

## CADMIUM

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

**Domestic Production and Use:** Two companies in the United States produced cadmium metal in 2007. One company, operating in Tennessee, recovered cadmium as a byproduct of zinc leaching from roasted sulfide concentrates. The other company, located in Pennsylvania, thermally recovered cadmium metal from spent nickel-cadmium (NiCd) batteries and other cadmium-bearing scrap. A third company located in Illinois, which historically recovered byproduct cadmium from zinc concentrates, shuttered in 2006 owing to recent mine closures and the increasing cash price of zinc concentrate. As a result of the closure, U.S. refinery production in 2007 was withheld in order to protect the company proprietary data of the remaining two operations. Based on the average New York dealer price, U.S. cadmium metal consumption was valued at about \$3.62 million in 2007. Cadmium use in batteries amounted to an estimated 83% of apparent consumption. The remaining 17% was distributed as follows: pigments, 8%; coatings and plating, 7%; stabilizers for plastics, 1.2%; and nonferrous alloys, photovoltaic devices, and other, 0.8%.

<b>Salient Statistics—United States:</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007<sup>e</sup></b>
Production, refinery <sup>1</sup>	1,450	1,480	1,470	700	W
Imports for consumption, metal only	74	102	207	179	172
Imports for consumption, metal, alloys, scrap	112	263	288	180	174
Exports of metal, alloys, scrap	615	154	686	483	304
Shipments from Government stockpile excesses	146	—	—	—	—
Consumption of metal, apparent	1,020	1,840	699	561	441
Price, metal, average annual <sup>2</sup>					
Dollars per kilogram	1.31	1.20	3.30	2.98	8.21
Dollars per pound	0.59	0.55	1.50	1.35	3.72
Stocks, yearend, producer and distributor <sup>3</sup>	1,430	1,170	1,540	1,380	W
Net import reliance <sup>4</sup> as a percentage of apparent consumption	E	20	E	E	E

**Recycling:** Cadmium is recovered from spent consumer and industrial 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.

**Import Sources (2003-06):** Metal:<sup>5</sup> Australia, 41%; Canada, 20%; China, 10%; Peru, 9%; and other, 20%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations<sup>6</sup></b>
		<b>12-31-07</b>
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.
Cadmium other	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 (approximately 50%) was produced in Asia and the Pacific—specifically China, Japan, and the Republic of Korea—followed by North America (20%), Central Eurasia (16%), and Europe (12.5%). Global primary cadmium production may increase in 2007 as the International Lead and Zinc Study Group forecast zinc concentrate production to increase by 9.4%. However, primary producers may opt to voluntarily cut back primary cadmium production. High zinc prices have recently allowed smelters to discard byproduct cadmium as hazardous waste rather than process it. Global secondary cadmium production accounts for approximately 19% of all refined cadmium production, and this percentage is expected to increase in the future.

## CADMIUM

NiCd battery production was the leading end use of cadmium, accounting for approximately 83% of global cadmium consumption. 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. Approximately 85% of the global NiCd battery market was concentrated in Asia. Japan alone constituted 35% of global NiCd battery sales. However, the percentage share of NiCd batteries in the rechargeable battery market has been on the decline since the mid-1990s. In 1996, NiCd batteries accounted for 56% of the rechargeable battery market. By 2006, that percentage had decreased to 18%. Global sales of NiCd batteries also decreased during 2006 by approximately 16% from that of 2005. However, demand for cadmium may increase owing to several new market opportunities for NiCd batteries, particularly in industrial applications. NiCd batteries currently power approximately 80% of battery electric vehicles in circulation and are also used as a source of power in a limited number of hybrid electric vehicles.

Concern over 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. The final effect of this legislation 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, Reserves, and Reserve Base:**

	Refinery production		Reserves <sup>7</sup>	Reserve base <sup>7</sup>
	2006	2007 <sup>e</sup>		
United States	700	W	43,000	67,000
Australia	400	390	66,000	260,000
Canada	1,710	2,100	23,000	84,000
China	3,000	3,400	99,000	280,000
Germany	640	640	—	8,000
India	450	500	21,000	49,000
Japan	2,290	2,100	—	—
Kazakhstan	2,000	2,000	41,000	89,000
Korea, Republic of	3,250	3,600	—	—
Mexico	1,400	1,600	21,000	39,000
Netherlands	570	570	—	—
Peru	420	420	54,000	87,000
Russia	1,100	1,210	12,000	37,000
Other countries	1,370	1,370	110,000	200,000
World total (rounded)	19,300	<sup>8</sup> 19,900	490,000	1,200,000

**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. Barium/zinc or calcium/zinc stabilizers can replace barium/cadmium stabilizers in flexible polyvinylchloride applications.

<sup>e</sup>Estimated. E Net exporter. W Withheld to avoid disclosing company proprietary data. — Zero.

<sup>1</sup>Cadmium metal and oxide produced as a byproduct of lead-zinc refining plus metal from recycling. Refinery production was revised based on new data from company surveys.

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

<sup>3</sup>Yearend stocks were revised based on new data from company surveys.

<sup>4</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>5</sup>Imports only of unwrought metal and metal powders (Tariff no. 8107.20.0000).

<sup>6</sup>No tariff for Australia, Canada, and Mexico for items shown.

<sup>7</sup>See Appendix C for definitions.

<sup>8</sup>Excludes U.S. refinery production.