CADMIUM

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

Domestic Production and Uses: Two companies, one in Illinois and one in Tennessee, recovered cadmium as a byproduct of the smelting and refining of zinc concentrates. A third company, in Colorado, had been recovering cadmium from other nonferrous sources, such as lead smelter baghouse dust, but halted operations in mid-1993. Based on the average New York dealer price, the output of primary metal in 1995 was valued at $5.3 million. The estimated consumption pattern included batteries, 65%; pigments, 14%; coatings and plating, 9%; stabilizers for engineering plastics and similar synthetic products, 9%; nonferrous alloys, 2%; and other including electrooptics, 1%.

Salient Statistics—United States:	1991	1992	1993	1994	1995[e]
Production, refinery	1,680	1,620	1,090	1,010	1,300
Imports for consumption, metal	2,040	1,960	1,420	1,110	1,040
Exports of metal, alloys, and scrap	448	213	38	1,450	1,050
Shipments from Government stockpile	—	—	185	209	450
Consumption, apparent	3,080	3,330	2,940	1,020	1,600
Price, average, dollars per pound, 99.95% purity in 5-short ton lots, New York dealer	2.01	0.91	0.45	1.13	1.84
Stocks, yearend, producer and distributor	835	868	582	439	540
Employment, smelter and refinery	190	190	195	125	125
Net import reliance[1] as a percent of apparent consumption	46	51	63	1	21

Recycling: Cadmium recycling has been practical only for nickel-cadmium batteries, some alloys, and dust from electric arc furnaces operated by the steel industry. The exact amount recycled is not known. In 1994, the U.S. steel industry generated more than 500,000 tons of electric furnace dust, typically containing 0.003% to 0.07% Cd. Seventeen States are in the process of setting up collection networks for recycling nickel-cadmium batteries.

Import Sources (1991-94): Metal: Canada, 39%; Mexico, 14%; Belgium, 12%; Germany, 8%; and other, 27%.

Tariff: Item	Number	Canada and Mexico 12/31/95	Most favored nation (MFN) 12/31/95	Non-MFN[2] 12/31/95
Cadmium sulfide	2830.30.0000	Free	3.1% ad val.	25% ad val.
Pigments and preparations based on cadmium compounds	3206.30.0000	Free	3.1% ad val.	25% ad val.
Unwrought cadmium; waste and scrap; powders	8107.10.0000	Free	Free	33¢/kg.

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

Government Stockpile:

Stockpile Status—9-30-95

Material	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposals Jan.-Sept. 95
Cadmium	2,020	243	2,020	338

Events, Trends, and Issues: Demand for rechargeable nickel-cadmium (Ni-Cd) batteries continues to grow in the Western World, although at a somewhat slower rate than in past years. More than 60% of cadmium consumed by Western countries now goes into batteries, making batteries the principal end use for the chemical element. Japan continues to be, by far, the largest refiner of cadmium and is also a net importer of cadmium metal. About 93% of the cadmium consumed by Japanese industry goes into batteries.

About 75% of the Ni-Cd batteries being produced by Western manufacturers are for cordless electronic equipment. The remaining 25% are used for industrial purposes, such as emergency power supplies for telephone exchanges and hospital operating rooms. This ratio could change dramatically if sales of electric vehicles (EV's) accelerate in the United States, the European Union, and Japan. Ni-Cd batteries could conceivably capture 30% of the midterm (2000-2005) EV battery market, but competition from nickel-metal hydride batteries may be intense because of environmental

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concerns about cadmium. Much of the present battery research is driven by the impending 1998 deadline requiring 2% of new vehicles sold in California to be emission free. The U.S. Advanced Battery Consortium, a partnership between domestic automobile manufacturers and the Electric Power Research Institute, is working with the U.S. Department of Energy to develop and evaluate advanced battery systems for EV's. The Electric Transportation Coalition, the Electric Vehicle Association of the Americas, and several other support groups are also helping to make affordable EV's a reality. In November 1995, a Swedish public-service organization ordered 150 EV's from a French automobile manufacturer. France is planning to have 100,000 EV's on its highways by the year 2000.

On May 11, 1995, the U.S. Environmental Protection Agency published new, simplified regulations governing the collection and management of spent Ni-Cd batteries and several other widely generated hazardous wastes. The new regulations are designed to encourage environmentally sound recycling of Ni-Cd batteries and keep them out of the municipal waste stream. The bulk of the batteries currently being collected go to a nickel and chromium recovery facility in western Pennsylvania. There, the batteries are crushed, blended with furnace dusts from stainless steel plants, and then smelted in an electric arc furnace. The Pennsylvania plant recently acquired the necessary refining equipment and technology to produce cadmium sticks from the lead-zinc-cadmium dust that collects in the plant's baghouse.

Domestic demand for pigments based on cadmium sulfide and cadmium sulfoselenide reportedly is only one-eighth as large as it was in 1988. The U.S. market for cadmium pigments has shrunk dramatically because of the adoption of stricter environmental regulations and the increased availability of alternative pigments. Both suppliers and consumers are concerned about recyclability and potential liability. Further substitution, however, is becoming increasingly difficult. The alternatives still cannot match many of the properties of cadmium pigments (e.g., color brightness, opacity, heat and light stability, etc.) that have made them popular for decades. Replacement of key cadmium pigments by organic substitutes is not straightforward, especially in applications that require high temperature or pressure processing. Many manufacturers of polyvinylchloride continue to use cadmium-bearing stabilizers to keep their products from degrading when exposed to heat or sunlight. The most popular stabilizers are mixtures of cadmium and barium organic salts (e.g., stearate).

The price of cadmium metal plummeted between 1990-93, bottoming out at an alltime low of $0.38 to $0.48 per pound on June 10, 1993. The collapse was driven by global recessionary forces, loss of markets due to environmental concerns, and the introduction of stricter Federal occupational exposure standards in 1992. The price has partially recovered since 1993 and stood at $2.05 to $2.20 per pound on Nov. 24, 1995.

World Refinery Production, Reserves, and Reserve Base:

	Refinery production		Reserves[3]	Reserve base[3]
	1994	1995[e]		
United States	1,010	1,300	70,000	210,000
Australia	910	950	55,000	150,000
Belgium	1,560	1,600	—	—
Canada	2,130	2,300	80,000	170,000
Germany	1,120	1,200	6,000	8,000
Japan	2,630	2,800	10,000	15,000
Mexico	646	700	35,000	40,000
Other countries	8,110	8,000	280,000	380,000
World total (rounded)	18,100	18,900	540,000	970,000

World Resources: Estimated world resources of cadmium were about 6 million tons based on zinc resources containing about 0.3% cadmium. The zinc-bearing coals of the midcontinental United States and Carboniferous-age coals of other countries also contain large potential resources of cadmium.

Substitutes: Coatings of zinc or vapor-deposited aluminum can substitute for cadmium in some plating applications. However, cadmium is still required in situations where the surface characteristics of the coating are critical (e.g., fasteners for aircraft). Cerous sulfide (Ce_2S_3) is being evaluated as an alternative to some of the red, cadmium-based pigments used to color plastics.

[e]Estimated.

[1]Defined as imports - exports + adjustments for Government and industry stock changes.

[2]See Appendix B.

[3]See Appendix C for definitions.