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2020 Minerals Yearbook

RECYCLING—METALS [ADVANCE RELEASE]

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Recycling—Metals

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In 2020, recycled material as a percentage of apparent supply of various metals, including aluminum, chromium, copper, iron and steel, lead, magnesium, nickel, and tin, ranged from a low of 25% for chromium to a high of 78% for lead (table 1). In 2020, the United States recycled 50.6 million metric tons (Mt) with a total value of $26.2 billion (excluding titanium and zinc for which data were withheld to avoid disclosing company proprietary data). In 2019, the quantity of metals recycled was 53.3 Mt valued at $29.9 billion. In 2020, the quantity of metals recycled was equivalent to 52% of the apparent supply of those metals, and the total value of metals recycled was equivalent to 48% of the apparent supply's value. These values were 15% more than the 45% of the quantity of apparent supply from recycled metals and 9% more than the 44% of the value of apparent supply from the value of recycled metals in 2019. In 2020, iron and steel accounted for 90% of the total quantity of recycled metals and 39% of the total value of recycled metals. Aluminum accounted for 6% of the total quantity of recycled metals and 23% of the total value of recycled metals. By gross weight, the United States exported 20.3 Mt of scrap metals with a total value of $10.5 billion and imported 5.4 Mt worth $2.7 billion of these same metals (table 2).

In 2020, Umicore N.V. (Umicore) closed its Umicore Specialty Materials Recycling plant in Wickliffe, OH, which processed superalloy scrap to recover cobalt, nickel, and rhenium as metal salts. In September 2020, Umicore announced that it would close its Umicore Specialty Chemicals plant in Arab, AL, which processed spent cobalt-manganese catalyst scrap to produce new catalyst material (Umicore N.V., 2020).

On November 1, 2020, updated standards for imports of high-grade copper scrap into China took effect, with minimum copper contents ranging from 94% to 99.9%, depending on the scrap type. The Government of China planned to ban imports of material that it classifies as solid waste, including some types of copper scrap, beginning on January 1, 2021. Imports of scrap that contain no less than the minimum copper quantities would no longer be considered solid waste when the new regulations go into effect (CRU International Ltd., 2020; Mir, 2020; Staub, 2020).

American Zinc Recycling Corp. (Pittsburgh, PA) operated a solvent extraction–electrowinning (SX–EW) zinc refinery in Mooresboro, NC. The refinery reopened in March 2020 after being idle for most of 2019. The plant had the capacity to produce about 141,000 metric tons per year (155,000 short tons per year) of Special High Grade zinc from secondary materials, mostly Waelz oxide sourced from the company's four electric arc furnace dust recycling operations in Barnwell, SC, Calumet, IL, Palmerton, PA, and Rockwood, TN (American Zinc Recycling LLC, 2020).

At least 9 of the 10 States that collected deposits on beverage containers adjusted rules on redemption centers to be consistent with lockdown orders in response to the global coronavirus disease 2019 (COVID-19) pandemic. Starting in mid-March 2020, these States generally ordered redemption centers to close, suspended enforcement of deposit redemptions at retail locations still open, and encouraged consumers to return containers once the redemption centers reopened. As a result, supplies of Used Beverage Can (UBC) scrap decreased while demand for can sheet and beverages in aluminum cans remained firm. In response to the shortage of domestic UBC scrap, imports of UBC scrap in May increased by 37% compared with imports in April 2020 and increased by 45% compared with those in May 2019. By July, as many of the States permitted redemption centers to reopen and domestic supplies increased, UBC imports decreased but were still significantly higher for the rest of the year when compared with the corresponding month in 2019. As COVID-19 infections increased in the fall, some States suspended deposit redemption enforcement again (Container Recycling Institute, 2020; Stewart, 2020).

Actions to achieve the goals and objectives of Executive Order 13817, "A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals," issued in December 2017, continued in 2020 (Trump, 2017). As outlined in a report issued by the U.S. Department of Commerce, a strategy was developed to reduce the Nation's reliance on critical minerals including: (1) an assessment of progress toward developing critical minerals recycling and reprocessing technologies and technological alternatives to critical minerals; (2) options for accessing and developing critical minerals through investment and trade with U.S. allies and partners; (3) a plan to improve the topographic, geologic, and geophysical mapping of the United States and make the resulting data and metadata electronically accessible (to the extent permitted by law and subject to appropriate limitations for purposes of privacy and security) to support private sector mineral exploration of critical minerals; (4) recommendations to streamline permitting and review processes related to developing leases; (5) enhancing access to resources of critical minerals; and (6) increasing discovery, production, and domestic refining of critical minerals (U.S. Department of Commerce, 2019). Of the 10 commodities analyzed in this report, 4 were identified as critical minerals: chromium, magnesium, tin, and titanium (U.S. Department of the Interior, 2018).

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 economic processes to mine and process metallic ores from the Earth, recycle metal from use and (or) process streams,

and develop efficient uses for 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

American Zinc Recycling LLC, 2020, American Zinc Recycling restarts production at facility in Rutherford County, N.C., produces Special High Grade zinc solely from recycled sources: Pittsburgh, PA, American Zinc Recycling LLC news release, October 14. (Accessed March 5, 2022, at https://americanzincproducts.com/american-zinc-recycling-restarts-production-at-facility-in-rutherford-county-n-c-produces-special-high-grade-zinc-solely-from-recycled-sources/.)

Container Recycling Institute, 2020, COVID-19 impact on deposit redemption—U.S. & Canada: Culver City, CA, Container Recycling Institute, December 8. (Accessed April 9, 2021, at http://www.bottlebill.org/index.php/covid-19-bottle-redemption-update.)

CRU International Ltd., 2020, CRU copper China fortnightly: London, United Kingdom, CRU International Ltd., October 30, 5 p. (Accessed November 6, 2021, via http://www.crugroup.com/.)

Mir, Fawad, 2020, China updates copper, aluminum scrap metal import standards: New York, NY, S&P Global Market Intelligence, January 20. (Accessed January 24, 2022, via http://www.snl.com/.)

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, at https://pubs.usgs.gov/circ/circ1196/.)

Staub, Colin, 2020, China confirms expanded import ban starting Jan. 1: Portland, OR, Resource Recycling, Inc., December 1. (Accessed December 18, 2021, at https://resource-recycling.com/recycling/2020/12/01/china-confirms-expanded-import-ban-starting-jan-1/.)

Stewart, Jenny, 2020, UBC imports climb in May on weak supply: Fastmarkets AMM, v. 128, no. 29–2, July 14, p. 3.

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 February 22, 2022, at https://www.govinfo.gov/content/pkg/FR-2017-12-26/pdf/2017-27899.pdf.)

Umicore N.V., 2020, Umicore streamlines its cobalt and specialty materials activities: Brussels, Belgium, Umicore N.V. press release, September 30. (Accessed April 13, 2022, at https://www.umicore.com/en/newsroom/news/umicore-streamlines-its-cobalt-specialty-materials-activities/.)

U.S. Department of Commerce, 2019, A Federal strategy to ensure secure and reliable supplies of critical minerals: U.S. Department of Commerce, June 4, 50 p. (Accessed April 13, 2022, at https://www.commerce.gov/data-and-reports/reports/2019/06/federal-strategy-ensure-secure-and-reliable-supplies-critical-minerals.)

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 April 13, 2022, 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[1]

	Quantity (metric tons)					Value (thousands)			
Metal and year	Recycled from new scrap[2]	Recycled from old scrap[3]	Total recycled	Apparent supply[4]	Percent recycled[5]	Recycled from new scrap[2]	Recycled from old scrap[3]	Total recycled	Apparent supply[4]
Aluminum:[6]									
2016	2,010,000	1,570,000	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	47	4,430,000	3,440,000	7,870,000	16,700,000
2018	2,140,000	1,570,000	3,710,000	7,040,000	53	5,410,000	3,970,000	9,280,000 r	17,800,000
2019	1,920,000	1,540,000	3,470,000	6,910,000 r	50 r	4,220,000	3,380,000	7,600,000	15,200,000 r
2020	1,630,000	1,420,000	3,050,000	5,620,000	54	3,230,000	2,800,000	6,030,000	11,100,000
Chromium:[7]									
2016	NA	NA	152,000 r	451,000 r	34	NA	NA	222,000 r	1,310,000 r
2017	NA	NA	152,000 r	541,000 r	28 r	NA	NA	359,000 r	2,110,000 r
2018	NA	NA	139,000 r	583,000 r	24	NA	NA	316,000 r	2,380,000 r
2019	NA	NA	135,000 r	520,000 r	26 r	NA	NA	246,000 r	1,660,000 r
2020	NA	NA	116,000	465,000	25	NA	NA	170,000	1,370,000
Copper:[8]									
2016	690,000	149,000	838,000	2,570,000	33	3,420,000	737,000	4,160,000	12,800,000
2017	702,000	146,000	847,000	2,560,000	33	4,410,000	918,000	5,330,000	16,100,000
2018	712,000	141,000 r	853,000 r	2,530,000 r	34	4,690,000	926,000 r	5,620,000 r	16,700,000
2019	700,000 r	166,000 r	866,000 r	2,520,000	34	4,320,000 r	1,020,000 r	5,340,000 r	15,600,000 r
2020	697,000	160,000	858,000	2,360,000	36	4,410,000	1,010,000	5,420,000	14,900,000
Iron and steel:[9]									
2016	NA	NA	49,800,000	100,000,000	50	NA	NA	9,760,000	19,600,000
2017	NA	NA	50,400,000	108,000,000	47	NA	NA	13,500,000	28,600,000
2018	NA	NA	52,300,000 r	109,000,000	48 r	NA	NA	16,900,000	35,300,000 r
2019	NA	NA	47,400,000 r	106,000,000	45 r	NA	NA	11,800,000 r	26,400,000
2020	NA	NA	45,300,000	86,800,000	52	NA	NA	10,300,000	19,800,000
Lead:[10]									
2016	19,200	1,090,000	1,110,000	1,480,000	75	39,900	2,280,000	2,320,000	3,080,000
2017	20,000	1,120,000	1,140,000	1,650,000	69	50,600	2,820,000	2,870,000	4,170,000
2018	20,900	1,150,000	1,170,000	1,550,000	75	51,100	2,800,000	2,850,000	3,780,000
2019	20,100	1,160,000	1,180,000	1,560,000	76	44,300	2,550,000	2,590,000	3,430,000
2020	15,000	1,020,000	1,030,000	1,330,000	78	30,200	2,050,000	2,080,000	2,680,000
Magnesium:[11]									
2016	72,700	29,400	102,000	169,000	60	344,000	139,000	484,000	802,000
2017	85,400	29,000	114,000	186,000	62	405,000	138,000	542,000	881,000
2018	80,100 r	28,400 r	109,000	186,000	58	385,000	137,000	522,000	891,000
2019	74,500	26,100	101,000	192,000	52	214,000	141,000	355,000	1,030,000
2020	72,500	27,300	99,800	180,000	55	398,000	149,000	547,000	998,000
Nickel:[12]									
2016	NA	NA	131,000	235,000	56	NA	NA	1,260,000	2,250,000
2017	NA	NA	133,000	273,000	49	NA	NA	1,380,000	2,840,000
2018	NA	NA	123,000	259,000	48	NA	NA	1,610,000	3,390,000
2019	NA	NA	111,000	217,000	51	NA	NA	1,540,000	3,020,000
2020	NA	NA	99,000	190,000	52	NA	NA	1,320,000	2,620,000
Tin:[13]									
2016	8,770	9,960	18,700	50,900	37	162,000	184,000	346,000	942,000
2017	8,080	10,000	18,100	52,400 r	35	167,000	207,000	374,000	1,080,000
2018	8,110	9,890 r	18,000	54,800	33	167,000	204,000	371,000 r	1,130,000
2019	8,120 r	10,100 r	18,600 r	52,800 r	35	155,000	201,000 r	356,000 r	1,010,000 r
2020	7,990	9,550	17,500	49,200	36	141,000	168,000	309,000	866,000
Titanium:[14]									
2016	55,000	1,000	56,000	W	62	NA	NA	295,000	NA
2017	62,400	1,000	63,400	W	62	NA	NA	317,000	NA
2018	52,100	1,000	53,100	W	60	NA	NA	251,000	NA
2019e	W	1,000	W	W	60	NA	NA	NA	NA
2020e	W	1,000	W	W	W	NA	NA	NA	NA
Zinc:[15]									
2016	135,000	29,300	165,000	942,000	17	303,000	65,400	368,000	2,110,000
2017	135,000	30,100	165,000	979,000	17	415,000	92,400	507,000	3,010,000
2018	W	W	W	W	W	W	W	W	W
2019	W	W	W	W	W	W	W	W	W
2020	W	W	W	W	W	W	W	W	W

See footnotes at end of table.

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

[e]Estimated. [r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.
[1]Table includes data available through February 23, 2022. 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]Apparent supply, calculated on a contained-weight basis, is primary production plus recycled metal plus imports minus exports with adjustments for stock changes.
[5]Also referred to as recycling rate. Calculated by dividing the total amount recycled by apparent supply.
[6]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.
[7]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 include chromite ore, ferrochromium, chromium metal and scrap, a variety of chromium-containing chemicals, and stainless steel mill products and scrap. Monetary value is estimated based on the average import value of high-carbon ferrochromium.
[8]Quantity includes copper recovered from unalloyed and alloyed copper-base scrap and from aluminum-, nickel-, and zinc-base 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).
[9]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 Fastmarket AMM U.S. composite price for No. 1 heavy-melting.
[10]Monetary value is estimated based on the annual average S&P Global Platts Metals Week North American price for refined lead.
[11]Quantity includes magnesium content of aluminum-base scrap. Monetary value is estimated based on the annual average S&P Global Platts Metals Week U.S. Western spot price for magnesium.
[12]Quantity includes nickel recovered from alloys and stainless-steel scrap and aluminum-, copper-, and nickel-base scrap, among others. Monetary value is estimated based on annual average S&P Global Platts Metals Week London Metal Exchange cash price for nickel.
[13]Apparent supply does not include withheld stock changes. Monetary value is estimated based on the annual average S&P Global Platts Metals Week New York dealer price for tin.
[14]Percentage recycled is based on titanium scrap consumed divided by primary sponge and scrap consumption.
[15]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[1]

	Exports			Imports for consumption		
	Quantity			Quantity		
Metal and year	Gross weight (metric tons)	Metal content (metric tons)	Value (thousands)	Gross weight (metric tons)	Metal content (metric tons)	Value[2] (thousands)
Aluminum:[3]						
2016	1,350,000	NA	$1,880,000	609,000	NA	$806,000
2017	1,570,000	NA	2,330,000	699,000 r	NA	1,060,000
2018	1,760,000	NA	2,630,000	695,000	NA	1,200,000
2019	1,860,000	NA	2,280,000	596,000	NA	847,000
2020	1,840,000	NA	2,260,000	150,000	NA	189,000
Chromium:[4]						
2016	654,000	111,000	443,000	263,000	44,900	183,000
2017	486,000 r	82,800 r	425,000 r	283,000	48,300	282,000
2018	545,000	92,800	320,000	331,000	56,400	347,000
2019	422,000 r	71,800 r	345,000 r	205,000	35,000	184,000
2020	314,000	53,400	276,000	220,000	37,500	198,000
Copper:[5]						
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
2019	871,000 r	714,000	2,820,000	138,000	108,000	606,000
2020	776,000	643,000	2,670,000	114,000	89,900	492,000
Iron and steel:						
2016	12,600,000	NA	3,550,000	3,870,000	3,870,000	953,000
2017	15,000,000	NA	4,860,000	4,640,000	4,640,000	1,490,000
2018	17,100,000	NA	5,900,000	5,050,000	5,050,000	1,810,000
2019	17,600,000	NA	5,320,000	4,290,000	4,290,000	1,300,000
2020	16,900,000	NA	4,790,000	4,570,000	4,570,000	1,330,000
Lead:[6]						
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
2019	39,100	NA	61,300 r	6,600	4,430	5,260
2020	46,200	NA	68,100	6,560	4,470	4,530
Magnesium:[7]						
2016	996	NA	2,040	21,800 r	NA	50,200 r
2017	1,200	NA	2,270	16,900	NA	33,000 r
2018	784	NA	1,450	22,200	NA	40,700
2019	933	NA	1,480	32,100	NA	67,500
2020	2,300	NA	3,280	23,800	NA	52,800
Nickel:[8]						
2016	683,000	63,700	541,000	288,000	32,300	325,000
2017	516,000 r	51,500	544,000 r	316,000	38,100	494,000
2018	582,000	59,400	479,000	371,000	45,100	634,000 r
2019	455,000 r	47,800 r	480,000 r	249,000	37,700	510,000
2020	335,000	34,100	355,000	250,000	31,800	377,000
Tin:[9]						
2016	4,570	NA	11,100	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
2019	2,470	NA	2,270	30,400	NA	11,200
2020	1,200	NA	1,840	20,700	NA	8,700
Titanium:[10]						
2016	9,720	NA	25,600	18,500	NA	93,600
2017	9,450	NA	28,000	25,200	NA	123,000 r
2018	11,900	NA	33,500	26,700	NA	123,000
2019	15,000	NA	40,200	30,100	NA	133,000 r
2020	14,100	NA	34,100	15,800	NA	71,300
Zinc:[11]						
2016	30,100	NA	37,800	11,300	NA	12,800
2017	33,600	NA	41,100	11,100	NA	20,200
2018	40,400	NA	49,800	12,900	NA	22,000
2019	30,800	NA	40,200	10,400	NA	18,200
2020	25,000	NA	29,600	11,400	NA	15,800

See footnotes at end of table.

TABLE 2—Continued
SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS[1]

[r]Revised. NA Not available.
[1]Table includes data available through February 23, 2022. Metal content is equal to gross weight, unless otherwise specified. Data are rounded to no more than three significant digits.
[2]Import value is customs value.
[3]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.
[4]Includes stainless steel scrap and chromium metal waste and scrap, HTS codes 7204.21.000 and 8112.22.0000. For HTS code 7204.21.0000, the chromium content for import and exports is 17% of gross weight; for HTS code 8112.22.0000, the chromium content is 100% of gross weight.
[5]Includes copper waste and scrap. For alloyed exports (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 copper content is estimated to be 65% of the gross weight. For alloyed imports for consumption (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 copper content is estimated to be 72% of the gross weight.
[6]Includes waste and scrap obtained from lead-acid batteries, HTS codes 7802.00.0030 and 7802.00.0060.
[7]Includes magnesium waste and scrap, HTS code 8104.20.0000.
[8]Includes nickel waste and scrap. For HTS code 7204.21.0000, the nickel content is 7.5% of gross weight. For HTS code 7204.29.0000, the nickel content for imports and exports is 0.4% of gross weight. For HTS code 7503.00.0000, the nickel content is 50% of gross weight.
[9]Includes tin waste and scrap, HTS code 8002.00.0000.
[10]Includes titanium waste and scrap, HTS code 8108.30.0000.
[11]Includes zinc waste and scrap, HTS code 7902.00.0000.