

CADMIUM

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

Domestic Production and Use: Three companies in the United States were thought to have produced refined cadmium in 2011. One company, operating in Tennessee, recovered primary cadmium as a byproduct of zinc leaching from roasted sulfide concentrates. The other two companies, with facilities in Ohio and Pennsylvania, thermally recovered secondary cadmium metal from spent nickel-cadmium (NiCd) batteries and other cadmium-bearing scrap. Cadmium metal and compounds are mainly consumed for alloys, coatings, nickel-cadmium batteries, pigments, and plastic stabilizers. Based on the average New York dealer price, U.S. cadmium metal consumption was valued at about \$1.35 million in 2011.

Salient Statistics—United States:	2007	2008	2009	2010	2011^e
Production, refinery ¹	735	777	633	637	600
Imports for consumption:					
Metal only	315	153	117	216	150
Metal, alloys, scrap	316	197	122	221	160
Exports:					
Metal only	270	295	276	40	70
Metal, alloys, scrap	424	421	661	306	290
Consumption of metal, apparent	594	528	199	477	490
Price, metal, annual average, ² dollars per kilogram	7.61	5.92	2.87	3.90	2.75
Stocks, yearend, producer and distributor	107	132	27	102	80
Net import reliance ³ as a percentage of apparent consumption	E	E	E	E	E

Recycling: Cadmium is mainly recovered from spent consumer and industrial NiCd batteries. Other waste and scrap from which cadmium can be recovered includes copper-cadmium alloy scrap, some complex nonferrous alloy scrap, and cadmium-containing dust from electric arc furnaces (EAF). The amount of cadmium recycled was not disclosed.

Import Sources (2007–10): Metal:⁴ Mexico, 38%; Australia, 17%; Canada, 14%; Germany, 11%; and other, 20%.

Tariff: Item	Number	Normal Trade Relations⁵ 12-31-11
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.

Events, Trends, and Issues: Most of the world's primary cadmium metal was produced in Asia and the Pacific—specifically China, Japan, and the Republic of Korea—followed by North America, Central Europe and Eurasia, and Western Europe. Secondary cadmium production takes place mainly at NiCd battery recycling facilities.

Cadmium use in batteries accounted for the majority of global consumption. The remainder was distributed as follows, in order of descending consumption: pigments, coatings and plating, stabilizers for plastics, nonferrous alloys, and other specialized uses (including photovoltaic devices). The percentage of cadmium consumed globally for NiCd battery production has been increasing, while the percentages for the other traditional end uses of cadmium—specifically coatings, pigments, and stabilizers—have gradually decreased owing to environmental and health concerns. A large percentage of the global NiCd battery market was concentrated in Asia.

NiCd battery use in consumer electronics was thought to be declining owing partly to the preference for other rechargeable battery chemistries—particularly lithium ion (Li-ion) batteries, which have already replaced NiCd batteries to a large degree in laptops and cell phones. Li-ion batteries are used in lightweight electronic devices because of their greater energy density (power-to-weight ratio). However, demand for cadmium may increase owing

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to several new market opportunities for NiCd batteries, particularly in industrial applications. Industrial-sized NiCd batteries could also be used to store energy produced by certain on-grid systems. For load leveling, excess energy produced during periods of low demand, such as night time, would be stored in a NiCd battery and later released during periods of high electricity demand, such as midday.

Concern about cadmium's toxicity has spurred various recent legislative efforts, especially in the European Union, to restrict the use of cadmium in most of its end-use applications. In May, the European Commission announced that the use of cadmium in brazing sticks, plastics, and jewelry will be banned in the European Union beginning in December 2011. The new legislation was adopted as an amendment under the REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) regulation. The final effect of this legislation and others on global cadmium consumption has yet to be seen. If recent legislation involving cadmium dramatically reduces long-term demand, a situation could arise, such as has been recently seen with mercury, where an accumulating oversupply of byproduct cadmium will need to be permanently stockpiled.

World Refinery Production and Reserves: Reserve data for Kazakhstan and Poland were revised based on new company information and country reports.

	Refinery production		Reserves ⁶
	2010	2011 ^e	
United States	637	600	39,000
Australia	350	380	61,000
Canada	1,300	1,300	18,000
China	7,200	7,500	92,000
Germany	400	400	—
India	620	660	130,000
Japan	2,050	2,000	—
Kazakhstan	1,800	1,800	35,000
Korea, Republic of	2,500	2,500	—
Mexico	1,480	1,500	48,000
Netherlands	580	580	—
Peru	400	400	45,000
Poland	530	550	16,000
Russia	NA	NA	21,000
Other countries	1,250	1,300	130,000
World total (rounded)	21,100	21,500	640,000

World Resources: Cadmium is generally recovered as a byproduct from zinc concentrates. Zinc-to-cadmium ratios in typical zinc ores range from 200:1 to 400:1. Sphalerite (ZnS), the most economically significant zinc mineral, commonly contains minor amounts of other elements; cadmium, which shares certain similar chemical properties with zinc, will often substitute for zinc in the sphalerite crystal lattice. The cadmium mineral greenockite (CdS) is frequently associated with weathered sphalerite and wurtzite but usually at microscopic levels. Zinc-bearing coals of the Central United States and Carboniferous age coals of other countries also contain large subeconomic resources of cadmium.

Substitutes: Li-ion and nickel-metal hydride batteries are replacing NiCd batteries in some applications. However, the higher cost of these substitutes restricts their use in less-expensive products. Except where the surface characteristics of a coating are critical (e.g., fasteners for aircraft), coatings of zinc or vapor-deposited aluminum 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 polyvinylchloride applications.

^eEstimated. E Net exporter. NA Not available. — Zero.

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

²Average New York dealer price for 99.95% purity in 5-short-ton lots. Source: Platts Metals Week.

³Defined as imports – exports + adjustments for Government and industry stock changes.

⁴Imports for consumption of unwrought metal and metal powders (Tariff no. 8107.20.0000).

⁵No tariff for Australia, Canada, Mexico, and Peru for items shown.

⁶[See Appendix C for resource/reserve definitions and information concerning data sources.](#)