



# 2008 Minerals Yearbook

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## CADMIUM [ADVANCE RELEASE]

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# CADMIUM

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In 2008, estimated cadmium metal production in the United States was 777 metric tons (t), 6% higher than that of 2007 (table 1). Apparent consumption of cadmium was 550 t, a 6% decrease from that of the previous year. Cadmium metal (including alloys, powders, and waste and scrap) was primarily exported to China (75%), Canada (12%), and Israel (8%) (table 3). Canada (32%), Australia (26%), Mexico (20%), and Peru (13%) supplied the bulk of cadmium metal imported into the United States (table 4). The average annual New York dealer price of cadmium metal in 2008 declined by 22% from that of 2007 to \$5.92 per kilogram (\$2.69 per pound).

In 2008, global primary production of cadmium increased to 19,600 t (table 5). Most of the world's primary cadmium was being produced in Asia and the Pacific—specifically China, Japan, and the Republic of Korea—followed by Central Europe and Eurasia, North America, and Western Europe. Global secondary cadmium production accounted for approximately 20% of all cadmium metal production, and this percentage was expected to increase in the future. Most secondary metal was produced from nickel-cadmium (NiCd) battery recycling. There were three major NiCd collection and recycling programs in the world—the Rechargeable Battery Recycling Corp. (RBRC) program in the United States and Canada, the Battery Association of Japan program, and the CollectNiCad program in Europe.

According to data published by the World Bureau of Metal Statistics (WBMS), world refined cadmium consumption in 2008 increased by 3% from that of 2007. Leading consumers of refined cadmium included—in descending order of quantity—China, Belgium, and Japan. NiCd battery production continued to be the leading end use of cadmium, accounting for the majority of global cadmium consumption. Other significant end uses of cadmium included alloys, anticorrosive coatings, pigments, polyvinylchloride stabilizers, and semiconducting compounds for solar cells. 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 because of environmental and health concerns. Most of the NiCd battery market was concentrated in Asia. Cadmium metal is sold in several shapes and forms, which are used for different types of consumption. Slabs or sticks are commonly consumed for alloys; balls and spheres for plating; and flakes, powder, or sticks for chemicals and pigments (World Bureau of Metal Statistics, 2009, p. 37).

## Production

**Mine production.**—Data on domestic mine production of cadmium were not collected by the U.S. Geological Survey (USGS). Primary cadmium is generally recovered from zinc

concentrates. The cadmium content of typical zinc ores ranges from 0.2% to 0.3%. Sphalerite (ZnS), the most economically significant zinc mineral, is commonly impure; cadmium will often substitute for zinc in the crystal lattice. The cadmium mineral greenockite (CdS) is frequently associated with weathered sphalerite and wurtzite, but usually at microscopic levels. In 2008, zinc concentrate producing States were Alaska, Idaho, Missouri, Montana, New York, Tennessee, and Washington.

**Metal production.**—Domestic metal production data were collected by the USGS from a voluntary survey on production of cadmium metal and compounds. In 2008, cadmium metal was produced in three States—Ohio (Toxco, Inc.'s Lancaster facility), Pennsylvania [The International Metals Reclamation Co., Inc. (INMETCO), Ellwood City], and Tennessee (Nyrstar NV's Clarksville facility).

**Primary.**—Clarksville [owned and operated by Nyrstar (Balen, Belgium)] is an electrolytic zinc refinery located along the Cumberland River in Montgomery County, TN, 80 kilometers (km) northwest of Nashville. The complex's main products were Special High Grade Zinc and galvanizing alloys, and byproducts included cadmium metal, intermediate copper cementate, leach product, sulfuric acid, and synthetic gypsum. Cadmium-bearing zinc concentrates were partially sourced from the recently reopened Tennessee Valley zinc mines. Remaining concentrates were imported. Nyrstar reported a 3% increase in zinc production at Clarksville in 2008 compared with that of 2007 owing to the increased use of secondary feedstock, the processing of excess calcine originating from the company's Aubry, France, smelter, and an increase in cell house throughput (Nyrstar NV, 2009, p. 18).

**Secondary.**—INMETCO (a wholly owned subsidiary of Vale Inco Ltd., Canada) produced secondary cadmium metal (ingot and shot) at its metals recovery facility in Ellwood City. The company was established in 1978 to process stainless steel wastes and then expanded in December 1995 to recycle NiCd batteries. The cadmium recovery plant thermally recovered cadmium from both large industrial and portable consumer NiCd batteries in eight cadmium retort furnaces. The bulk of the cadmium metal produced was sold back to battery manufacturers. Chromium and nickel were also reclaimed in the recovery process as a ferrous remelt alloy for stainless steel production. In addition to NiCd batteries, INMETCO processed alkaline, lithium, magnesium, nickel chloride, nickel iron, nickel metal hydride, and zinc carbon batteries.

Toxco's (Anaheim, CA) recycling operations in Lancaster also produced secondary cadmium metal in the form of ingots. Cadmium was recovered from NiCd batteries in 12 cadmium retort furnaces, each with a 550-pound (249-kilogram) capacity. Nickel-iron cells were also produced during the recycling process.

## Consumption

**Coatings and plating.**—Cadmium coatings and plating can be applied to certain metals to prevent their corrosion. The amount of cadmium consumed for coatings and plating has decreased domestically over the past several decades as cadmium-plated parts were phased out of motor vehicles. However, cadmium coatings are still used by the aerospace industry and military for some critical applications where coating substitution may compromise operational safety; the metal is commonly used to plate fasteners in aircraft landing gear and parachutes owing to a combination of properties not present in other anticorrosive coatings.

**Nickel-cadmium batteries.**—Reactions within a NiCd rechargeable battery occur between the nickel compounds at the positive electrode and between the cadmium compounds at the negative electrode. NiCd batteries have a high number of charge-discharge cycles, a high rate of energy discharge, and a wide operating temperature. They power portable consumer electronics (primarily power tools) and provide emergency backup power for industrial applications and aircraft electrical systems.

Domestically, NiCd batteries were thought to have been produced at six facilities operated by four battery manufacturing companies. Globally, leading NiCd battery manufacturers included BYD Co., Ltd. (China), Matsushita Electric Industrial Co., Ltd. (Japan) (renamed Panasonic Corp. on January 10), and Sanyo Electric Co., Ltd. (Japan). 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 in cellular telephones and laptops owing to their high energy density. However, NiCd batteries have a cost advantage compared with other battery chemistries and are still favored for use in less expensive consumer appliances and electronics.

Industrial-sized NiCd batteries could potentially be used to store energy produced by certain on-grid solar or wind systems. About 2% of the Nation's power generation is currently from solar cells and wind farms. If this percentage were to increase to more than 10%, mass energy storage may be required for load leveling. Peak energy could be stored in a battery storage system, from which it would be later dispatched during periods of high electricity demand. NiCd batteries may be a favored battery chemistry for this use owing to their stability in offshore and harsh weather environments.

**Pigments.**—Cadmium pigments are inorganic and based on cadmium sulfide, which is golden yellow in color. The increased replacement of zinc or mercury for cadmium and selenium for sulfur forms the spectrum of cadmium pigments that range in color from bright yellow to maroon. Cadmium pigments are predominantly used to color plastics that are processed at higher temperatures; the pigments are able to withstand the elevated temperatures without degrading.

**Solar cells.**—Cadmium telluride (CdTe) flexible thin-film solar cells are an alternative to traditional crystalline silicon solar cells and are practical for commercial rooftop applications and large-scale, ground-mounted utility systems. CdTe photovoltaic cells were considered a safe, environmentally

friendly application for cadmium; the cadmium would remain contained and recyclable. CdTe cells contain on average 7 grams (g) of cadmium per square meter. This equates to 70 g of cadmium per kilowatt of electric power produced, assuming the cells are 10% efficient. Companies involved in developing CdTe thin-film technology within the United States were Ascentool, Inc., AVA Solar, Inc., Canrom Photovoltaics, Inc., China Nuvo Solar Energy, First Solar, Inc., Primestar Solar, Inc., Solar Fields LLC, and Zia Watt Solar (Fthenakis, 2003; Ullal and von Roedern, 2007).

## Recycling

Although NiCd battery recycling rates have increased and the consumption of NiCd batteries has decreased in the United States, only a small fraction of cadmium was recycled compared with the total amount of cadmium contained in all retired NiCd batteries for a given year. The remaining, unrecycled contained cadmium was either discarded as municipal solid waste or remained in temporary storage—for example, household storage or industry stockpiles (D.R. Wilburn, physical scientist, U.S. Geological Survey, unpub. data, September 2006).

Established when INMETCO began cadmium recycling in 1995, RBRC has organized a multifaceted, national rechargeable battery collection and recycling program to help manufacturers and consumers comply with various State laws and regulations regarding rechargeable battery disposal or recycling. The program was financed with proceeds from licensing its seal of approval to individual companies involved in the importation, manufacturing, and distribution of rechargeable batteries or battery-operated products. The RBRC recycling program, Call2Recycle, facilitates uniform battery labeling, removability from appliances, a national network of collection systems, regulatory relief to facilitate battery collection, and widespread publicity to encourage public participation. To increase participation, RBRC has undertaken an extensive public education campaign and has established numerous collection sites throughout the United States and Canada. In 2008, RBRC collected 3,150 t of rechargeable batteries, a 10% increase from that of 2007. RBRC attributed the increase to expanding its collection program to include nickel-zinc batteries and new partner initiatives that raised public awareness and participation (Rechargeable Battery Recycling Corp., 2009).

Launched by Toxco in 2003, The Big Green Box program is a privately sponsored battery collection system. Program participants purchase a United Nations-approved box for collecting disposable and rechargeable batteries and portable battery-operated electronic devices. Shipping and recycling fees are included in the purchase cost of the box. When the box is returned to a receiving facility, the batteries are separated by chemistry and sent for recycling.

## Prices

Platts Metals Week publishes a weekly and monthly New York [NY] dealer price for cadmium (minimum 99.95% purity) in dollars per pound. The 2008 average New York dealer price for cadmium was \$5.92 per kilogram (\$2.69 per pound), 22% less than the average price in 2007. Average monthly New

York dealer prices rose through the first 4 months of the year—beginning in January at \$6.66 per kilogram (\$3.02 per pound) and reaching a high in April at \$7.94 per kilogram (\$3.60 per pound)—then declined sharply through December to \$2.65 per kilogram (\$1.20 per pound).

## World Review

In 2008, global primary production of cadmium was 19,600 t. Most of the world's primary cadmium (approximately 53%) was being produced in Asia and the Pacific (primarily China, Japan, and the Republic of Korea), with Central Europe and Eurasia (19%), North America (19%), and Western Europe (6%) following.

Global secondary cadmium production was thought to have accounted for approximately 20% of all cadmium metal production, and this percentage was expected to increase in the future. Most secondary metal was produced at NiCd battery recycling facilities in Asia, Europe, and the United States. In Japan, NiCd battery recyclers included Kansai Catalyst Co., Ltd., Mitsui Mining and Smelting Co., Ltd., and Toho Zinc Co., Ltd. In Europe, NiCd battery recycling took place at Accurec GmbH's facility in Germany, Saft AB's plant in Sweden, and Societe Nouvelle D'Affinage des Metaux's two recycling facilities France. Spent NiCd batteries were supplied to the recycling facilities through various global battery collection schemes. There were three major NiCd battery collection programs in the world—the RBRC program in the United States and Canada, the Battery Association of Japan program, and the CollectNiCad program in Europe (Hugh Morrow, International Cadmium Association, unpub. data, 2007).

The WBMS published data on global consumption of primary cadmium. Consumption in 2008 increased by 3% compared with that of the previous year. Asia (48%) was the leading consuming region, followed by Europe (45%) and the Americas (6%). By country, China accounted for the most cadmium consumption (32%), followed closely by Belgium (30%) and Japan (12%) (World Bureau of Metal Statistics, 2009, p. 36).

**Australia.**—Most of the cadmium metal produced domestically was exported; a small amount was consumed in the country by specialized electroplating industries. Nyrstar's Hobart zinc smelter, in Tasmania, produced cadmium metal from cadmium-bearing zinc concentrates sourced from OZ Minerals Ltd.'s Century and Rosebery Mines.

Sun Metals Corporation Pty. Ltd.'s (a subsidiary of Korea Zinc Co., Ltd.) zinc refinery near Townsville, North Queensland, had the capacity to produce 1,000 metric tons per year (t/yr) of cadmium cake (containing 75% to 80% cadmium). Sun Metals was thought to have exported most of the cadmium cake to Korea Zinc's Onsan zinc-lead refinery in the Republic of Korea, where it was refined into metal (Park, undated, p. 5).

**Belgium.**—Belgium was a significant consumer of refined cadmium. Most of this consumption took place at Floridienne Chimie S.A.'s plant in Ath for the production of cadmium compounds (carbonate, nitrate, and oxide) and powder, which were then exported out of the country to downstream consumers.

**Brazil.**—Votorantim Metais Ltda.'s (Sao Paulo, Brazil, a unit of Grupo Votorantim) Juiz de Fora zinc smelter in Minas Gerais was the sole producer of refined cadmium in Brazil.

**Canada.**—Teck Cominco Ltd. produced refined cadmium at its metallurgical complex at Trail. Refined zinc and lead metal were the main products produced at Trail along with a number of byproducts that included copper compounds, germanium dioxide, gold, indium, silver, and various sulfur products. The cadmium plant at Trail was constructed in 1991 to handle the increased cadmium input from the Red Dog Mine in Alaska and can produce up to 1,400 t/yr of refined cadmium. Cadmium metal products, which were mostly consumed by NiCd battery manufacturers, included balls, billets, and sticks. Teck Cominco also produced cadmium chemicals and continuously cast cadmium sheet. Cadmium sheet is commonly used to shield radiation measurement and control devices from slow neutrons. HudBay Minerals Inc.'s (Winnipeg, Manitoba) copper smelting and zinc refining operations in Flin Flon, Manitoba, also produced byproduct cadmium metal. Xstrata plc, under the operating division Xstrata Copper Canada, produced cadmium at the Kidd Creek Metallurgical complex near Timmins, Ontario (Teck Cominco Ltd., undated, p. 13).

**China.**—On August 1, China canceled the 5% export tax rebate on cadmium products [Harmonized Tariff Schedule (HTS) code 8107.90.000] and nickel-cadmium batteries (HTS code 8507.30). The rebate for cadmium powder and scrap had already been eliminated. The battery industry, however, was thought to have been prepared for a possible rebate removal since early in the year; in February, the Ministry of Environmental Protection produced a list of 141 products that were considered environmental hazards, which included nickel-cadmium cells. The ministry suggested that export rebates be removed for 39 of these products (Metal-Pages Ltd., 2008; Shen, 2008).

**India.**—Hindustan Zinc Ltd. (HZL) (Udaipur) produced cadmium metal at the Chanderiya lead-zinc smelter complex, Debari zinc smelter, and Vizag zinc smelter. The cadmium production rate at Chanderiya was reported to have been reduced by 40% to 7 to 8 metric tons per month in August owing to scheduled maintenance at the smelter. During the financial year ending March 31, 2008, HZL's cadmium metal production capacity was 833 t/yr, an increase of 9% from that of the previous financial year. The company also continued carrying out a research and development project that involved recovering cadmium metal from hot gas precipitator dust generated at Chanderiya (Hindustan Zinc Ltd., 2008, p. 52, 100; Leahy, 2008a).

**Korea, Republic of.**—Korea Zinc was one of the leading suppliers of cadmium metal to China. Production capacity of refined cadmium at the company's leading smelter, the Onsan zinc-lead refinery in Kyoung Nam Province, was approximately 3,000 t/yr. Cadmium was also produced at Young Poong Corp.'s (Seoul) Sukpo zinc refinery in the form of sticks. Cadmium production capacity at Sukpo was 805 t/yr (Korea Zinc Co., Ltd., 2007, p. 23; Young Poong Corp., 2009).

**Mexico.**—Refined cadmium in Mexico was produced mainly at Industrias Penoles S.A. de C.V.'s Met-Mex metallurgical complex in Torreon (in the form of balls and sticks) and at Grupo Mexico S.A. de C.V.'s electrolytic zinc refinery in San Luis Potosi (in the form of ingots, minijumbos, spheres, and sticks). In 2008, Met-Mex's cadmium production declined by



10% from that of 2007 to 887 t, and cadmium production at San Luis Potosi remained about level at 647 t. Cadmium-bearing zinc concentrates treated at San Luis Potosi were sourced from Grupo Mexico's mines, principally the Charcas zinc mine. About 60% of the zinc concentrates processed at Met-Mex originated from Industrias Penoles' mines (Southern Copper Corp, 2009, p. 62–63).

**Peru.**—Cadmium metal was produced at Votorantim's Cajamarquilla zinc refinery and at Doe Run Peru's (Lima) La Oroya metallurgical operations. Cajamarquilla can produce about 430 t/yr of cadmium (Harris, 2007).

**Poland.**—Zinc metal producer Huta Cynku Miasteczko Slaskie has been producing cadmium since mid-2000 and was the only cadmium producer in Poland. In August, the company began processing secondary materials—including Waelz oxides and electric arc furnace (EAF) dust—along with zinc concentrates to reduce costs. Huta Cynku ultimately planned to completely switch its feedstock to secondary materials within the next 2 years. Cadmium can be recovered from EAF dust (Leahy, 2008b).

**Russia.**—Cadmium metal in Russia was produced at Chelyabinsk Zinc Plant OJSC's (Chelyabinsk) zinc refinery and Ural Mining and Metallurgy Company's (Sverdlovsk) Electrozinc lead-zinc refinery. Chelyabinsk's cadmium production increased by 6% in 2008 from that of 2007 to 592 t (Chelyabinsk Zinc Plant OJSC, 2009).

## Outlook

Concern over cadmium's toxicity has spurred various legislative efforts, especially in the European Union, to restrict the use of cadmium in most of its end-use applications. However, cadmium-containing residues will continue to be produced as a byproduct from the zinc smelting process regardless of cadmium demand. If the applications and markets for cadmium continue to decline, excess byproduct cadmium may need to be permanently stockpiled and managed, similar to the situation the United States currently faces with mercury.

However, demand for cadmium may increase owing to several new market opportunities for NiCd batteries, particularly in industrial applications. NiCd batteries power some battery electric vehicles in circulation and are also used as a source of power in a limited number of hybrid electric vehicles. NiCd batteries have also been used to support various renewable energy installations owing to their long service life, low maintenance, and stability in harsh weather environments. A small island community in Norway relies completely on renewable energy that is backed up by NiCd batteries. The community consumes energy generated by a wind power and hydrogen storage unit that is buffered by a 37-kilowatt-hour NiCd battery system. NiCd batteries were also used as a buffer in transportable, renewable hybrid-power systems developed to generate electricity in remote locations and underdeveloped regions.

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TABLE 1  
SALIENT CADMIUM STATISTICS<sup>1,2</sup>

		2004	2005	2006	2007	2008
United States:						
Production of metal <sup>3,4</sup>	metric tons	1,480	1,470	723	735	777
Shipments of metal by producers <sup>4,5</sup>	do.	1,410	1,680	833	692	774
Exports of metal, alloys, scrap	do.	154	686	483	424	421
Imports for consumption, metal, alloys, and scrap	do.	263	288	180	316	197
Apparent consumption of metal	do.	1,840	699	568	585	550
Price, average, New York dealer <sup>6</sup>	dollars per pound	0.55	1.50	1.35	3.45	2.69
Do. <sup>6</sup>	dollars per kilogram	1.20	3.30	2.98	7.61	5.92
World, refinery production	metric tons	18,600 <sup>r</sup>	20,100 <sup>r</sup>	19,900	19,400 <sup>r</sup>	19,600 <sup>e</sup>

<sup>e</sup>Estimated. <sup>r</sup>Revised. Do., do. Ditto.

<sup>1</sup>Data are rounded to no more than three significant digits, except prices.

<sup>2</sup>Cadmium content.

<sup>3</sup>Primary and secondary cadmium metal. Includes equivalent metal content of cadmium sponge used directly in production of compounds.

<sup>4</sup>Partially estimated.

<sup>5</sup>Includes metal consumed at producer plants to make oxide and other cadmium compounds.

<sup>6</sup>Price for 1- to 5-short ton lots of metal having a minimum purity of 99.95% (Platts Metals Week).

TABLE 2  
SUPPLY AND APPARENT CONSUMPTION OF CADMIUM METAL<sup>1,2</sup>

(Metric tons)

	2004	2005	2006	2007	2008
Producer stocks, January 1 <sup>3</sup>	1,430	1,170	1,540	1,400	1,460
Production <sup>3</sup>	1,480	1,470	723	735	777
Imports for consumption, metal, alloys, and scrap	263	288	180	316	197
Total supply	3,170	2,930	2,450	2,450	2,430
Exports of metal, alloys, scrap	154	686	483	424	421
Producer stocks, December 31 <sup>3</sup>	1,170	1,540	1,400	1,440	1,460
Consumption, apparent <sup>4</sup>	1,840	699	568	585	550

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Excludes supply and apparent consumption of cadmium sulfide, cadmium telluride, and related cadmium chemicals.

<sup>3</sup>Partially estimated. Beginning stocks may not equal ending stocks of the prior year owing to inventory adjustments.

<sup>4</sup>Total supply minus exports and yearend stocks.

TABLE 3  
U.S. EXPORTS OF CADMIUM PRODUCTS, BY COUNTRY AND TYPE<sup>1</sup>

	2007		2008	
	Quantity (kilograms)	Value	Quantity (kilograms)	Value
<b>Cadmium (Cd) metal:<sup>2</sup></b>				
Belgium	27,200	\$117,000	--	--
Canada	14,800	121,000	48,500	\$270,000
China	280,000	1,410,000	314,000	1,350,000
Colombia	1,250	13,000	2,390	26,100
Denmark	--	--	4,120	10,000
Germany	86	125,000	3,310	174,000
Honduras	7,870	19,500	--	--
Israel	14,800	92,300	35,300	212,000
Japan	4,030	198,000	--	--
Netherlands	68,900	602,000	--	--
Singapore	4,970	44,400	6,450	58,700
United Kingdom	108	5,210	5,950	97,700
Other	402 <sup>†</sup>	73,500 <sup>†</sup>	1,160	76,300
Total	424,000	2,820,000	421,000	2,270,000
Of which:				
Unwrought and powder	270,000	1,510,000	295,000	1,370,000
Other	154,000	1,310,000	126,000	901,000
<b>Cadmium sulfide, gross weight:</b>				
France	10,800	5,640	--	--
Germany	103,000	109,000	--	--
Hong Kong	--	--	5,000	2,600
India	--	--	16,500	8,590
Israel	11,900	6,160	--	--
Italy	--	--	24,500	12,800
Malaysia	9,950	5,180	171,000	89,000
Mexico	--	--	10,900	5,670
United Kingdom	--	--	13,200	6,860
Total	135,000	126,000	241,000	125,000
Total, calculated Cd content	105,000	XX	188,000	XX
<b>Cadmium pigments:</b>				
Brazil	6,310	37,500	16,300	68,200
Canada	27,200	533,000	73,700	1,280,000
China	18,600	33,700	16,400	46,400
Colombia	79,400	306,000	33,200	139,000
Dominican Republic	136,000	234,000	138,000	215,000
Ecuador	4,180	62,700	128,000	264,000
France	19,400	70,500	--	--
Germany	24,000	56,900	47,500	202,000
Greece	44,000	65,600	--	--
Guatemala	188,000	317,000	77,000	126,000
Hong Kong	60,600	180,000	4,490	40,300
Jamaica	19,000	43,300	57,300	116,000
Japan	13,400	175,000	--	--
Mexico	251,000	1,120,000	458,000	2,230,000
Morocco	44,000	60,800	17,000	24,700
New Zealand	204,000	315,000	17,000	25,400
Spain	114,000	171,000	--	--
Switzerland	3,250	964,000	15,000	885,000
Turkey	--	--	3,410	110,000
United Kingdom	3,130	31,400	2,770	127,000
Other	106,000 <sup>†</sup>	396,000 <sup>†</sup>	86,700	342,000
Total	1,370,000	5,180,000	1,190,000	6,240,000

<sup>†</sup>Revised. XX Not applicable. -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes exports of cadmium in alloys (Schedule B 8107.90) and waste and scrap (Schedule B 8107.30).

Source: U.S. Census Bureau.

TABLE 4  
U.S. IMPORTS OF CADMIUM PRODUCTS, BY COUNTRY AND TYPE<sup>1</sup>

	2007		2008	
	Quantity (kilograms)	Value	Quantity (kilograms)	Value
<b>Cadmium (Cd) metal:<sup>2</sup></b>				
Australia	34,000	\$155,000	51,000	\$368,000
Belgium	5,400	140,000	17,200	449,000
Canada	25,600	958,000	63,400	4,220,000
China	22	5,700	--	--
France	--	--	33	25,400
Germany	20,100	122,000	68	7,990
Hong Kong	18,000	238,000	--	--
India	323	139,000	10	5,000
Japan	1	2,500	14	29,200
Malaysia	--	--	66	12,200
Mexico	193,000	208,000	40,000	312,000
Peru	20,000	144,000	25,000	194,000
Russia	--	--	2	18,000
Singapore	--	--	5	8,250
United Kingdom	1	2,110	--	--
<b>Total</b>	<b>316,000</b>	<b>2,120,000</b>	<b>197,000</b>	<b>5,650,000</b>
Of which:				
Unwrought and powder	315,000	1,880,000	153,000	5,090,000
Other	1,300	237,000	44,000	565,000
<b>Cadmium oxide:</b>				
Belgium	150,000	1,420,000	88,800	940,000
India	--	--	16,000	138,000
Japan	--	--	320	24,100
United Kingdom	--	--	7	5,870
<b>Total</b>	<b>150,000</b>	<b>1,420,000</b>	<b>105,000</b>	<b>1,110,000</b>
Total, calculated Cd content	131,000	XX	92,000	XX
<b>Cadmium sulfide, gross weight:</b>				
Canada	29,000	133,000	40,800	220,000
China	2	2,270	318,000	315,000
Germany	--	--	8	2,440
Russia	215,000	1,000,000	77,800	2,470,000
United Kingdom	1,350	9,840	1,820	35,100
<b>Total</b>	<b>245,000</b>	<b>1,150,000</b>	<b>439,000</b>	<b>3,040,000</b>
Total, calculated Cd content	191,000	XX	341,000	XX
<b>Cadmium pigments:</b>				
Belgium	--	--	10,900	188,000
Brazil	7,290	129,000	6,020	96,700
Canada	4,910	76,200	8,410	77,000
Finland	8,050	242,000	5,410	136,000
France	6,920	101,000	4,850	90,100
Germany	1,000	5,740	25,600	167,000
India	9,980	73,600	--	--
Japan	300	6,850	--	--
Mexico	--	--	241	3,590
Netherlands	--	--	45	2,820
Taiwan	1,000	2,800	500	3,080
United Kingdom	104,000	1,760,000	110,000	1,730,000
<b>Total</b>	<b>143,000</b>	<b>2,390,000</b>	<b>172,000</b>	<b>2,500,000</b>

XX Not applicable. -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes imports of cadmium in alloys [Harmonized Tariff Schedule of the United States (HTS) 8107.90] and waste and scrap (HTS 8107.30).

Source: U.S. Census Bureau.



TABLE 5  
CADMIUM: WORLD REFINERY PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2004	2005	2006	2007	2008 <sup>e</sup>
Argentina	39	3	6	6 <sup>r</sup>	6
Australia	347	358	329	351	330
Brazil <sup>4</sup>	187	200	141 <sup>r</sup>	200 <sup>e</sup>	200
Bulgaria	356	319	363 <sup>r</sup>	459 <sup>r</sup>	460
Canada <sup>5</sup>	1,880	1,727	2,090 <sup>r</sup>	1,388 <sup>r</sup>	1,300
China <sup>e</sup>	2,800	4,080	3,790	4,210 <sup>r</sup>	4,300
Germany <sup>e</sup>	640	640	640	400 <sup>r</sup>	400 <sup>e</sup>
India	489	409	457	583	599 <sup>6</sup>
Italy <sup>e</sup>	10	10	10	10	10
Japan	2,233	2,297	2,287	1,933	2,116 <sup>6</sup>
Kazakhstan	1,900	2,000	2,000	2,100	2,100
Korea, North <sup>e</sup>	200	200	200	200	200
Korea, Republic of	2,362	2,582	3,320	2,846 <sup>r</sup>	2,900
Mexico <sup>7</sup>	1,615	1,653	1,401	1,617	1,605 <sup>6</sup>
Netherlands	493	494	524	495	530
Norway	141 <sup>r</sup>	153 <sup>r</sup>	125 <sup>r</sup>	269 <sup>r</sup>	178 <sup>6</sup>
Peru	532	481	416	347 <sup>r</sup>	371 <sup>6</sup>
Poland	356	408 <sup>r</sup>	373 <sup>r</sup>	421 <sup>r</sup>	420
Russia	532	621	690	810	800 <sup>6</sup>
Ukraine <sup>e</sup>	25	25	25	25	25
United States <sup>5</sup>	1,480	1,470	723	735	777 <sup>6</sup>
Total	18,600 <sup>r</sup>	20,100 <sup>r</sup>	19,900	19,400 <sup>r</sup>	19,600

<sup>e</sup>Estimated. <sup>r</sup>Revised.

<sup>1</sup>This table gives unwrought production from ores, concentrates, flue dusts, and other materials of both domestic and imported origin. Sources generally do not indicate if secondary metal (recovered from scrap) is included or not; where known, this has been indicated by a footnote. Data derived in part from World Metal Statistics (published by World Bureau of Metal Statistics, Ware, United Kingdom) and from Metal Statistics (published jointly by Metallgesellschaft AG of Frankfurt am Main, Germany, and World Bureau of Metal Statistics). Cadmium is found in ores, concentrates, and/or flue dusts in several other countries, but these materials are exported for treatment elsewhere to recover cadmium metal; therefore, such output is not reported in this table to avoid double counting. This table includes data available through May 8, 2009.

<sup>2</sup>World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>3</sup>Romania, Thailand, and Uzbekistan may produce primary cadmium metal or oxide, but information is inadequate to make reliable estimates of output.

<sup>4</sup>Data for 2004 and 2005 are exports from Anuario Mineral Brasileiro (Departamento Nacional de Producao Mineral).

<sup>5</sup>Includes secondary.

<sup>6</sup>Reported figure.

<sup>7</sup>Excludes significant production of both cadmium oxide and cadmium contained in exported concentrates.