Refined cadmium was produced domestically by two companies. One company recovered cadmium as a byproduct of zinc recovery through the leaching of 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 and apparent consumption data were withheld to avoid disclosing company proprietary data.

The United States was a net importer of unwrought cadmium metal and powders in 2017, with net imports totaling 31 metric tons (t). Imports for consumption of unwrought cadmium increased for the third consecutive year to 254 t in 2017 from 240 t in 2016. Exports increased by 42% to 223 t in 2017 from 157 t in 2016 (table 1). As in 2016, cadmium metal was predominantly exported to China in 2017 (table 2). Australia replaced Canada as the leading supplier of imports (table 3). Of the downstream cadmium products, the United States was a net importer of cadmium oxide, sulfide, and waste and scrap and a net exporter of pigments in 2017 (tables 2, 3). Exports of cadmium pigments were 72% less than those of 2016; Mexico continued to be the leading destination (table 2). Metal Bulletin’s average global free market price for cadmium metal in 2017 increased by about 30% from that of 2016 to $1.75 per kilogram ($0.80 per pound) (table 1).

In 2017, estimated global primary production of cadmium, excluding U.S. production, was 25,400 t, slightly less than that of 2016 (table 5). Secondary cadmium was estimated to account for about 20% of all cadmium metal produced (Morrow, 2011, p. 8). Although detailed data on the global consumption of primary cadmium by end use in 2017 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. Zinc concentrates typically contain from 0.2% to 0.3% cadmium. In 2017, zinc-concentrate-producing States were Alaska, Idaho, Missouri, Tennessee, and Washington. Zinc concentrates from Alaska, Idaho, Missouri, and Washington were exported for processing. Zinc concentrates from Tennessee were smelted and refined in Tennessee and processed for byproduct cadmium recovery.

Metal Production.—Domestic metal production data were collected by the U.S. Geological Survey from a voluntary survey of cadmium metal and compounds producers. In 2017, cadmium metal was produced at one primary and one secondary smelter, and one producer responded to the survey. Annual domestic production data were withheld to avoid disclosing company proprietary data.

Primary.—Nyrstar N.V.’s (Belgium) electrolytic zinc refinery in Clarksville, TN, produced zinc metal and several byproducts, including cadmium metal. In 2017, the company’s East Tennessee and Middle Tennessee zinc mine complexes supplied most of the zinc concentrate feed treated at Clarksville.

Secondary.—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. According to the World Bureau of Metal Statistics (2018), global consumption of cadmium in 2017 decreased by 3% from that of 2016. Most of the cadmium consumed globally was thought to be used in NiCd batteries. Other uses included alloys, coatings, pigments, solar cells, and stabilizers.

Nickel-Cadmium Batteries.—The NiCd battery industry was almost exclusively located in Asia, and the leading manufacturers included BYD Co., Ltd. (China) and Panasonic Corp. (Japan). These two companies accounted for about 75% of the NiCd market in terms of sales volume. Saft Groupe S.A. (France) and Gold Peak Industries Ltd. (China) were also significant producers of NiCd batteries (Pillot, 2017, p. 14). Small portable batteries were used to power consumer electronics (commonly, power tools and security lighting), and large industrial NiCd batteries 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 (Morrow, 2011, p. 10–11). According to Avicenne Energy, the compound annual growth rate of the NiCd battery market in terms of sales volume from 2006 through 2016 decreased by 3% per year (Pillot, 2017, p. 15).

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 form the spectrum of cadmium pigments that range from bright yellow to maroon. Cadmium pigments were predominantly used to color engineering plastics that were processed at high temperatures and in artists’ paints.

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 used for the production of cadmium telluride (CdTe), a semiconducting compound used in thin-film photovoltaics. First Solar, Inc. (Tempe, AZ) was a leading producer of CdTe-based solar modules with manufacturing locations in Perrysburg, OH, and Kulim, Malaysia. In July, the company announced plans to produce modules at its idle manufacturing plant in Ho Chi Minh City, Vietnam, beginning in 2018 (First Solar, Inc., 2018, p. 54, 146). 5N Plus Inc. (Canada) was the sole supplier of CdTe to First Solar (5N Plus Inc., 2014). PPM Pure Metals GmbH (Germany) also produced high-purity CdTe for photovoltaic applications at its manufacturing facility in Langelsheim, Germany (PPM Pure Metals GmbH, undated).

**Prices**

In 2017, the average Metal Bulletin global free market price for 99.95%-minimum-purity cadmium was $1.75 per kilogram ($0.80 per pound), 30% more than the average price in 2016 (table 1). This price reflected the average price of cadmium traded on a spot basis; however, most cadmium produced was sold through long-term contracts. The average monthly price increased by about 15% in the first 5 months of the year, rising from $0.68 per pound in January to $0.78 per pound in May, and then decreased for the next 3 months to $0.71 per pound in August. The average monthly price generally increased for the rest of 2017, ending the year at $1.02 per pound in December. News sources attributed price movements during the year to changes in demand in China and India.

**World Industry Structure**

**Primary Production**—Global cadmium production, excluding U.S. production, decreased slightly to an estimated 25,400 t (table 5). The two leading producers were China and the Republic of Korea, accounting for 32% and 22%, respectively, of global production. Most (65%) of the world’s refined cadmium was produced in Asia and the Pacific (Australia, China, India, Japan, and the Republic of Korea), followed by Europe and Central Eurasia (Bulgaria, Germany, Kazakhstan, the Netherlands, Norway, Poland, Russia, and Uzbekistan) with 20%; North America (Canada and Mexico), 12%; and South America (Argentina, Brazil, and Peru), 4%. Major global producers of primary cadmium are listed in table 4.

**Secondary Production**—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., KOBAR Ltd., and Korea Zinc Co. Ltd. in the Republic of Korea and Nippon Recycle Center Corp. in Japan. In Europe, NiCd battery recycling took place at Accurec Recycling GmbH’s facility in Germany, Saft Groupe’s plant in Sweden, and Société Nouvelle d’Affinage des Métaux’s (a subsidiary of Floridienne Group) 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, Sweden, and Japan. Most of the NiCd battery manufacturing industry was in China and, to a lesser degree, in Japan. China’s cadmium consumption was estimated to have decreased in the past 5 years because any increases in annual production were more than offset by decreases in net imports between 2013 and 2017. China’s net imports of cadmium in 2017 were 8,190 t, 10% less than those in 2016. The Hunan Provincial government reportedly introduced regulations in 2017 that would restrict the use of cadmium in jewelry manufacturing, causing some cadmium-consuming plants to close or suspend production (Argus Metals International, 2017a; Global Trade Information Services Inc., 2018). As cadmium consumption in China has been decreasing, consumption in India has been increasing in recent years. India’s net imports of cadmium increased for the sixth consecutive year in 2017 to 4,910 t from 376 t in 2011. Most of the cadmium imported into India was reportedly purchased on the spot market rather than through long-term contracts with suppliers, and spot buyers were primarily in the cosmetics, pigment, and jewelry manufacturing sectors (Metal-Pages, 2016b; Argus Metals International, 2017a, b; Global Trade Information Services Inc., 2018). In Belgium, Flaurea Chemicals [owned by Aurea SA (France)] used cadmium to produce cadmium compounds, including cadmium chloride, nitrate, and oxide, and cadmium powder at its manufacturing facility in Ath. Flaurea’s cadmium compounds and powder were used mainly in coatings, NiCd batteries, paint pigments, PVC stabilizers, surface treatments, and thin-film solar panels (Flaurea Chemicals, undated).

**World Review**

**Australia.**—Nyrstar increased its crude cadmium production capacity at its lead smelter in Port Pirie, South Australia. The capacity expansion was part of a larger project at Port Pirie to enable the smelter to treat a wider range of feedstock and to update the facility’s environmental controls. The new capacity was commissioned in September. Port Pirie produced a crude cadmium product, which must be further refined to produce pure cadmium metal. Nyrstar’s zinc smelter in Hobart, Tasmania, was the sole producer of refined cadmium metal in Australia in 2017 (Metal-Pages, 2016a; Nyrstar N.V., 2018, p. 12; undated).

**Outlook**

NiCd batteries had been favored for use in less expensive consumer appliances and electronics owing to their cost advantage over other battery chemistries. Lithium-ion batteries, however, have significantly replaced NiCd batteries in some electronics, particularly power tools, and substitution is expected to continue. NiCd batteries 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. 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 in 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 batteries, 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.

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 end uses, if applications for and consumption of cadmium continue to decline, excess byproduct residues may need to be permanently stockpiled and managed.

References Cited


GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Cadmium. Ch. in Mineral Commodity Summaries, annual.


Other

### Table 1: Salient Cadmium Statistics

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>United States:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production of metal²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipments of metal by producers</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>Exports, unwrought metal and powders</td>
<td>do.</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>Imports for consumption, unwrought metal and powders</td>
<td>do.</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>Apparent consumption of metal</td>
<td>do.</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>Price, average, New York dealer³</td>
<td>0.87</td>
<td>0.88</td>
<td>0.67</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Price, average, free market⁴</td>
<td>1.92</td>
<td>1.94</td>
<td>1.47</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>World, refinery production⁵</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price, average, New York dealer³</td>
<td>NA</td>
<td>NA</td>
<td>0.50</td>
<td>0.61</td>
<td>0.80</td>
</tr>
<tr>
<td>Price, average, free market⁴</td>
<td>NA</td>
<td>NA</td>
<td>1.10</td>
<td>1.34</td>
<td>1.75</td>
</tr>
</tbody>
</table>

---

1. Table includes data available through June 21, 2018. Data are rounded to no more than three significant digits.
2. Although U.S. production data are withheld, primary and secondary cadmium were produced in the United States.
4. Price for 10-metric-ton lots of metal having a minimum purity of 99.95%. Cost, insurance, and freight; global ports (Source: Metal Bulletin).
5. Excludes U.S. production.
### TABLE 2
U.S. EXPORTS OF CADMIUM PRODUCTS, BY COUNTRY OR LOCALITY AND TYPE¹

<table>
<thead>
<tr>
<th>Quantity (kilograms)</th>
<th>Value</th>
<th>Quantity (kilograms)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>--</td>
<td>6,970</td>
<td>$22,300</td>
</tr>
<tr>
<td>Canada</td>
<td>823</td>
<td>$16,600</td>
<td>3,530</td>
</tr>
<tr>
<td>China</td>
<td>156,000</td>
<td>206,000</td>
<td>191,000</td>
</tr>
<tr>
<td>India</td>
<td>--</td>
<td>19,100</td>
<td>42,400</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>1</td>
<td>4,940</td>
<td>2,750</td>
</tr>
<tr>
<td>Total</td>
<td>157,000</td>
<td>228,000</td>
<td>223,000</td>
</tr>
</tbody>
</table>

#### Waste and scrap:

| China                | 11,300     | 20,800               | --         |
| France               | --         | --                   | 9          |
| Korea, Republic of   | 2          | 9,780                | --         |
| Kuwait               | --         | --                   | 9          |
| Mexico               | 544        | 23,000               | --         |
| Total                | 11,900     | 53,500               | 18         |

#### Cadmium sulfide:

| Belgium              | 294        | 58,800               | --         |
| Korea, Republic of   | 331        | 66,300               | --         |
| Total                | 625        | 125,000              | --         |

#### Cadmium pigments:

| Bahamas, The         | --         | --                   | 1,130      |
| Brazil               | 12,800     | 116,000              | 6,330      |
| Chile                | 1,680      | 26,000               | 1,390      |
| China                | 1,460      | 19,300               | 555        |
| Colombia             | --         | --                   | 3,630      |
| El Salvador          | 98         | 5,010                | 18,000     |
| France               | 1,360      | 16,500               | 28         |
| Guatemala            | 1,330      | 15,700               | --         |
| Japan                | 187,000    | 2,520,000            | 40,600     |
| Korea, Republic of   | 8,540      | 56,500               | 39,300     |
| Mexico               | 1,860,000  | 7,380,000            | 410,000    |
| Pakistan             | 2,150      | 73,900               | 6,060      |
| Russia               | 15,600     | 97,000               | 3,890      |
| Switzerland          | 88,000     | 30,800,000           | 63,800     |
| Taiwan               | 7,260      | 41,100               | 640        |
| Trinidad and Tobago  | 1,150      | 9,970                | --         |
| Uruguay              | --         | --                   | 18,100     |
| Other                | 2,980 '    | 87,300 '             | 3,550      |
| Total                | 2,190,000  | 41,300,000           | 617,000    |

¹Revised. -- Zero.

¹Table includes data available through June 21, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.
TABLE 3
U.S. IMPORTS FOR CONSUMPTION OF CADMIUM PRODUCTS, BY COUNTRY OR LOCALITY AND TYPE¹

<table>
<thead>
<tr>
<th>Country or locality and type</th>
<th>Quantity (kilograms)</th>
<th>Value (value)</th>
<th>Quantity (kilograms)</th>
<th>Value (value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td></td>
<td>2017</td>
<td></td>
</tr>
<tr>
<td>Unwrought metal and powders:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>44,000</td>
<td>$60,700</td>
<td>104,000</td>
<td>$187,000</td>
</tr>
<tr>
<td>Belgium</td>
<td>17,800</td>
<td>71,200</td>
<td>40,900</td>
<td>167,000</td>
</tr>
<tr>
<td>Canada</td>
<td>109,000</td>
<td>363,000</td>
<td>5,030</td>
<td>165,000</td>
</tr>
<tr>
<td>China</td>
<td>13,200</td>
<td>143,000</td>
<td>44,000</td>
<td>410,000</td>
</tr>
<tr>
<td>Germany</td>
<td>--</td>
<td>--</td>
<td>60,300</td>
<td>106,000</td>
</tr>
<tr>
<td>Mexico</td>
<td>39,000</td>
<td>47,500</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Peru</td>
<td>16,800</td>
<td>27,500</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>240,000</td>
<td>713,000</td>
<td>254,000</td>
<td>1,030,000</td>
</tr>
<tr>
<td>Waste and scrap:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>40,100</td>
<td>106,000</td>
<td>20,100</td>
<td>57,300</td>
</tr>
<tr>
<td>Mexico</td>
<td>11,600</td>
<td>18,800</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>51,700</td>
<td>125,000</td>
<td>20,100</td>
<td>57,300</td>
</tr>
<tr>
<td>Cadmium oxide:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>45,000</td>
<td>581,000</td>
<td>46,500</td>
<td>612,000</td>
</tr>
<tr>
<td>China</td>
<td>4,690</td>
<td>22,500</td>
<td>3,000</td>
<td>16,200</td>
</tr>
<tr>
<td>Japan</td>
<td>--</td>
<td>--</td>
<td>8</td>
<td>9,860</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>7,000</td>
<td>5,880</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Mexico</td>
<td>1,960</td>
<td>16,500</td>
<td>9,260</td>
<td>33,100</td>
</tr>
<tr>
<td>Total</td>
<td>58,600</td>
<td>626,000</td>
<td>58,800</td>
<td>671,000</td>
</tr>
<tr>
<td>Cadmium sulfide, Russia</td>
<td>--</td>
<td>--</td>
<td>645</td>
<td>114,000</td>
</tr>
<tr>
<td>Cadmium pigments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>214</td>
<td>2,120</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Belgium</td>
<td>1,500</td>
<td>5,510</td>
<td>500</td>
<td>8,170</td>
</tr>
<tr>
<td>Brazil</td>
<td>9,820</td>
<td>164,000</td>
<td>4,580</td>
<td>136,000</td>
</tr>
<tr>
<td>Canada</td>
<td>12,100</td>
<td>237,000</td>
<td>9,030</td>
<td>268,000</td>
</tr>
<tr>
<td>China</td>
<td>146,000</td>
<td>2,730,000</td>
<td>25,900</td>
<td>1,140,000</td>
</tr>
<tr>
<td>Germany</td>
<td>1,150</td>
<td>8,220</td>
<td>10,200</td>
<td>28,700</td>
</tr>
<tr>
<td>India</td>
<td>--</td>
<td>--</td>
<td>19,300</td>
<td>33,700</td>
</tr>
<tr>
<td>Japan</td>
<td>285</td>
<td>17,500</td>
<td>5,130</td>
<td>258,000</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>240</td>
<td>28,600</td>
<td>73</td>
<td>3,850</td>
</tr>
<tr>
<td>Spain</td>
<td>1,560</td>
<td>22,900</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Taiwan</td>
<td>--</td>
<td>--</td>
<td>2,200</td>
<td>88,100</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>56,000</td>
<td>1,080,000</td>
<td>80,800</td>
<td>1,780,000</td>
</tr>
<tr>
<td>Total</td>
<td>228,000</td>
<td>4,300,000</td>
<td>158,000</td>
<td>3,740,000</td>
</tr>
</tbody>
</table>

¹Revised.  -- Zero.

¹Table includes data available through June 21, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.
### Table 4

<table>
<thead>
<tr>
<th>Country or locality</th>
<th>Major operating company</th>
<th>Location of main facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>Société Algérienne du Zinc S.p.A. (METANOF)</td>
<td>Ghazaouet, Tlemcen</td>
</tr>
<tr>
<td>Argentina</td>
<td>AR Zinc S.A. (Glencore plc)</td>
<td>Fray Luis Beltran, Santa Fe</td>
</tr>
<tr>
<td>Australia</td>
<td>Nyrstar N.V.</td>
<td>Hobart, Tasmania</td>
</tr>
<tr>
<td>Brazil</td>
<td>Votorantim Metais S.A.</td>
<td>Juiz de Fora, Minas Gerais</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>KCM AD</td>
<td>Plovdiv, Plovdiv</td>
</tr>
<tr>
<td>Canada</td>
<td>HudBay Minerals Inc.</td>
<td>Flin Flon, Manitoba</td>
</tr>
<tr>
<td>Do.</td>
<td>Teck Resources Ltd.</td>
<td>Trail, British Columbia</td>
</tr>
<tr>
<td>China</td>
<td>Huludao Zinc Smelting Co.</td>
<td>Huludao, Liaoning</td>
</tr>
<tr>
<td>Do.</td>
<td>Hunan Sanli Group Co. Ltd.</td>
<td>Xiangxi, Hunan</td>
</tr>
<tr>
<td>Do.</td>
<td>Yuguang Gold-Lead Co. Ltd.</td>
<td>Jiyuan, Henan</td>
</tr>
<tr>
<td>Do.</td>
<td>Yunnan Chihong Zinc and Germanium Co. Ltd.</td>
<td>Qujing, Yunnan</td>
</tr>
<tr>
<td>Do.</td>
<td>Yunnan Luoping Zinc &amp; Electricity Co. Ltd.</td>
<td>Do.</td>
</tr>
<tr>
<td>Do.</td>
<td>Zhuzhou Smelter Group Co. Ltd.</td>
<td>Zhuzhou, Hunan</td>
</tr>
<tr>
<td>India</td>
<td>Hindustan Zinc Ltd.</td>
<td>Chanderiya, Rajasthan</td>
</tr>
<tr>
<td>Do.</td>
<td>do.</td>
<td>Debari, Rajasthan</td>
</tr>
<tr>
<td>Japan</td>
<td>Akita Zinc Co. Ltd. (Dowa Metals and Mining Co. Ltd.)</td>
<td>Iijima, Akita</td>
</tr>
<tr>
<td>Do.</td>
<td>Hachinohe Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd.)</td>
<td>Hachinohe, Aomori</td>
</tr>
<tr>
<td>Do.</td>
<td>Kamioka Mining &amp; Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd.)</td>
<td>Hida, Gifu</td>
</tr>
<tr>
<td>Do.</td>
<td>Toho Zinc Co. Ltd.</td>
<td>Annaka, Gunma</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>Kazzinc JSC (Glencore plc)</td>
<td>Ust-Kamenogorsk, East Kazakhstan</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>Korea Zinc Co. Ltd.</td>
<td>Ulsan</td>
</tr>
<tr>
<td>Mexico</td>
<td>Grupo México S.A.B. de C.V.</td>
<td>San Luis Potosí, San Luis Potosí</td>
</tr>
<tr>
<td>Do.</td>
<td>Industrias Peñoles S.A.B. de C.V.</td>
<td>Torreon, Coahuila</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Nyrstar N.V.</td>
<td>Bude, Noord Brabant</td>
</tr>
<tr>
<td>Norway</td>
<td>Boliden AB</td>
<td>Odda, Hordaland</td>
</tr>
<tr>
<td>Peru</td>
<td>Votorantim Metais S.A.</td>
<td>Cajamarquilla, Lima</td>
</tr>
<tr>
<td>Poland</td>
<td>Huta Cynku &quot;Miasteczkō Śląskie&quot; S.A.</td>
<td>Miasteczko Śląskie, Silesia</td>
</tr>
<tr>
<td>Russia</td>
<td>Chelyabinsk Zinc Plant OJSC</td>
<td>Chelyabinsk, Chelyabinsk</td>
</tr>
<tr>
<td>Do.</td>
<td>Ural Mining and Metallurgical Co.</td>
<td>Vladikavkaz, North Caucasus</td>
</tr>
<tr>
<td>United States</td>
<td>Nyrstar N.V.</td>
<td>Clarksville, TN</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>JSC Almalyk Mining Metallurgical Complex</td>
<td>Almalyk, Tashkent</td>
</tr>
</tbody>
</table>

Table includes data available through June 21, 2018.
TABLE 5
CADMIUM: WORLD REFINERY PRODUCTION, BY COUNTRY OR LOCALITY\(^1,2\)

(Metric tons)

<table>
<thead>
<tr>
<th>Country or locality</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>28</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Australia</td>
<td>380</td>
<td>350</td>
<td>380</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Brazil</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>411</td>
<td>382</td>
<td>344</td>
<td>362</td>
<td>360</td>
</tr>
<tr>
<td>Canada</td>
<td>1,313</td>
<td>1,180</td>
<td>1,159</td>
<td>2,305</td>
<td>1,802</td>
</tr>
<tr>
<td>China</td>
<td>7,496</td>
<td>8,200</td>
<td>8,162</td>
<td>8,200</td>
<td>8,200</td>
</tr>
<tr>
<td>Germany</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>India</td>
<td>287</td>
<td>116</td>
<td>130</td>
<td>21</td>
<td>61</td>
</tr>
<tr>
<td>Japan</td>
<td>1,826</td>
<td>1,820</td>
<td>1,959</td>
<td>1,988</td>
<td>2,142</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>1,319</td>
<td>1,633</td>
<td>1,475</td>
<td>1,500</td>
<td>1,500</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>3,904</td>
<td>5,645</td>
<td>5,600</td>
<td>5,600</td>
<td>5,600</td>
</tr>
<tr>
<td>Mexico</td>
<td>1,451</td>
<td>1,409</td>
<td>1,283</td>
<td>1,244</td>
<td>1,156</td>
</tr>
<tr>
<td>Netherlands</td>
<td>610</td>
<td>620</td>
<td>620</td>
<td>620</td>
<td>600</td>
</tr>
<tr>
<td>Norway</td>
<td>310</td>
<td>310</td>
<td>310</td>
<td>310</td>
<td>300</td>
</tr>
<tr>
<td>Peru</td>
<td>695</td>
<td>769</td>
<td>757</td>
<td>820</td>
<td>797</td>
</tr>
<tr>
<td>Poland</td>
<td>460</td>
<td>628</td>
<td>383</td>
<td>319</td>
<td>320</td>
</tr>
<tr>
<td>Russia</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
</tr>
<tr>
<td>United States</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>160</td>
<td>200</td>
<td>220</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Total</td>
<td>22,500</td>
<td>25,100</td>
<td>24,600</td>
<td>25,800</td>
<td>25,400</td>
</tr>
</tbody>
</table>

\(^{1}\)Estimated.  \(^{2}\)Revised.  \(^{3}\)Withheld to avoid disclosing proprietary data; not included in total.

1Table includes data available through May 21, 2018. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

2This 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.

3In addition to the countries and (or) localities listed, Algeria, North Korea, and Turkey may have produced cadmium, but available information was inadequate to make reliable estimates of output.

4Although U.S. production data are withheld, primary and secondary cadmium were produced in the United States.