



# 2014 Minerals Yearbook

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## CADMIUM [ADVANCE RELEASE]

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# CADMIUM

By Amy C. Tolcin

**Domestic survey data and tables were prepared by Sheema Merchant, statistical assistant, and the world production table was prepared by Lisa D. Miller, international data coordinator.**

Refined cadmium was produced domestically by two companies. One company recovered cadmium as a byproduct of zinc leaching from roasted sulfide concentrates at a smelter in Tennessee, and the other company recovered secondary cadmium metal from recycled nickel-cadmium (NiCd) batteries at a facility in Ohio. Annual domestic production data for 2011–14 were withheld to avoid disclosing company proprietary data.

The United States reverted to being a net exporter of unwrought cadmium metal and powders in 2014 after becoming a net importer in 2013, with net exports totaling 65 metric tons (t) in 2014. Imports for consumption of unwrought cadmium decreased by 53% to 133 t in 2014 from those of 2013, whereas exports increased by 51% to 198 t (table 1). Cadmium metal was primarily exported to China (98%) (table 3), whereas Canada (77%) and Mexico (15%) supplied the majority of imports (table 4). The annual average Platts Metals Week New York dealer price of cadmium metal in 2014 increased slightly from that of 2013 to \$1.94 per kilogram (\$0.88 per pound) (table 1).

In 2014, estimated global primary production of cadmium, excluding U.S. production, was 22,400 t (table 6). Secondary cadmium was estimated to account for about 20% of all cadmium metal produced. Most secondary cadmium metal was recovered from recycling of NiCd batteries. Although detailed data on the global consumption of primary cadmium in 2014 were not available, NiCd battery production was thought to have continued to account for the majority of global cadmium consumption. Other end uses for cadmium included alloys, anticorrosive coatings, pigments, polyvinyl chloride (PVC) stabilizers, and semiconductors for solar cells. Cadmium metal is sold in several shapes and forms depending on end use: slabs or sticks are commonly consumed for alloys; balls and spheres for plating; and flakes, powder, or sticks for chemicals and pigments.

## Production

**Mine production.**—Domestic data on the recoverable cadmium content of zinc concentrates, the principal source of primary cadmium, were not available. The cadmium content of typical zinc concentrates ranges from 0.2% to 0.3%. In 2014, zinc-concentrate-producing States were Alaska, Idaho, Missouri, Tennessee, and Washington. Zinc concentrates from Alaska, Idaho, Missouri, and Washington were exported for processing. Concentrates from Tennessee were smelted and refined domestically in Tennessee and processed for byproduct cadmium recovery.

**Metal production.**—Domestic metal production data were collected by the U.S. Geological Survey (USGS) from a voluntary survey of cadmium metal and compounds production. In 2014, cadmium metal was produced at one primary smelter and one secondary smelter.

**Primary.**—Nyrstar NV's (Belgium) electrolytic zinc refinery in Clarksville, TN, produced zinc metal and several byproducts, including cadmium metal. Nyrstar's Tennessee Valley zinc mines supplied most of the zinc concentrate feed treated at Clarksville.

**Secondary.**—In December 2013, Horsehead Holding Corp. (Pittsburgh, PA) idled the cadmium metal recovery plant at its International Metals Reclamation Co. Inc. (INMETCO) metals recovery facility in Ellwood, PA, in order to reduce costs. The cadmium recovery plant previously processed large industrial and portable consumer NiCd batteries through eight retort furnaces to recover cadmium. Although the cadmium recovery plant was shuttered, Horsehead continued to recycle NiCd batteries through a modified process to produce nickel remelt alloys for stainless steel production. Spent NiCd batteries were secured from the Rechargeable Battery Recycling Corp. and through INMETCO's own collection programs (Horsehead Holding Corp., 2015, p. 4, 54).

Retriev Technologies Inc.'s (Anaheim, CA) battery recycling operations in Lancaster, OH, recovered cadmium metal in the form of ingot from consumer and industrial NiCd batteries.

## Consumption

Data on the domestic consumption of cadmium were not available. About 85% of the cadmium consumed globally was used in NiCd batteries, 10% in pigments, 4% in coatings, and 1% in various uses including alloys, solar cells, and stabilizers.

**Nickel-cadmium batteries.**—The NiCd battery industry was almost exclusively concentrated in Asia, and leading manufacturers included BYD Co., Ltd. (China) and Panasonic Corp. (Japan). Small portable batteries accounted for 80% of the cadmium consumed for the production of NiCd batteries and were used to power consumer electronics (commonly, power tools). Large industrial NiCd batteries accounted for the remaining 20% of consumption and were used predominantly for aeronautical and railway applications. In railway and transit systems, NiCd batteries were used to start locomotive engines and to power passenger cars and trackside signaling. In airplanes, NiCd batteries provided startup power for jet engines and emergency backup power for aircraft electrical systems. Airbus Group NV (Netherlands) announced plans to revert to using lithium-ion batteries from NiCd batteries in the production of its A350–900 aircraft beginning in 2016. Although the A350–900 was designed to use lithium-ion batteries, Airbus elected to use NiCd batteries on some of its first production jets following several incidents of lithium-ion batteries malfunctioning on Boeing Co.'s (Chicago, IL) 787 Dreamliner (Morrow, 2011, p. 10–11; Rothman, 2014).

**Pigments.**—Inorganic cadmium pigments are based on cadmium sulfide, which is golden yellow in color.

The replacement of zinc or mercury for cadmium and the substitution of selenium for sulfur forms the spectrum of cadmium pigments that range from bright yellow to maroon. Because the pigments were able to withstand elevated temperatures without degrading, cadmium pigments were predominantly used to color engineering plastics that were processed at high temperatures.

**Coatings and plating.**—Cadmium anticorrosive coatings were used by the aerospace industry and military for some critical applications where coating substitution might compromise operational safety. The metal was commonly used to plate fasteners in aircraft landing gear and parachutes owing to a combination of properties not available from other coatings.

**Solar.**—Cadmium was consumed for the production of cadmium telluride (CdTe), a semiconducting compound used in thin-film photovoltaics. First Solar Inc. (Tempe, AZ) was the leading producer of CdTe-based solar modules with manufacturing locations in Perrysburg, OH, and Kulim, Malaysia. First Solar planned to restart four idle production lines at its Malaysia plant and add two new lines at its Ohio facility in 2015 owing to increased market demand for solar cells (First Solar Inc., 2015, p. 5). 5N Plus Inc. (Canada) was the sole supplier of CdTe to First Solar (5N Plus Inc., 2014).

## Prices

In 2014, the average Platts Metals Week New York dealer price for 99.95%-minimum-purity cadmium was \$1.94 per kilogram (\$0.88 per pound), slightly more than the average price in 2013. This price reflected the average price of cadmium traded on a spot basis; however, most cadmium produced was sold through long-term contracts. Average monthly New York dealer prices remained unchanged at \$0.88 per pound from January through October. Aside from a notable increase in 2010, U.S. cadmium prices have generally trended downwards from 2007 to 2012, before leveling off at about the current value (fig. 1).

## World Industry Structure

**Primary production.**—Global cadmium production totaled 22,400 t in 2014 (table 6), a slight increase from the amount produced in 2013. Most (62%) of the world's refined cadmium was produced in Asia (Australia, China, India, Japan, North Korea, and the Republic of Korea), followed by 22% in Europe and Central Eurasia (Bulgaria, Germany, Kazakhstan, the Netherlands, Norway, Poland, Russia, and Uzbekistan), 12% in North America (Canada and Mexico), and 4% in South America (Argentina, Brazil, and Peru). Major global producers of primary cadmium are listed in table 5.

**Secondary production.**—Globally, secondary cadmium production was thought to have accounted for approximately one-fifth of all cadmium metal produced. Most secondary metal was recovered at NiCd battery recycling facilities in Asia, Europe, and the United States. In Asia, NiCd battery recyclers included Kansai Catalyst Co., Ltd. (Japan), KOBAR Ltd. (Republic of Korea), and Nippon Recycle Center Corp. (Japan). 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 in France.

**Consumption.**—Based on production and trade data, China was the leading consumer of cadmium, followed by, in descending order of quantity, India, Belgium, and Japan. Most of the NiCd battery manufacturing industry was located in China and, to a lesser degree, in Japan. China's production of NiCd batteries has decreased significantly from 2009 to 2013 (latest year for which data were available) owing to the increased regulation of NiCd batteries in Europe and competition from other battery chemistries. In 2013, China produced 347 million NiCd batteries compared with 990 million units in 2009, whereas production of lithium-ion batteries reached 2.9 billion units in 2013 compared with 1.45 billion units in 2009 (Zhao, 2015). China imported a large percentage of the global cadmium produced outside of China; 2014 imports of unwrought cadmium totaled 10,000 t, equivalent to about 65% of global production outside of China, and were 5% less than the amount imported in 2013. Leading import sources included the Republic of Korea (44%), Kazakhstan (13%), Canada (7%), and Mexico (7%) (Metal-Pages, 2015). Japan's production of rechargeable dry alkaline batteries (including NiCd batteries) decreased by 30% in 2014 from that of 2013 to 101 million units owing to the increased use of lithium-ion and nickel-metal hydride batteries in consumer products that were traditionally powered by NiCd batteries. Japan's production of rechargeable dry alkaline batteries has decreased for at least the past 5 years (Ministry of Economy, Trade, and Industry, 2015, p. 325). In Belgium, Aurea SA (France, formerly, Floridienne Chimie S.A.), an intermediate processor of cadmium, accounted for almost all of the country's cadmium consumption for the production of cadmium salts, which were then exported to downstream consumers in Asia. It was estimated that Aurea consumed up to 7,200 metric tons per year (t/yr) of refined cadmium (Metal Bulletin, 2009). According to UN Comtrade, net imports of unwrought cadmium into Belgium totaled 1,830 t in 2014, 55% less than net imports in 2013 (United Nations Statistics Division, 2015).

## World Review

**Australia.**—Nyrstar's Hobart zinc smelter in Tasmania produced an estimated 300 to 400 t/yr of cadmium metal from zinc concentrates sourced from zinc-lead mines in Australia.

**Belgium.**—Aurea purchased cadmium chemicals producer Floridienne Chimie in late June after Floridienne went into administration under the Belgian judicial reorganization proceedings to avoid bankruptcy. Located in Ath, Floridienne Chimie was 60% owned by Floridienne Group and 40% owned by the regional government. Aurea planned to continue producing cadmium and zinc salts and may resume manufacturing PVC stabilizers after upgrading the metallurgical facilities (Sparks, 2014).

**Canada.**—Teck Resources Ltd.'s metallurgical complex in Trail, British Columbia, had the capacity to produce up to 1,400 t/yr of refined cadmium. Cadmium metal products included balls, billets, and sticks for NiCd battery manufacturing and continuously cast cadmium sheet for radiation shielding.

Teck also produced cadmium chemicals. HudBay Minerals Inc.'s copper smelting and zinc refining operations in Flin Flon, Manitoba, also produced cadmium metal. Most of the cadmium produced in Canada was exported for processing.

**India.**—Hindustan Zinc Ltd. (HZL) produced cadmium metal at its Chanderiya lead-zinc smelter complex and Debari zinc smelter. The two plants had a combined cadmium production capacity of 695 t/yr. HZL produced cadmium in the form of rods in purities of 99.95% cadmium at Debari and 99.99% cadmium at Chanderiya. Binani Zinc Ltd. also produced a small amount of cadmium at its zinc plant in Binanipuram. Production capacity was 80 t/yr of cadmium (Indian Bureau of Mines, 2015).

**Japan.**—In 2013 (latest year for which data were available), Japan exported 883 t of cadmium metal, 7% less than that of 2012. Exports were sent primarily to India (48%), China (36%), and Belgium (16%). Exports to China decreased by 51% from that of 2012 owing to a decline in production of NiCd batteries in China. Cadmium exports to India, however, doubled in 2013 from that of 2012 to 420 t owing to increased consumption of cadmium in India for silver-cadmium solder for jewelry. Japan imported 100 t of cadmium, mostly from the Republic of Korea. Cadmium imports declined by 52% from that of 2012 reportedly owing to a shift in domestic raw material demand by NiCd battery producers from cadmium metal to cadmium sulfate. Data on cadmium sulfate production and imports were not available (Roskill's Letter from Japan, 2014).

**Korea, Republic of.**—Korea Zinc Ltd.'s Onsan zinc-lead refinery had the capacity to produce 3,000 t/yr of refined cadmium, and Young Poong Corp.'s Sukpo zinc refinery had the capacity to produce 1,400 t/yr of cadmium. Most of the cadmium produced in the Republic of Korea was exported to China.

**Mexico.**—The Instituto Nacional de Estadística y Geografía (2015) reported that Mexico produced about 1,410 t of cadmium in 2014, slightly less than that in 2013. However, according to company data, total smelter production in 2014 was about 1,330 t. Industrias Peñoles S.A.B. de C.V.'s Met-Mex metallurgical complex in Torreon produced 732 t of cadmium in 2014, 12% less than that in 2013, and Grupo México S.A.B. de C.V.'s zinc smelter in San Luis Potosi produced about 600 t of cadmium in 2014, unchanged from that of 2013 (Industrias Peñoles S.A.B. de C.V., 2015; Southern Copper Corp., 2015, p. 48).

## Outlook

Concern over cadmium's toxicity has spurred legislation, especially in the European Union (EU), to restrict the use of cadmium in most of its applications. In October 2013, the European Parliament amended the EU Battery Directive (2006/66/EC) to prohibit the inclusion of NiCd batteries in cordless power tools beginning in 2017 (European Parliament, 2013). The initial directive, which went into effect in 2008, banned all NiCd batteries from the EU market, except those used in cordless power tools, emergency systems, and medical equipment. In December, the European Chemical Agency (ECHA) added cadmium fluoride and cadmium sulfate to the "Candidate List of Substances of Very High Concern for Authorisation," requiring the ECHA and the European

Commission to assess whether the use of these chemicals in the European Union would need special authorization. Cadmium fluoride was used in the manufacturing of alloys, and cadmium sulfate was used in the cadmium electroplating process (Metal Bulletin, 2015).

NiCd batteries had been favored for use in less expensive consumer appliances and electronics owing to their cost advantage over other battery chemistries. During the past few years, lithium-ion batteries have begun to replace NiCd batteries in some low-cost electronics, because the manufacturing cost of lithium-ion batteries has been decreasing and their electrical storage capacity has been increasing. According to Robert Bosch GmbH, a leading manufacturer of power tools, 74% of cordless power tools sold in 2012 were powered by lithium-ion batteries compared with 26% in 2007 (Müller, 2013).

NiCd batteries, however, are expected to continue to be used in certain industrial applications because of their superior reliability and stability compared with the other rechargeable battery technologies, and consumption may actually increase owing to increased usage in some industrial applications. NiCd batteries power some battery-powered electric vehicles and are also used in a limited number of hybrid electric vehicles. NiCd batteries also are used as buffers in transportable, renewable hybrid-power systems developed to generate electricity in remote locations and underdeveloped regions. Industrial-sized NiCd batteries potentially could be used to store energy produced by certain on-grid solar or wind systems. Excess energy generated during periods of low electricity demand could be stored in a battery storage system, from which it would later be dispatched during periods of high electricity demand. NiCd may be a favored battery chemistry for this use owing to its stability in offshore and harsh weather environments.

An emerging use for cadmium may be for the semiconducting compound, cadmium arsenide. Scientists at the University of Oxford (United Kingdom), SLAC National Accelerator Laboratory (Menlo Park, CA), and the Stanford and Lawrence Berkeley National Laboratory (Berkeley, CA) recently discovered that cadmium arsenide was a more physically stable alternative to graphene in sensors, transistors, and transparent electrodes, and its use as a semiconductor in these applications may result in faster electronic devices (Chui, 2014).

Cadmium-containing residues will continue to be produced as a byproduct from zinc smelting, regardless of cadmium demand. Although there is growth potential in certain markets, if the applications and markets for cadmium continue to decline, excess byproduct cadmium may need to be permanently stockpiled and managed.

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

		2010	2011	2012	2013	2014
United States:						
Production of metal <sup>2</sup>	metric tons	637	W	W	W	W
Shipments of metal by producers	do.	563	W	W	W	W
Exports, unwrought metal and powders	do.	75	63	253	131	198
Imports for consumption, unwrought metal and powder	do.	216	201	170	284	133
Apparent consumption of metal	do.	703 <sup>r</sup>	W	W	W	W
Price, average, New York dealer <sup>3</sup>	dollars per pound	1.77	1.25	0.92	0.87	0.88
Do. <sup>3</sup>	dollars per kilogram	3.90	2.76	2.03	1.92	1.99
World, refinery production	metric tons	23,700 <sup>r</sup>	21,300 <sup>r</sup>	22,400 <sup>r</sup>	22,100 <sup>r</sup>	22,400 <sup>e</sup>

<sup>e</sup>Estimated. <sup>r</sup>Revised. Do., do. Ditto. W Withheld to avoid disclosing company proprietary data.

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

<sup>2</sup>Primary and secondary cadmium metal. Includes equivalent metal content of cadmium sponge used directly in production of compounds.

<sup>3</sup>Price for 1- to 5-short-ton lots of metal having a minimum purity of 99.95% cadmium (Platts Metals Week).

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

(Metric tons)

	2010	2011	2012	2013	2014
Producer stocks, January 1 <sup>2</sup>	27	W	W	W	W
Production	637	W	W	W	W
Imports for consumption, unwrought metal and powder	216	201	170	284	133
Total supply	880 <sup>†</sup>	W	W	W	W
Exports, unwrought metal and powders	75	63	253	131	198
Producer stocks, December 31 <sup>2</sup>	102	W	W	W	W
Consumption, apparent <sup>3</sup>	703 <sup>†</sup>	W	W	W	W

<sup>†</sup>Revised. W Withheld to avoid disclosing company proprietary data.

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

<sup>2</sup>Beginning stocks may not equal ending stocks of the prior year owing to inventory adjustments.

<sup>3</sup>Total supply minus exports and yearend stocks.

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

	2013		2014	
	Quantity (kilograms)	Value	Quantity (kilograms)	Value
<b>Unwrought metal and powders:</b>				
Argentina	--	--	2,000	\$7,910
Canada	2,410	\$61,300	554	14,100
China	107,000	218,000	195,000	465,000
France	1,030	3,360	--	--
Germany	--	--	364	17,100
India	20,100	41,000	--	--
Korea, Republic of	100	3,480	150	5,210
Total	131,000	327,000	198,000	509,000
<b>Waste and scarp:</b>				
Canada	903	13,400	--	--
China	19,400	30,000	--	--
Total	20,400	43,400	--	--
<b>Cadmium sulfide:</b>				
China	5,710	2,970	--	--
Korea, Republic of	--	--	495	99,000
Malaysia	--	--	2,250	563,000
Venezuela	--	--	251	50,200
Total	5,710	2,970	3,000	712,000
<b>Cadmium pigments:</b>				
Australia	--	--	11,300	32,700
Brazil	2,310	23,400	55,500	288,000
Canada	360,000 <sup>†</sup>	1,890,000 <sup>†</sup>	372,000	1,790,000
Chile	9,700	32,300	272	5,090
Colombia	8,210	59,100	4,540	43,100
El Salvador	141,000	234,000	--	--
Germany	8,430	44,100	--	--
Mexico	2,020,000 <sup>†</sup>	6,510,000 <sup>†</sup>	2,370,000	8,190,000
Netherlands	26,900	118,000	14,600	64,000
Peru	5,910	58,900	1,230	29,700
Philippines	1,020	10,700	8,120	103,000
Saint Kitts and Nevis	--	--	19,800	8,500
Switzerland	278	90,000	1,000	4,200,000
Taiwan	5,450	60,500	675	7,600
Trinidad and Tobago	52,500	155,000	17,500	52,100
Venezuela	--	--	6,220	101,000
Vietnam	1,560	6,020	6,500	141,000
Other	19,100 <sup>†</sup>	568,000 <sup>†</sup>	10,600	563,000
Total	2,670,000 <sup>†</sup>	9,870,000 <sup>†</sup>	2,900,000	15,600,000

<sup>†</sup>Revised. -- Zero.

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

Source: U.S. Census Bureau, U.S. International Trade Commission.

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

	2013		2014	
	Quantity (kilograms)	Value	Quantity (kilograms)	Value
<b>Unwrought metal and powders:</b>				
Australia	42,000	\$126,000	--	--
Belgium	22,000	100,000	4,350	\$130,000
Canada	136,000	332,000	103,000	206,000
China	83,200	173,000	452	7,210
Germany	24	4,680	--	--
Italy	1	2,480	--	--
Mexico	--	--	19,300	46,100
Peru	--	--	6,000	10,200
Total	284,000	739,000	133,000	399,000
Waste and scrap, India	16	32,900	--	--
<b>Cadmium oxide:</b>				
Belgium	88,000	931,000	52,100	595,000
United Kingdom	--	--	1,540	14,700
Total	88,000	931,000	53,600	610,000
<b>Cadmium sulfide:</b>				
Canada	7	2,250	--	--
Germany	1	2,540	--	--
Russia	6,850	1,260,000	9,000	1,680,000
United Kingdom	2	4,200	--	--
Total	6,860	1,270,000	9,000	1,680,000
<b>Cadmium pigments:</b>				
Belgium	600	8,910	1,300	19,300
Brazil	10,900	416,000	11,300	390,000
Canada	28,100	174,000	62,300	338,000
China	176,000 <sup>r</sup>	9,980,000 <sup>r</sup>	55,400	4,230,000
Georgia	--	--	180	10,900
Germany	124,000	790,000	137,000	925,000
Japan	4,800	448,000	3,570	292,000
Mexico	--	--	1,710	86,600
Sweden	1	3,920	--	--
United Kingdom	72,500	1,330,000	78,100	1,480,000
Total	417,000 <sup>r</sup>	13,100,000 <sup>r</sup>	351,000	7,770,000

<sup>r</sup>Revised. -- Zero.

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

Source: U.S. Census Bureau, U.S. International Trade Commission.

TABLE 5  
MAJOR PRIMARY CADMIUM PRODUCTION FACILITIES IN 2014

Country	Major operating company	Location of main facilities
Algeria	Société Algérienne du Zinc (METANOF)	Ghazaouet
Argentina	AR Zinc S.A. (Glencore plc)	Fray Luis Beltran
Australia	Nyrstar NV	Hobart, Tasmania
Brazil	Votorantim Metais S.A.	Juiz de Fora
Bulgaria	KCM AD	Plovdiv
Canada	HudBay Minerals Inc.	Flin Flon, Manitoba
Do.	Teck Resources Ltd.	Trail, British Columbia
China	Huludao Zinc Industry Co. Ltd.	Longgang, Huludao, Liaoning
Do.	Hunan Sanli Group Co. Ltd.	Huayuan, Xiangxi, Hunan
Do.	Yuguang Gold and Lead Co. Ltd.	Jiyuan, Henan
Do.	Yunnan Chihong Zinc and Germanium Co. Ltd.	Huize, Qujing, Yunnan
Do.	Yunnan Luoping Zinc & Electricity Co. Ltd.	Luoping, Qujing, Yunnan
Do.	Zhuzhou Smelter Group Co. Ltd.	Shifeng, Zhuzhou, Hunan
India	Binani Zinc Ltd.	Binanipuram
Do.	Hindustan Zinc Ltd.	Chanderiya
Do.	Hindustan Zinc Ltd.	Debari
Japan	Akita Zinc Co. Ltd. (Dowa Metals and Mining Co. Ltd.)	Iijima, Akita
Do.	Hachinohe Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd.)	Hachinohe, Aomori
Do.	Kamioka Mining & Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd.)	Hida, Gifu
Do.	Toho Zinc Co. Ltd.	Annaka, Gunma
Kazakhstan	Kazzinc JSC (Glencore plc)	Ust-Kamenogorsk
Korea, Republic of	Korea Zinc Ltd.	Onsan
Do.	Young Poong Corp.	Sukpo
Mexico	Grupo México S.A.B. de C.V.	San Luis Potosi, San Luis Potosi
Do.	Industrias Peñoles S.A.B. de C.V.	Torreón, Coahuila
Netherlands	Nyrstar NV	Budel
Norway	Boliden AB	Odda
Peru	Votorantim Metais S.A.	Cajamarquilla
Poland	Huta Cynku "Miasteczko Śląskie" S.A.	Miasteczko Slaskie
Russia	Chelyabinsk Zinc Plant OJSC	Chelyabinsk
Do.	Ural Mining and Metallurgy Co.	Vladikavkaz
United States	Nyrstar NV	Clarksville, Tennessee
Uzbekistan	JSC Almalyk Mining Metallurgical Complex	Almalyk
Do. Ditto.		

TABLE 6  
CADMIUM: WORLD REFINERY PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2010	2011	2012	2013	2014 <sup>e</sup>
Argentina	32	31	37	28 <sup>r</sup>	20
Australia <sup>e</sup>	350	390	380	380	350
Brazil <sup>e</sup>	200	200	200	200	200
Bulgaria <sup>e</sup>	460 <sup>r</sup>	460 <sup>r</sup>	360 <sup>r</sup>	350 <sup>r</sup>	350
Canada <sup>4</sup>	1,357	1,240	1,286	1,313 <sup>r</sup>	1,310
China <sup>e</sup>	7,360	6,670	7,270 <sup>r</sup>	7,000	7,000
Germany <sup>e,4</sup>	290	300	300	300	300
India <sup>5</sup>	550	449	391 <sup>r</sup>	420 <sup>r</sup>	380
Japan	2,142	1,755	1,855	1,826	1,829 <sup>6</sup>
Kazakhstan <sup>e</sup>	1,400	1,300	1,200	1,200	1,200
Korea, North <sup>e</sup>	200	200	200	200	200
Korea, Republic of	4,166	3,005	3,904	3,950 <sup>r,e</sup>	4,010
Mexico	1,464	1,485	1,482 <sup>r</sup>	1,451 <sup>r</sup>	1,409 <sup>6</sup>
Netherlands <sup>e</sup>	560	570	560	610 <sup>r</sup>	640
Norway	300	309	310	290	330
Peru	357	572	684	695	769 <sup>6</sup>
Poland	451	526	370	460 <sup>r</sup>	628 <sup>6</sup>
Russia	1,100 <sup>r</sup>	1,500 <sup>r</sup>	1,300 <sup>r</sup>	1,100 <sup>r</sup>	1,200
United States <sup>4</sup>	637	W	W	W	W
Uzbekistan	300	300	300	300	300
Total	23,700 <sup>r</sup>	21,300 <sup>r</sup>	22,400 <sup>r</sup>	22,100 <sup>r</sup>	22,400

<sup>e</sup>Estimated. <sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data, not included in "Total."

<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. Includes data available through September 11, 2015.

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

<sup>3</sup>In addition to the countries listed, Algeria produced cadmium, but available information is inadequate to make reliable estimates of output levels.

<sup>4</sup>Includes secondary.

<sup>5</sup>India's production is reported on a fiscal-year basis from April 1 to March 31.

<sup>6</sup>Reported figure.

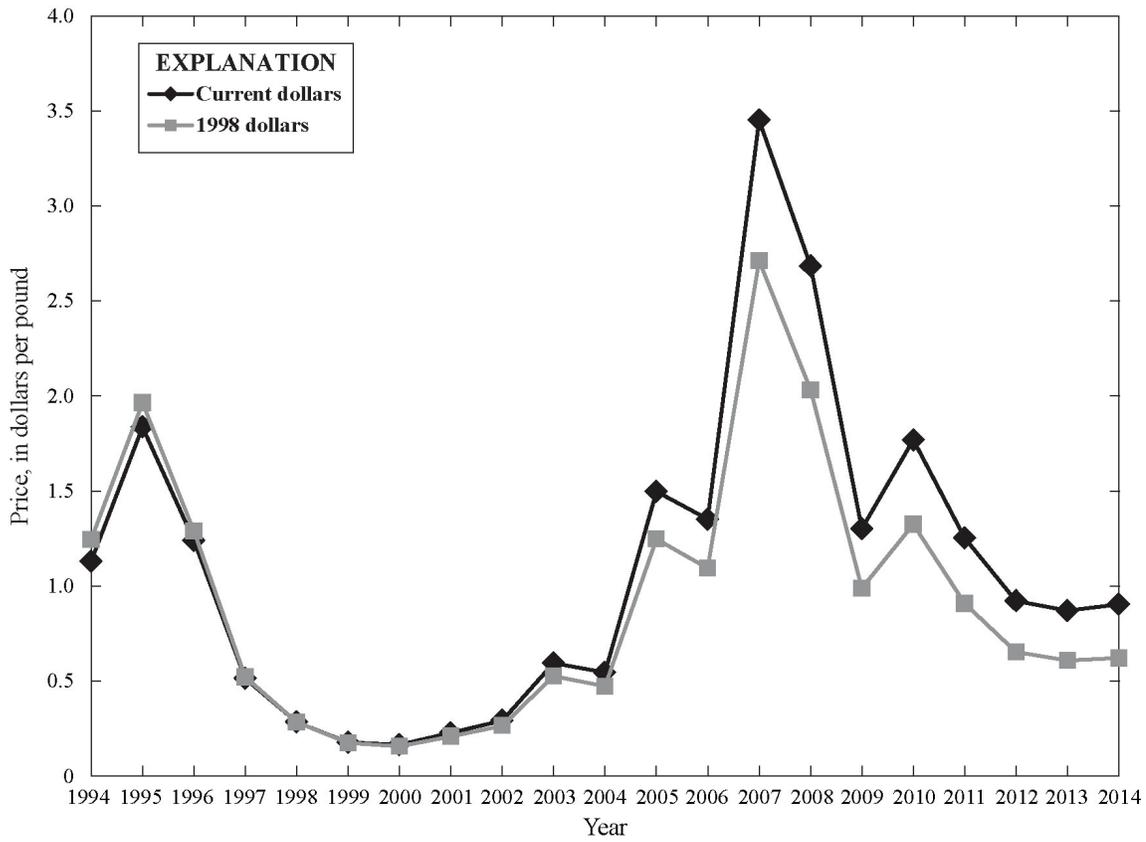


Figure 1. Average annual New York dealer cadmium prices from 1994 to 2014. Source: Platts Metals Week.