, a U.S.-based CdTe thin-film solar-cell producer continued constructing a second manufacturing plant in Ohio. The facility was expected to be completed in 2019 and reach its full production rate in 2020. The plant would triple the company's U.S. CdTe solar cell manufacturing capacity to 1.8 gigawatts per year.

World Refinery Production and Reserves:

	Refinery production		Reserves ⁶
	2018	2019 ^e	
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.
Canada	1,680	1,600	
China	8,200	8,200	
Japan	1,980	1,900	
Kazakhstan	1,500	1,400	
Korea, Republic of	5,000	5,000	
Mexico	1,360	1,400	
Netherlands	1,100	1,100	
Peru	765	770	
Russia	1,200	1,000	
Other countries	<u>2,310</u>	<u>2,300</u>	
World total (rounded)	⁷ 25,100	⁷ 25,000	

World Resources: 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 cadmium telluride in the thin-film solar-cell market. Research efforts continued to advance new thin-film technology based on perovskite material as a potential substitute.

^eEstimated. E Net exporter. W Withheld to avoid disclosing company proprietary data.

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

²Less than ½ unit.

³Average New York dealer price for 99.95% purity in 5-short-ton lots (2015). Source: Platts Metals Week. Average free market price for 99.95% purity in 10-ton lots; cost, insurance, and freight; global ports (2016–18). Source: Metal Bulletin.

⁴Defined as imports of unwrought metal and metal powders – exports of unwrought metal and metal powders + adjustments for industry stock changes.

⁵Imports for consumption of unwrought metal and metal powders (Harmonized Tariff Schedule of the United States code 8107.20.0000).

⁶See Appendix C for resource and reserve definitions and information concerning data sources.

⁷Excludes U.S. production.