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2016 Minerals Yearbook

RECYCLING—METALS [ADVANCE RELEASE]

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Recycling—Metals

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In 2016, the United States recycled 59.0 million metric tons (Mt) of selected metals, an amount equivalent to about 51% of the apparent supply of those metals (table 1). About 90% of recycled metal was iron and steel, and about 89% of apparent supply was iron and steel. By gross quantity, the United States exported 16.4 Mt of scrap metals and imported 5.25 Mt of these same metals (table 2).

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 and "old," postconsumer sources. The many stages of industrial processing that precede formation of an end product are the sources of new scrap. 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.

Reference 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], http://pubs.usgs.gov/circ/circ1196/. (Accessed May 11, 2018, via https://pubs.usgs.gov/circ/circ1196/.)

TABLE 1
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS[1]

	Quantity of metal (metric tons)					Value of metal (thousands)			
Year	Recycled from new scrap[2]	Recycled from old scrap[3]	Recycled[4]	Apparent supply[5]	Percentage recycled[6]	Recycled from new scrap[2]	Recycled from old scrap[3]	Recycled[4]	Apparent supply
Aluminum:[7]									
2012	1,750,000 r	1,620,000 r	3,380,000	5,880,000 r	57	$3,900,000 r	$3,620,000 r	$7,510,000 r	$13,100,000 r
2013	1,790,000	1,630,000	3,410,000 r	6,310,000 r	54	3,710,000 r	3,380,000 r	7,090,000 r	13,100,000 r
2014	1,870,000 r	1,690,000 r	3,570,000	6,940,000 r	51	4,310,000 r	3,900,000 r	8,210,000 r	16,000,000 r
2015	2,000,000 r	1,560,000 r	3,560,000 r	7,310,000 r	49 r	3,900,000 r	3,030,000 r	6,920,000 r	14,200,000 r
2016	2,010,000	1,580,000	3,580,000	7,100,000	50	3,560,000	2,790,000	6,350,000	12,600,000
Chromium:[8]									
2012	NA	NA	146,000	543,000	27	NA	NA	298,000	2,710,000
2013	NA	NA	150,000	477,000	31	NA	NA	275,000	1,640,000
2014	NA	NA	157,000	598,000	26	NA	NA	308,000	2,390,000 r
2015	NA	NA	154,000	463,000 r	33 r	NA	NA	303,000 r	1,650,000 r
2016	NA	NA	152,000	452,000	34	NA	NA	310,000	1,320,000
Copper:[9]									
2012	642,000	164,000	807,000 r	2,400,000	34 r	5,200,000	1,330,000	6,530,000	19,400,000
2013	630,000	166,000	797,000 r	2,390,000	33	4,720,000	1,250,000 r	5,970,000 r	17,900,000
2014	672,000	173,000	845,000	2,450,000	35 r	4,710,000	1,210,000 r	5,930,000 r	17,200,000 r
2015	640,000 r	166,000 r	806,000 r	2,460,000 r	33	3,610,000	940,000	4,550,000	13,900,000 r
2016	690,000	150,000	839,000	2,570,000	33	3,420,000	740,000	4,160,000	12,700,000
Iron and steel:[10]									
2012	NA	NA	63,100,000	106,000,000	59	NA	NA	22,800,000	35,400,000
2013	NA	NA	59,000,000	106,000,000	56	NA	NA	20,100,000	36,200,000
2014	NA	NA	58,500,000 r	117,000,000	50	NA	NA	20,500,000	38,900,000
2015	NA	NA	52,500,000	106,000,000	49	NA	NA	11,200,000	20,900,000
2016	NA	NA	53,000,000	102,000,000	52	NA	NA	7,200,000	19,200,000
Lead:[11]									
2012	19,200	1,090,000	1,110,000	1,490,000	74	48,200 r	2,740,000 r	2,790,000 r	3,760,000 r
2013	20,700	1,130,000	1,150,000	1,600,000	72	50,300 r	2,740,000 r	2,790,000 r	3,870,000 r
2014	18,400	1,020,000	1,040,000 r	1,560,000	67 r	43,000	2,380,000	2,430,000 r	3,650,000
2015	19,300	1,030,000	1,050,000	1,540,000	68	38,700	2,080,000	2,110,000 r	3,100,000
2016	NA	NA	1,000,000	1,490,000	67	NA	NA	2,080,000	3,100,000
Magnesium:[12]									
2012	51,900 r	25,200	77,000 r	137,000	56	252,000	122,000	374,000 r	663,000 r
2013	54,300	24,900 r	79,200 r	136,000	58	260,000 r	119,000 r	379,000 r	653,000 r
2014	56,100 r	25,000	81,100 r	148,000 r	55	266,000	118,000	384,000 r	700,000 r
2015	65,600 r	22,900 r	88,500 r	162,000 r	55 r	311,000 r	108,000 r	419,000 r	766,000 r
2016	72,800	23,200	96,000	178,000	54	345,000	110,000	455,000	846,000
Nickel:[13]									
2012	NA	NA	90,300 r	215,000	42	NA	NA	1,580,000 r	3,760,000 r
2013	NA	NA	89,100 r	200,000 r	44	NA	NA	1,340,000 r	3,050,000 r
2014	NA	NA	91,500 r	240,000 r	38	NA	NA	1,540,000 r	4,050,000 r
2015	NA	NA	90,600 r	209,000 r	43	NA	NA	1,070,000	2,500,000 r
2016	NA	NA	90,000	194,000	46	NA	NA	863,000	1,870,000
Tin:[14]									
2012	2,380	11,200	13,500	46,900 r	31	67,300	316,000	383,000	1,220,000
2013	2,150	10,600	12,700	45,100 r	28	49,300	243,000	292,000	1,050,000
2014	2,060	10,600	12,600	44,900 r	27	46,400	238,000	285,000	1,040,000
2015	1,120 r	10,100	11,200 r	43,800	26 r	18,700 r	168,000	186,000 r	722,000 r
2016	1,050	10,300	11,300	43,100	27	19,400	190,000	209,000	788,000
Titanium:[15]									
2012	38,700	1,000	39,700	W	52	NA	NA	278,000	NA
2013	39,100	1,000	40,100	W	60	NA	NA	210,000	NA
2014	44,300	1,000	45,300	W	63	NA	NA	244,000	NA
2015	52,200	1,000	53,200	W	63	NA	NA	310,000	NA
2016	55,000	1,000	56,000	W	62	NA	NA	293,000	NA

See footnotes at end of table.

TABLE 1—Continued
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS[1]

Year	Quantity of metal (metric tons) Recycled from new scrap[2]	Recycled from old scrap[3]	Recycled[4]	Apparent supply[5]	Percentage recycled[6]	Value of metal (thousands) Recycled from new scrap[2]	Recycled from old scrap[3]	Recycled[4]	Apparent supply
Zinc:[16]									
2012	205,000	129,000	335,000	1,090,000	31	433,000	273,000	706,000	2,300,000
2013	153,000	113,000	267,000	1,070,000	25	323,000	238,000	562,000	2,260,000
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 r	198,000	1,080,000	18	324,000 r	118,000 r	442,000 r	2,410,000 r
2016	135,000	29,200	164,000	942,000	17	415,000	89,700	504,000	2,890,000

[r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.

[1]Table includes data available through June 27, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]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.

[3]Scrap that results from consumer products.

[4]Metal recovered from new plus old scrap.

[5]Apparent supply is production plus imports minus exports plus stock changes. Production is primary production plus recycled metal. Apparent supply is calculated on a contained-weight basis.

[6]Also referred to as recycling rate. Calculated by dividing the amount recycled by the apparent supply.

[7]Quantity of metal is the calculated metallic recovery from purchased new and old aluminum-base scrap, estimated for full industry coverage. Monetary value is estimated based on average U.S. market price for primary aluminum metal ingot. Series revised by removing imported scrap to avoid double counting.

[8]Quantity of chromium metal recycled was estimated as chromium content of stainless steel scrap receipts (reported by the iron and steel and pig iron industries). For the calculation of apparent supply, trade includes reported or estimated chromium content of chromite ore, ferrochromium, chromium metal and scrap, a variety of chromium-containing chemicals, and stainless steel mill products and scrap. Stocks include estimated chromium content of reported and estimated producer, consumer, and Government stocks. Recycled monetary value estimated as recycled quantity times the average import value of high-carbon ferrochromium. Apparent supply monetary value estimated like apparent supply quantity with monetary value substituted for chromium content.

[9]Includes copper recovered from unalloyed and alloyed copper-base scrap, as refined copper or in alloy forms, as well as copper recovered from aluminum-, nickel-, and zinc-base scrap. Monetary value based on annual average refined copper prices.

[10]Recycled scrap reported from consuming manufacturers. Apparent supply measured as shipments of iron and steel products plus castings corrected for imported semifinished products. Recycled unit value is the U.S. annual average composite price for No. 1 heavy-melting steel calculated from prices published in American Metal Market. Unit value for the year was used to calculate values of recycled scrap and apparent supply of scrap.

[11]Apparent supply of lead is production plus net imports. Monetary values for 2012 are based on the Platts Metals Week North American Producer Price for refined lead, and 2013–16 values are based on the Platts Metals Week North American price for refined lead.

[12]Includes magnesium content of aluminum-base scrap. Monetary value based on the annual average Platts Metals Week U.S. spot western magnesium price.

[13]Nickel statistics were derived from the following:

Production, consumption, and receipts data

- •Reported nickel content of products made from reclaimed stainless steel dust, spent nickel-cadmium batteries, plating solutions, and other products.
- •Estimated nickel content of reported net receipts of alloy and stainless steel scrap.
- •Reported nickel content of recovered copper-base scrap.
- •Reported nickel content of obsolete and prompt purchased nickel-base scrap.
- •Estimated nickel content of various types of reported obsolete and prompt aluminum scrap.

Stock data

- •Reported or estimated nickel content of all scrap stocks, except copper.
- •Reported nickel content of primary products held by world producers in U.S. warehouses.
- •Reported nickel content of primary products held by U.S. consumers.
- •Reported nickel content of U.S. Government stocks.

Monetary value based on annual average cash price for cathode, as reported by the London Metal Exchange.

[14]Monetary value based on Platts Metals Week composite price for tin for 2012 and 2013, and on Platts Metals Week New York dealer tin price for 2014–2016. Apparent supply does not include withheld stock changes.

[15]Percentage recycled based on titanium scrap consumed divided by primary sponge and scrap consumption.

[16]Monetary value based on annual average Platts Metals Week North American price for Special High-Grade Zinc. Apparent supply for zinc is calculated as refined primary production plus total recycled from new and old scrap plus refined imports minus refined exports.

TABLE 2
SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS

Year	Exports: Quantity: Gross quantity (metric tons)	Exports: Quantity: Contained quantity (metric tons)	Exports: Value (thousands)	Imports for consumption: Quantity: Gross quantity (metric tons)	Imports for consumption: Quantity: Contained quantity (metric tons)	Imports for consumption: Value[1] (thousands)
Aluminum:[2]						
2012	2,030,000	NA	$3,490,000	588,000	NA	$905,000
2013	1,870,000	NA	3,270,000	565,000	NA	848,000
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	1,890,000	609,000	NA	806,000
Chromium:[3]						
2012	623,000	106,000	804,000	156,000	26,900	238,000 r
2013	644,000	109,000	742,000	226,000	38,600	211,000
2014	548,000	93,200	674,000	329,000	56,000	427,000 r
2015	514,000	87,500 r	639,000 r	192,000	32,800	166,000 r
2016	654,000	111,000	443,000	263,000	44,900	183,000
Copper:[4]						
2012	1,190,000	941,000	4,400,000	105,000	83,800	528,000
2013	1,150,000	908,000	4,070,000	106,000	84,700	521,000
2014	1,040,000	829,000	3,460,000	117,000	92,600	563,000
2015	954,000 r	769,000 r	2,750,000	112,000	88,400	457,000
2016	944,000	757,000	2,220,000	125,000	98,400	459,000
Iron and steel:						
2012	21,300,000	NA	9,410,000	3,720,000	3,720,000	1,590,000
2013	18,500,000	NA	7,550,000	3,930,000	3,930,000	1,470,000
2014	15,300,000	NA	6,150,000	4,260,000	4,260,000	1,720,000
2015	12,800,000	NA	4,010,000	3,590,000	3,590,000	967,000
2016	12,600,000	NA	3,550,000	3,870,000	3,870,000	953,000
Lead:[5]						
2012	25,900	NA	30,600	20,000 r	13,100	18,300 r
2013	34,400	NA	44,900	9,430 r	6,160	8,490 r
2014	36,300	NA	51,200	12,600 r	7,820	14,400 r
2015	46,600	NA	57,500	7,560 r	4,950	5,780 r
2016	45,900	NA	56,000	7,420	5,900	7,700
Magnesium:[6]						
2012	2,100	NA	5,290	20,900	20,900	47,700
2013	471	NA	1,420	17,500	17,500	43,300
2014	923	NA	2,460	19,000	19,000	43,800
2015	432	NA	895	21,300	21,300	44,300
2016	996	NA	2,040	21,900	21,900	50,300
Nickel:[7]						
2012	649,000	59,600	804,000	177,000	22,300	237,000
2013	669,000	61,100	742,000	245,000	26,300	211,000
2014	578,000	56,300	674,000	358,000	39,000	426,000
2015	541,000 r	51,900	639,000 r	218,000	27,100	165,000
2016	683,000	63,700	442,000	288,000	32,300	182,000
Tin:[8]						
2012	10,300	NA	27,200	72,500	NA	24,800
2013	5,020	NA	17,300	63,700	NA	23,100
2014	7,480	NA	19,600	49,700	NA	19,400
2015	2,530	NA	7,360	32,700	NA	12,300
2016	4,570	NA	11,200	27,200	NA	5,460
Titanium:[9]						
2012	8,760	NA	45,300	14,400	NA	98,500
2013	4,700	NA	21,800	12,700	NA	63,600
2014	4,610	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

See footnotes at end of table.

TABLE 2—Continued
SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS

Year	Exports: Quantity: Gross quantity (metric tons)	Exports: Quantity: Contained quantity (metric tons)	Exports: Value (thousands)	Imports for consumption: Quantity: Gross quantity (metric tons)	Imports for consumption: Quantity: Contained quantity (metric tons)	Imports for consumption: Value[1] (thousands)
Zinc:[10]						
2012	90,400	NA	107,000	20,000	NA	24,600
2013	88,000	NA	105,000	21,000	NA	25,300
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

[r]Revised. NA Not available.
[1]Imports value is customs value.
[2]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.
[3]Includes stainless steel scrap and chromium metal waste and scrap. Contained quantity for import and export quantities of HTS code 7204.21.0000 is 17% of gross quantity; for HTS code 8112.22.0000, contained quantity is 100% of gross quantity.
[4]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, contained quantity for exports is estimated as 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, contained quantity for imports is estimated as 72% of gross quantity.
[5]Includes waste and scrap obtained from lead-acid batteries HTS codes 7802.00.0030 and 7802.00.0060. Gross quantity also includes waste and scrap obtained from HTS codes 2620.19.6020, 2620.21.0020, 2620.29.0020, and 2620.30.0020.
[6]Includes magnesium waste and scrap HTS code 8104.20.0000.
[7]Contained quantity for import and export quantities is 0.4% of gross quantity for HTS code 7204.29.0000, 50% for HTS code 7503.00.0000, and 7.5% for HTS code 7204.21.0000.
[8]Includes tin waste and scrap HTS code 8002.00.0000.
[9]Includes titanium waste and scrap HTS code 8108.30.0000.
[10]Includes zinc waste and scrap HTS code 7902.00.0000.