

CADMIUM

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

Domestic Production and Use: Three companies in the United States produced cadmium metal in 2006. Two companies recovered cadmium as a byproduct of zinc leaching from roasted sulfide concentrates. One company operated in Illinois, the other in Tennessee. A third company produced cadmium metal in Pennsylvania from spent nickel-cadmium (NiCd) batteries and other cadmium-bearing scrap. Based on the average New York dealer price, U.S. cadmium metal production was valued at about \$2.50 million in 2006. Between 2002 and 2006, domestic consumption of cadmium metal declined by about 14% in response to environmental concerns. Cadmium use in batteries amounted to 82% of apparent consumption. The remaining 18% was distributed as follows: pigments, 9%; coatings and plating, 7%; stabilizers for plastics, 1.2%; and nonferrous alloys, photovoltaic devices, and other, 0.8%.

Salient Statistics—United States:	2002	2003	2004	2005	2006^e
Production, refinery ¹	1,430	1,420	1,010	1,070	892
Imports for consumption, metal only	56	74	102	207	143
Imports for consumption, metal, alloys, scrap	81	112	263	288	144
Exports of metal, alloys, scrap	264	615	154	686	597
Shipments from Government stockpile excesses	627	146	—	—	—
Consumption of metal, apparent	1,460	637	1,170	656	1,250
Price, metal, average annual ²					
Dollars per kilogram	0.64	1.31	1.20	3.30	2.80
Dollars per pound	0.29	0.59	0.55	1.50	1.27
Stocks, yearend, producer and distributor	2,160	2,580	2,540	2,550	1,740
Net import reliance ³ as a percentage of apparent consumption	2	E	13	E	29

Recycling: Cadmium is recovered from spent NiCd batteries, 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. In 2006, the U.S. steel industry generated about 0.7 million tons of EAF dust, typically containing 0.003% to 0.07% cadmium.

Import Sources (2002-05): Metal:⁴ Australia, 46%; Canada, 20%; Belgium⁵, 10%; Peru, 9%; and other, 15%.

Tariff: Item	Number	Normal Trade Relations⁶ 12-31-06
Cadmium oxide	2825.90.7500	Free.
Cadmium sulfide	2830.30.0000	3.1% ad val.
Pigments and preparations based on cadmium compounds	3206.30.0000	3.1% ad val.
Unwrought cadmium and powders	8107.20.0000	Free.
Cadmium waste and scrap	8107.30.0000	Free.
Cadmium other	8107.90.0000	4.4% ad val.

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

Government Stockpile: None.

Events, Trends, and Issues: Improved prices for zinc in 2006 triggered a resurgence of sphalerite mining in the United States, leading to a buildup of byproduct cadmium feedstocks at North American and Asian refineries. The Red Dog Mine in Alaska continued to be the leading U.S. source of cadmium-bearing sphalerite concentrate, followed by the Pend Oreille Mine in Washington State. A Canadian company reopened the Balmat Mine in upstate New York and began shipping sphalerite concentrate to Canada, where the zinc and byproduct cadmium were recovered and refined. A British-based company acquired the zinc refinery at Sauget, IL. The Sauget refinery was completely refurbished in 1998-2003 by its Korean seller and has been an important producer of cadmium metal and oxide since at least 1937. The refinery, which traditionally processed lead-zinc concentrates from mines in Illinois, Missouri, and Tennessee, is now being modified to recover zinc from steel mill EAF dusts and other recyclable zinc-rich wastes.

During the past decade, increased environmental awareness in many developed countries has resulted in regulatory pressure to reduce or even eliminate the use of cadmium. In the United States, Federal and State environmental agencies regulate industrial releases of cadmium and other metals with a high toxic potential. The U.S. Environmental Protection Agency (EPA) has identified cadmium as a persistent and bioaccumulative toxic pollutant.

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In 2003, the European Union (EU) adopted a set of environmental regulations that are having a profound impact on electronics and semiconductor manufacturing worldwide. One particular directive in this set—The Restriction of the Use of Hazardous Substances (RoHS)—prohibits the incorporation of cadmium in most electrical and electronic equipment sold in the EU after July 1, 2006. Cadmium plating of electronic components is exempt from RoHS. China's Ministry of Information Industry issued a regulation similar to RoHS in 2005. Most North American manufacturers of electronics now sell RoHS-compliant products. The EU issued a revised batteries directive (2006/66), making battery manufacturers and distributors responsible for collecting and recycling spent batteries. The directive bans, with some exemptions, portable NiCd batteries containing more than 0.002% cadmium by weight. The ban, which begins on September 26, 2008, does not apply to NiCd batteries used in alarm and emergency systems, cordless power tools, or medical equipment. The use of cadmium in electric vehicle and industrial batteries is prohibited unless the manufacturer can obtain an environmental exemption from regulatory authorities. EU member states must collect and recycle at least 25% of the portable batteries discarded annually by 2012, and 45% by 2016. Member states must monitor collection rates on a yearly basis, using sales formulas prescribed in the directive.

Although demand for cadmium in traditional uses, such as pigments and stabilizers, is decreasing, potential new uses for cadmium in the electronics sector are emerging. For example, in 2005, researchers in Berkeley, CA, synthesized ultrathin photovoltaic films comprised of cadmium selenide (CdSe) and cadmium telluride (CdTe) nanocrystals. If the efficiencies of these films for converting sunlight to electricity can be improved, solar cells could become an important market for cadmium. Such new electronic demand for cadmium could partially absorb the cadmium projected to be available from the forecast growth in zinc refining. Increased demand for cadmium could encourage recycling, while discouraging stockpiling of cadmium-bearing jarosite and other zinc refinery wastes.

World Refinery Production, Reserves, and Reserve Base:

	Refinery production ⁵		Reserves ⁷	Reserve base ⁷
	2005	2006 ^e		
United States	1,070	892	90,000	270,000
Australia ⁸	374	425	53,000	91,000
Canada	1,703	1,820	55,000	100,000
China	3,000	4,500	90,000	380,000
Germany	640	640	—	8,000
India	417	420	3,000	5,000
Japan	2,297	2,400	10,000	15,000
Kazakhstan	2,000	2,210	50,000	100,000
Korea, Republic of	2,900	2,800	—	—
Mexico	1,600	1,400	35,000	40,000
Netherlands	575	500	—	—
Peru	481	420	12,000	13,000
Russia	1,000	1,100	16,000	30,000
Other countries	1,400	1,400	120,000	540,000
World total (rounded)	19,400	20,900	540,000	1,600,000

World Resources: The bulk of the cadmium being recovered is associated with ores of sphalerite (ZnS). Estimated world identified resources of cadmium were about 6 million tons, based on identified zinc resources of 1.9 billion tons containing about 0.3% cadmium. Zinc-bearing coals of the Central United States and Carboniferous age coals of other countries also contain large subeconomic resources of cadmium.

Substitutes: Lithium-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.

^eEstimated. E Net exporter. — Zero.

¹Cadmium metal and oxide 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 only of unwrought metal and metal powders (Tariff no. 8107.20.0000).

⁵Belgium halted byproduct production of cadmium at Overpelt in 1992 and Balen in 2002.

⁶No tariff for Australia, Canada, and Mexico for items shown.

⁷See Appendix C for definitions.

⁸Reserves and reserve base estimates for Australia were revised downward based on new data published by Geoscience Australia in 2006.