



# 2018 Minerals Yearbook

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## RECYCLING—METALS [ADVANCE RELEASE]

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# RECYCLING—METALS

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In 2018, recycled material as a percentage of apparent supply of various metals, including aluminum, chromium, copper, iron and steel, lead, magnesium, nickel, tin, and titanium, ranged from a low of 22% for tin to a high of 75% for lead (table 1). In 2018, the United States recycled 58.6 million metric tons (Mt) of metals with a total value of \$37.7 billion (excluding zinc, for which data were withheld to avoid disclosing company proprietary data in 2018). In 2017, the quantity of metals recycled, including zinc, was 57 Mt valued at \$33 billion. In 2018, the quantity of metals recycled was equivalent to 48% of the apparent supply of those metals, slightly more than 47% of apparent supply in 2017. The total value of metals recycled was equivalent to 46% of the value of apparent supply of those metals, slightly more than 44% of apparent supply in 2017 (table 1). In 2018, iron and steel accounted for 89% of the total quantity of recycled metals and 45% of the total value of recycled metals. Aluminum accounted for 6% of the total quantity of recycled metals and 25% of the total value of recycled metals. By gross quantity, the United States exported 21 Mt of scrap metals, with a total value of \$12.7 billion and imported 6.72 Mt worth \$5 billion of these same metals (table 2).

On May 18, 2018, the Secretary of the Interior, in coordination with the Secretary of Defense, and in consultation with the heads of other relevant executive departments and agencies, developed a final list of 35 minerals or mineral material groups defined as critical that was published in the Federal Register (83 FR 23295) (U.S. Department of the Interior, 2018). This list was developed pursuant to Executive Order 13817, “A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals” issued on December 20, 2017 (82 FR 60835) (Trump, 2017). A critical mineral, as defined by the Executive order, is a mineral identified to be “(i) a nonfuel mineral or mineral material essential to the economic and national security of the United States, (ii) the supply chain of which is vulnerable to disruption, and (iii) that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for the U.S. economy or national security.” Of the 10 commodities analyzed in this recycling report, 4 were included in the 2018 critical minerals list: chromium, magnesium, tin, and titanium.

Metals are important, reusable resources. Although the ultimate supply of metal is fixed by nature, human ingenuity determines the quantity available for use by developing economical processes to recover metal from the Earth, recycle metal from the use and (or) process stream, and develop efficient uses for those metals. The reusable nature of metals contributes to the sustainability of their use. Recycling, a significant factor in the supply of many of the metals used by society, provides environmental and economic benefits, such as energy savings and reduced volumes of waste.

The term “primary” is used to indicate materials from ore deposits, and the term “secondary” indicates materials from scrap, including used products and residuals from manufacturing. Recycling practices vary substantially among the metal industries. Generally, scrap is categorized as “new” or “old.” “New” indicates preconsumer sources, whereas “old,” indicates postconsumer sources. New scrap is supplied during the many stages of industrial processing that precede formation of an end product. For example, when metal is converted into shapes—bars, plates, rods, or sheets—new scrap is generated in the form of cuttings, trimmings, and off-specification forms. When these shapes are converted to parts, additional new scrap may be generated in the form of cuttings, stampings, turnings, and off-specification parts. Similarly, when parts are assembled into products, new scrap may be generated. A wide variety of descriptive terms, many duplicative, including external scrap, home scrap, internal scrap, mill scrap, prompt scrap, and purchased scrap, have evolved to describe scrap generated by diverse industry practices.

Once a product completes its useful life, it becomes postconsumer material, often called old scrap or junk, which is recycled into scrap and reuse material streams. For example, a junked motor might be refurbished for reuse. If it cannot be refurbished, it could be deconstructed to recover its metal constituents, primarily copper and steel. Used appliances, automobiles, and beverage cans are examples of sources of old consumer scrap; used jet engine turbine blades and vanes, junked machinery and ships, and metal recovered from commercial buildings or industrial plants are examples of old industrial scrap. The material flow of recycled metal commodities in the United States has been documented in a series of reports published by the U.S. Geological Survey (Sibley, 2006–11).

Individual annual reviews for each of the metals listed in the tables are included in the respective chapters in this volume of the U.S. Geological Survey Minerals Yearbook, volume I, Metals and Minerals.

## References Cited

- Sibley, S.F., ed., 2006–11, Flow studies for recycling metal commodities in the United States: U.S. Geological Survey Circular 1196–A–Z–AA, [variously paged]. (Accessed May 11, 2020, via <http://pubs.usgs.gov/circ/circ1196/>.)
- Trump, D.J., 2017, A Federal strategy to ensure secure and reliable supplies of critical minerals—Executive Order 13817 of December 20, 2017: Federal Register, v. 82, no. 246, December 26, p. 60835–60837. (Accessed July 29, 2019, at <https://www.govinfo.gov/content/pkg/FR-2017-12-26/pdf/2017-27899.pdf>.)
- U.S. Department of the Interior, 2018, Final list of critical minerals 2018: Federal Register, v. 83, no. 97, May 18, p. 23295–23296. (Accessed July 29, 2019, at <https://www.govinfo.gov/content/pkg/FR-2018-05-18/pdf/2018-10667.pdf>.)

TABLE 1  
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS<sup>1</sup>

Year	Quantity of metal (metric tons)					Value of metal (thousands)			
	Recycled from new scrap <sup>2</sup>	Recycled from old scrap <sup>3</sup>	Total recycled	Apparent supply <sup>4</sup>	Percent recycled <sup>5</sup>	Recycled from new scrap <sup>2</sup>	Recycled from old scrap <sup>3</sup>	Total recycled	Apparent supply <sup>4</sup>
<b>Aluminum:</b> <sup>6</sup>									
2014	1,930,000 <sup>r</sup>	1,700,000 <sup>r</sup>	3,640,000 <sup>r</sup>	7,010,000 <sup>r</sup>	52 <sup>r</sup>	\$4,450,000 <sup>r</sup>	\$3,920,000 <sup>r</sup>	\$8,380,000 <sup>r</sup>	\$16,200,000 <sup>r</sup>
2015	1,910,000 <sup>r</sup>	1,470,000 <sup>r</sup>	3,380,000 <sup>r</sup>	7,120,000 <sup>r</sup>	47 <sup>r</sup>	3,710,000 <sup>r</sup>	2,850,000 <sup>r</sup>	6,560,000 <sup>r</sup>	13,900,000 <sup>r</sup>
2016	2,010,000	1,570,000 <sup>r</sup>	3,580,000	7,100,000	50	3,560,000	2,790,000	6,350,000	12,600,000
2017	2,050,000	1,590,000	3,630,000	7,730,000 <sup>r</sup>	47	4,430,000	3,440,000	7,870,000	16,700,000 <sup>r</sup>
2018	2,140,000	1,570,000	3,710,000	7,000,000	53	5,410,000	3,970,000	9,380,000	17,700,000
<b>Chromium:</b> <sup>7</sup>									
2014	NA	NA	161,000 <sup>r</sup>	629,000 <sup>r</sup>	26	NA	NA	372,000 <sup>r</sup>	2,560,000 <sup>r</sup>
2015	NA	NA	159,000 <sup>r</sup>	467,000 <sup>r</sup>	34 <sup>r</sup>	NA	NA	366,000 <sup>r</sup>	1,810,000 <sup>r</sup>
2016	NA	NA	156,000 <sup>r</sup>	457,000 <sup>r</sup>	34	NA	NA	312,000 <sup>r</sup>	1,540,000 <sup>r</sup>
2017	NA	NA	156,000 <sup>r</sup>	543,000 <sup>r</sup>	29	NA	NA	369,000 <sup>r</sup>	2,110,000 <sup>r</sup>
2018	NA	NA	143,000	567,000	25	NA	NA	330,000	2,370,000
<b>Copper:</b> <sup>8</sup>									
2014	672,000	173,000	845,000	2,450,000	35	4,710,000	1,210,000	5,930,000	17,200,000
2015	640,000	166,000	806,000	2,460,000	33	3,610,000	940,000	4,550,000	13,900,000
2016	690,000	149,000	839,000	2,570,000	33	3,420,000	737,000 <sup>r</sup>	4,160,000	12,700,000
2017	702,000	146,000	847,000 <sup>r</sup>	2,570,000	33	4,410,000 <sup>r</sup>	918,000	5,330,000 <sup>r</sup>	16,200,000
2018	712,000	149,000	861,000	2,510,000	34	4,690,000	981,000	5,670,000	16,500,000
<b>Iron and steel:</b> <sup>9</sup>									
2014	NA	NA	58,100,000 <sup>r</sup>	119,000,000 <sup>r</sup>	49 <sup>r</sup>	NA	NA	20,400,000 <sup>r</sup>	41,600,000 <sup>r</sup>
2015	NA	NA	51,300,000 <sup>r</sup>	105,000,000 <sup>r</sup>	49	NA	NA	10,900,000 <sup>r</sup>	22,300,000 <sup>r</sup>
2016	NA	NA	49,900,000 <sup>r</sup>	100,000,000 <sup>r</sup>	50 <sup>r</sup>	NA	NA	9,760,000 <sup>r</sup>	19,600,000 <sup>r</sup>
2017	NA	NA	50,700,000 <sup>r</sup>	108,000,000 <sup>r</sup>	47	NA	NA	13,500,000 <sup>r</sup>	28,600,000 <sup>r</sup>
2018	NA	NA	52,400,000	109,000,000	48	NA	NA	16,900,000	36,300,000
<b>Lead:</b> <sup>10</sup>									
2014	16,900	1,010,000	1,020,000	1,470,000	69 <sup>r</sup>	39,500	2,350,000	2,390,000	3,650,000
2015	16,900	989,000	1,010,000	1,410,000	71 <sup>r</sup>	34,000	1,990,000	2,020,000	3,100,000
2016	17,600	1,060,000	1,070,000	1,490,000	72 <sup>r</sup>	36,700	2,200,000	2,230,000	3,100,000
2017	20,000 <sup>r</sup>	1,120,000 <sup>r</sup>	1,140,000 <sup>r</sup>	1,650,000	69	50,600 <sup>r</sup>	2,820,000 <sup>r</sup>	2,870,000 <sup>r</sup>	4,170,000
2018	20,900	1,150,000	1,170,000	1,550,000	75	51,000	2,810,000	2,860,000	3,800,000
<b>Magnesium:</b> <sup>11</sup>									
2014	56,100	25,000	81,100	148,000	55	266,000	118,000	384,000	700,000
2015	65,600	22,900	88,500	162,000	55	311,000	108,000	419,000	766,000
2016	72,700 <sup>r</sup>	29,400	102,000	169,000	60	344,000	139,000	484,000	802,000 <sup>r</sup>
2017	85,400	29,000	114,000	186,000	62	405,000	138,000	542,000	881,000
2018	80,100	28,400	109,000	187,000	58	383,000	136,000	518,000	895,000
<b>Nickel:</b> <sup>12</sup>									
2014	NA	NA	127,000 <sup>r</sup>	276,000 <sup>r</sup>	46 <sup>r</sup>	NA	NA	2,140,000 <sup>r</sup>	4,650,000 <sup>r</sup>
2015	NA	NA	116,000 <sup>r</sup>	234,000 <sup>r</sup>	50 <sup>r</sup>	NA	NA	1,370,000 <sup>r</sup>	2,770,000 <sup>r</sup>
2016	NA	NA	131,000 <sup>r</sup>	235,000 <sup>r</sup>	56 <sup>r</sup>	NA	NA	1,260,000 <sup>r</sup>	2,250,000 <sup>r</sup>
2017	NA	NA	133,000 <sup>r</sup>	273,000 <sup>r</sup>	49 <sup>r</sup>	NA	NA	1,380,000 <sup>r</sup>	2,840,000 <sup>r</sup>
2018	NA	NA	124,000	259,000	48	NA	NA	1,610,000	3,390,000
<b>Tin:</b> <sup>13</sup>									
2014	2,060	10,600	12,600	44,900	27	46,400	238,000	285,000	1,040,000
2015	1,120	10,100	11,200	43,800	26	18,700	168,000	186,000	722,000
2016	1,080	10,300	11,400	41,400	27	20,000	190,000	210,000	766,000
2017	W	10,000	10,000 <sup>r</sup>	42,000 <sup>r</sup>	23 <sup>r</sup>	W	207,000	207,000 <sup>r</sup>	866,000 <sup>r</sup>
2018	W	9,900	9,900	44,600	22	W	204,000	204,000	921,000
<b>Titanium:</b>									
2014	44,300	1,000	45,300	W	63 <sup>14</sup>	NA	NA	244,000	NA
2015	52,200	1,000	53,200	W	63 <sup>14</sup>	NA	NA	310,000	NA
2016	55,000	1,000	56,000	W	62 <sup>14</sup>	NA	NA	295,000	NA
2017	62,400	1,000	63,400	W	62 <sup>14</sup>	NA	NA	317,000	NA
2018	52,100	1,000	53,100	W	60 <sup>14</sup>	NA	NA	251,000	NA

See footnotes at end of table.

TABLE 1—Continued  
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS<sup>1</sup>

Year	Quantity of metal (metric tons)					Value of metal (thousands)			
	Recycled from new scrap <sup>2</sup>	Recycled from old scrap <sup>3</sup>	Total recycled	Apparent supply <sup>4</sup>	Percent recycled <sup>5</sup>	Recycled from new scrap <sup>2</sup>	Recycled from old scrap <sup>3</sup>	Total recycled	Apparent supply <sup>4</sup>
Zinc: <sup>15</sup>									
2014	173,000	74,900	248,000	1,140,000	22	409,000	177,000	586,000	2,700,000
2015	145,000	52,800	198,000	1,080,000	18	306,000 <sup>r</sup>	111,000 <sup>r</sup>	417,000 <sup>r</sup>	2,280,000 <sup>r</sup>
2016	135,000	29,300	165,000 <sup>r</sup>	942,000	17	303,000 <sup>r</sup>	65,400 <sup>r</sup>	368,000 <sup>r</sup>	2,110,000 <sup>r</sup>
2017	135,000 <sup>r</sup>	30,100 <sup>r</sup>	165,000 <sup>r</sup>	979,000 <sup>r</sup>	17 <sup>r</sup>	415,000 <sup>r</sup>	92,400 <sup>r</sup>	507,000 <sup>r</sup>	3,010,000 <sup>r</sup>
2018	W	W	W	W	W	W	W	W	W

<sup>1</sup>Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Table includes data available through September 17, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Scrap that results from the manufacturing process, including metal and alloy production. New scrap of aluminum, copper, lead, tin, and zinc does not include home scrap, which is scrap generated and recycled in the metal-producing plant.

<sup>3</sup>Scrap that results from consumer products.

<sup>4</sup>Apparent supply, calculated on a contained-weight basis, is primary production plus recycled metal plus imports minus exports with adjustments for stock changes.

<sup>5</sup>Also referred to as recycling rate. Calculated by dividing the total amount recycled by apparent supply.

<sup>6</sup>Quantity is the calculated metal recovery from purchased new and old aluminum-base scrap. Monetary value is estimated based on the annual average Midwest U.S. Market price for primary aluminum metal ingot.

<sup>7</sup>Quantity is estimated as chromium content of stainless-steel scrap receipts, which includes new plus old scrap. Trade data used in the apparent supply calculation includes chromite ore, ferrochromium, chromium metal and scrap, a variety of chromium-containing chemicals, and stainless-steel mill products and scrap.

<sup>8</sup>Quantity includes copper recovered from unalloyed and alloyed copper-based scrap as well as from aluminum-, nickel-, and zinc-based scrap. Monetary value is estimated based on the U.S. producers cathode price (COMEX high grade first position plus S&P Global Platts Metals Week New York dealer cathode premium).

<sup>9</sup>Quantity is the reported recycled scrap from consuming manufacturers. Apparent supply is calculated as shipments of iron and steel products plus castings corrected for imported semifinished products. Monetary value is estimated based on the annual average American Metal Market U.S. composite price for No. 1 heavy-melting.

<sup>10</sup>Monetary value is estimated based on the annual average S&P Global Platts Metals Week North American price for refined lead.

<sup>11</sup>Quantity included magnesium content of aluminum-based scrap. Monetary value is estimated based on the annual average S&P Global Platts Metals Week U.S. Western spot price for magnesium.

<sup>12</sup>Quantity includes nickel recovered from alloys and stainless-steel scrap, as well as aluminum-, copper-, and nickel-based scrap among others. Monetary value is estimated based on annual average S&P Global Platts Metals Week London Metal Exchange cash price for nickel.

<sup>13</sup>Apparent supply does not include withheld stock changes. Monetary value is estimated based on the annual average New York dealer price for tin.

<sup>14</sup>Percentage recycled based on titanium scrap consumed divided by primary sponge and scrap consumption.

<sup>15</sup>Monetary value is estimated based on the annual average S&P Global Platts Metals Week North American price for Special High-Grade zinc.

TABLE 2  
SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS<sup>1</sup>

Year	Exports			Imports for consumption		
	Quantity		Value (thousands)	Quantity		Value <sup>2</sup> (thousands)
	Gross quantity (metric tons)	Contained quantity (metric tons)		Gross quantity (metric tons)	Contained quantity (metric tons)	
<b>Aluminum:</b> <sup>3</sup>						
2014	1,720,000	NA	\$2,880,000	559,000	NA	\$931,000
2015	1,550,000	NA	2,450,000	521,000	NA	795,000
2016	1,350,000	NA	1,880,000	609,000	NA	806,000
2017	1,570,000	NA	2,330,000	699,000 <sup>r</sup>	NA	1,060,000
2018	1,760,000	NA	2,630,000	695,000	NA	1,200,000
<b>Chromium:</b> <sup>4</sup>						
2014	548,000	93,200	674,000	329,000	56,000	427,000
2015	514,000	87,500	639,000	192,000	32,800	166,000
2016	654,000	111,000	443,000	263,000	44,900	183,000
2017	488,000	83,100	426,000	283,000	48,300	282,000
2018	545,000	92,800	320,000	331,000	56,400	347,000
<b>Copper:</b> <sup>5</sup>						
2014	1,040,000	829,000	3,460,000	117,000	92,600	563,000
2015	954,000	769,000	2,750,000	112,000	88,400	457,000
2016	944,000	758,000	2,230,000	125,000	98,400	459,000
2017	1,000,000	826,000	2,750,000	165,000	129,000	761,000
2018	913,000	772,000	3,150,000	157,000	123,000	766,000
<b>Iron and steel:</b>						
2014	15,300,000	NA	6,150,000	4,260,000 <sup>r</sup>	4,260,000 <sup>r</sup>	1,720,000 <sup>r</sup>
2015	12,800,000	NA	4,010,000	3,590,000 <sup>r</sup>	3,590,000 <sup>r</sup>	967,000 <sup>r</sup>
2016	12,600,000	NA	3,550,000	3,870,000 <sup>r</sup>	3,870,000 <sup>r</sup>	953,000 <sup>r</sup>
2017	15,000,000	NA	4,860,000	4,640,000 <sup>r</sup>	4,640,000 <sup>r</sup>	1,490,000
2018	17,100,000	NA	5,900,000	5,050,000	5,050,000	1,810,000
<b>Lead:</b> <sup>6</sup>						
2014	36,300	NA	51,200	12,600	7,820	14,400
2015	46,600	NA	57,500	7,560	4,850 <sup>r</sup>	5,780
2016	45,900	NA	56,100	7,420	5,900	7,700
2017	57,600	NA	80,700	9,850	6,610	9,310
2018	49,500	NA	79,100	6,240	4,120	5,710
<b>Magnesium:</b> <sup>7</sup>						
2014	923	NA	2,460	19,000	NA	43,800
2015	432	NA	895	21,300	NA	44,300
2016	996	NA	2,040	21,800 <sup>r</sup>	NA	50,200 <sup>r</sup>
2017	1,200	NA	2,270	16,900	NA	33,000 <sup>r</sup>
2018	784	NA	1,450	22,200	NA	40,700
<b>Nickel:</b> <sup>8</sup>						
2014	578,000	56,300	799,000	358,000	39,000	642,000
2015	541,000	51,900	746,000	218,000	27,100	337,000
2016	683,000	63,700	541,000	288,000	32,300	325,000
2017	518,000	51,500	545,000	316,000	38,100	494,000
2018	582,000	59,400	479,000	371,000	45,100	664,000
<b>Tin:</b> <sup>9</sup>						
2014	7,480	NA	19,600	49,700	NA	19,400
2015	2,530	NA	7,360 <sup>r</sup>	32,700	NA	12,300
2016	4,570	NA	11,200 <sup>r</sup>	27,200	NA	5,460
2017	3,460	NA	8,530	52,100	NA	15,800
2018	5,980	NA	4,570	47,700	NA	15,700
<b>Titanium:</b> <sup>10</sup>						
2014	4,610 <sup>r</sup>	NA	18,200	19,300	NA	101,000
2015	6,860	NA	25,900	22,100	NA	124,000
2016	9,720	NA	25,600	18,500	NA	93,600
2017	9,450	NA	28,100	25,200	NA	122,000
2018	11,900	NA	33,500	26,700	NA	123,000

See footnotes at end of table.

TABLE 2—Continued  
 SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS<sup>1</sup>

Year	Exports			Imports for consumption		
	Quantity		Value (thousands)	Quantity		Value <sup>2</sup> (thousands)
	Gross quantity (metric tons)	Contained quantity (metric tons)		Gross quantity (metric tons)	Contained quantity (metric tons)	
Zinc: <sup>11</sup>						
2014	71,400	NA	93,700	24,900	NA	30,900
2015	55,200	NA	68,600	18,000	NA	20,100
2016	30,100	NA	37,800	11,300	NA	12,800
2017	33,600	NA	41,100	11,100 <sup>r</sup>	NA	20,200
2018	40,400	NA	49,800	12,900	NA	22,000

<sup>1</sup>Revised. NA Not available.

<sup>1</sup>Table includes data available through September 17, 2020. Contained quantity is equal to gross quantity, unless otherwise specified. Data are rounded to no more than three significant digits.

<sup>2</sup>Import value is customs value.

<sup>3</sup>Includes aluminum remelt scrap ingot and aluminum waste and scrap, Harmonized Tariff Schedule of the United States (HTS) codes 7601.20.9075, 7602.00.0030, and 7602.00.0090.

<sup>4</sup>Includes stainless-steel scrap and chromium metal waste and scrap, HTS codes 7204.21.0000 and 8112.22.0000. For HTS code 7204.21.0000, the contained quantity for imports and exports is 17% of gross quantity; for HTS code 8112.22.0000, the contained quantity is 100% of gross quantity.

<sup>5</sup>Includes copper waste and scrap. For HTS codes 7404.00.0041, 7404.00.0046, 7404.00.0051, 7404.00.0056, 7404.00.0061, 7404.00.0066, 7404.00.0075, 7404.00.0085, and 7404.00.0095, the contained quantity for exports is estimated to be 65% of gross quantity. For HTS codes 7404.00.3045, 7404.00.3055, 7404.00.3065, 7404.00.3090, 7404.00.6045, 7404.00.6055, 7404.00.6065, and 7404.00.6090, the contained quantity for imports is estimated to be 72% of gross quantity.

<sup>6</sup>Includes waste and scrap obtained from lead-acid batteries, HTS codes 7802.00.0030 and 7802.00.0060.

<sup>7</sup>Includes magnesium waste and scrap, HTS code 8104.20.0000.

<sup>8</sup>Includes nickel waste and scrap. For HTS code 7204.29.0000, the contained quantity for import and exports is 0.4% of gross quantity. For HTS code 7503.00.0000, the contained quantity is 50% of gross quantity. For HTS code 7204.21.0000, the contained quantity is 7.5% of gross quantity.

<sup>9</sup>Includes tin waste and scrap, HTS code 8002.00.0000.

<sup>10</sup>Includes titanium waste and scrap, HTS code 8108.30.0000.

<sup>11</sup>Includes zinc waste and scrap, HTS code 7902.00.0000.