



2010 Minerals Yearbook

RECYCLING—METALS

RECYCLING—METALS

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In 2009, the United States recycled 58 million metric tons (Mt) of selected metals, an amount equivalent to 73% of the apparent supply of those metals (table 1). This percentage was dominated by steel because of its higher volume, and a greater percentage of steel was produced from scrap in 2009 rather than iron ore because of scrap's high availability and low cost. The United States exported 28.7 Mt of scrap metal and imported 4.4 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 of supply available for use by developing economical processes for the recovery from the Earth (the primary source of metal) and recycled from the use/process stream (the secondary source of metal). 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 our society, provides environmental benefits such as energy savings and reduced volumes of waste.

The term "primary" indicates material from ore deposits, and the term "secondary" indicates material from recycling, including used products and residuals from manufacturing. Recycling practices and the description of those 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.

Once a product completes its useful life, it becomes old scrap. Used appliances, automobiles, and beverage cans are examples of old consumer scrap; used jet engine blades and vanes, junked machinery and ships, and metal recovered from commercial buildings or industrial plants are examples of old industrial scrap. A wide variety of descriptive terms, including external scrap, home scrap, internal scrap, mill scrap, prompt scrap, and purchased scrap, have evolved to describe scrap generated by diverse industry practices. The material flow of recycled metal commodities in the United States has been documented in a series of reports published by the USGS (Sibley, 2004).

Individual annual reviews for each of the metals listed in the tables are 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–R and T–Z, chapters are separately paginated, available by searching <http://pubs.er.usgs.gov/>.

TABLE 1
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS¹

Year	Quantity of metal (metric tons)				Percentage recycled ⁶	Value of metal (thousands)			
	Recycled from new scrap ²	Recycled from old scrap ³	Recycled ⁴	Apparent supply ⁵		Recycled from new scrap ²	Recycled from old scrap ³	Recycled ⁴	Apparent supply ⁷
Aluminum: ⁸									
2005	1,950,000	1,080,000	3,030,000	8,480,000 ^r	36 ^r	\$3,910,000	\$2,160,000	\$6,070,000	\$17,000,000 ^r
2006	2,290,000	1,260,000	3,540,000	8,190,000	43 ^r	6,160,000	3,380,000	9,540,000	22,000,000
2007	2,250,000	1,540,000	3,790,000	7,990,000	47	6,110,000	4,170,000	10,300,000	21,700,000
2008	1,960,000	1,370,000	3,330,000	6,900,000	48	5,240,000	3,650,000	8,890,000	18,500,000
2009	1,520,000	1,190,000	2,710,000	5,840,000	46	2,650,000	2,080,000	4,740,000	10,200,000
Chromium: ⁹									
2005	NA	NA	174,000	548,000	32	NA	NA	227,000	1,530,000
2006	NA	NA	179,000	589,000	30	NA	NA	213,000	1,870,000
2007	NA	NA	162,000	493,000	33	NA	NA	297,000	1,860,000
2008	NA	NA	146,000	432,000	34	NA	NA	491,000 ^r	2,600,000
2009	NA	NA	141,000	160,000	88	NA	NA	185,000	233,000
Copper: ¹⁰									
2005	769,000	183,000	953,000	3,190,000	30.0	2,940,000	701,000	3,640,000	12,200,000
2006	819,000	150,000	968,000	3,010,000	32.1	5,680,000	1,040,000	6,720,000	20,900,000
2007	767,000	158,000	925,000	3,040,000	30.5	5,550,000	1,140,000	6,690,000	22,000,000
2008	697,000	156,000 ^r	852,000 ^r	2,690,000 ^r	31.7 ^r	4,900,000	1,100,000 ^r	6,000,000 ^r	18,900,000 ^r
2009	638,000	137,000	774,000	2,210,000	35.0	3,390,000	727,000	4,120,000	11,800,000
Iron and steel: ¹¹									
2005	NA	NA	65,600,000	121,000,000	54	NA	NA	12,600,000	21,900,000
2006	NA	NA	65,300,000	137,000,000	48	NA	NA	14,300,000	28,000,000 ^r
2007	NA	NA	64,000,000	119,000,000	54	NA	NA	16,200,000 ^r	29,200,000 ^r
2008	NA	NA	66,400,000 ^r	109,000,000	62 ^r	NA	NA	23,200,000 ^r	37,600,000 ^r
2009	NA	NA	53,100,000	69,100,000	77	NA	NA	11,000,000	12,600,000
Lead: ¹²									
2005	20,300	1,130,000	1,150,000	1,430,000	80.1	27,300	1,530,000	1,550,000	1,920,000
2006	19,600	1,140,000	1,160,000	1,470,000	78.9	33,500	1,950,000	1,980,000	2,510,000
2007	24,100	1,160,000	1,180,000	1,540,000	76.7	65,700	3,150,000	3,220,000	4,200,000
2008	20,100	1,120,000 ^r	1,140,000 ^r	1,540,000 ^r	74.5 ^r	53,300 ^r	2,980,000 ^r	3,040,000 ^r	4,080,000 ^r
2009	21,600	1,090,000	1,110,000	1,380,000	80.5	41,400	2,090,000	2,130,000	2,640,000
Magnesium: ¹³									
2005	53,500	19,400	72,900	168,000	43	172,000	62,400	235,000	541,000
2006	60,500	21,700	82,200	165,000	50	155,000	55,400	210,000	421,000
2007	59,900	23,500	83,300	160,000	52	227,000	89,000	316,000	608,000
2008 ^r	61,100	22,600	83,700	170,000	49	451,000	167,000	618,000	1,250,000
2009	47,100	19,500	66,600	116,000	57	269,000	111,000	380,000	664,000
Nickel: ¹⁴									
2005	NA	NA	98,500	233,000 ^r	42	NA	NA	1,450,000	3,440,000
2006	NA	NA	103,000 ^r	247,000	42	NA	NA	2,510,000	5,990,000 ^r
2007	NA	NA	98,900 ^r	211,000	47	NA	NA	3,680,000	7,870,000
2008	NA	NA	85,200	200,000	43	NA	NA	1,800,000	4,230,000
2009	NA	NA	79,800	173,000	46	NA	NA	1,170,000	2,530,000
Tin: ¹⁵									
2005	2,280	11,700	14,000	46,300	30	24,300	125,000	150,000	495,000
2006	2,340	11,600	13,900	51,600	27	29,100	145,000	174,000	642,000
2007	2,860	12,200	15,100	44,500	31	56,700	242,000	298,000	882,000
2008	2,100	11,700 ^r	13,800 ^r	24,700 ^r	56 ^r	52,300 ^r	291,000 ^r	344,000 ^r	615,000 ^r
2009	2,310	11,100	13,400	82,300	16	42,600	205,000	247,000	1,520,000

See footnotes at end of table.

TABLE 1—Continued
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS¹

Year	Quantity of metal (metric tons)					Value of metal (thousands)			
	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 ⁷
Titanium: ¹⁶									
2005	NA	NA	25,700	W	50	NA	NA	\$302,000 ^e	NA
2006	NA	NA	25,000	W	47	NA	NA	253,000 ^e	NA
2007	NA	NA	23,800	W	41	NA	NA	167,000 ^e	NA
2008	NA	NA	23,200	W	W	NA	NA	148,000 ^e	NA
2009	24,700 ^e	1,000 ^e	25,700 ^e	W	W	NA	NA	101,000 ^e	NA
Zinc: ¹⁷									
2005	303,000	50,700	354,000	1,430,000 ^f	25 ^f	\$448,000	\$75,000	524,000	\$2,120,000 ^f
2006	294,000	47,900	342,000	1,530,000 ^f	22 ^f	1,030,000	168,000	1,200,000	5,370,000 ^f
2007	207,000	26,700	234,000	1,270,000 ^f	18 ^f	705,000	90,900	796,000	4,340,000 ^f
2008 ^r	247,000	92,900	339,000	1,350,000	25	483,000	182,000	665,000	2,650,000
2009	194,000	78,800	273,000	1,170,000	23	334,000	135,000	469,000	2,000,000

^eEstimated. ^rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data.

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

²Scrap that results from the manufacturing process, including metal and alloy production. New scrap of aluminum, copper, lead, tin, and zinc excludes home scrap, which is scrap generated and recycled in the metal producing plant.

³Scrap that results from consumer products.

⁴Metal recovered from new plus old scrap.

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

⁶Also referred to as recycling rate.

⁷Same as apparent supply defined in footnote 5 above but calculated based on a monetary value.

⁸Quantity 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.

⁹Chromium quantity of 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.

¹⁰Includes 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.

¹¹Recycled 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 used to calculate values of recycled scrap and apparent supply of scrap.

¹²Monetary value of scrap and apparent supply estimated based upon average quoted price of common lead.

¹³Includes magnesium content of aluminum-base scrap. Monetary value based on the annual average Platts Metals Week U.S. spot Western magnesium price.

¹⁴Nickel statistics were derived from the following:

Production, consumption, receipts

- 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.

Trade data

- Reported nickel content of International Nickel Study Group (INSG) class I primary products, including briquets, cathode, flake, pellets, and powder.
- Reported or estimated nickel content of INSG class II primary products, including ferronickel, metallurgical-grade nickel oxide, and a variety of nickel-containing chemicals.
- Estimated nickel content of secondary products, including nickel waste and scrap and stainless steel scrap.

TABLE 1—Continued
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS¹

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.

¹⁵Monetary value based on Platts Metals Week composite price for tin. Apparent supply excludes withheld stock changes.

¹⁶Percentage recycled based on titanium scrap consumed divided by primary sponge and scrap consumption.

¹⁷Monetary value based on annual average Platts Metals Week metal price for North American special high-grade zinc.

TABLE 2
SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS¹

Year	Exports			Imports for consumption		
	Quantity		Value (thousands)	Quantity		Value (thousands)
	Gross weight (metric tons)	Contained weight (metric tons)		Gross weight (metric tons)	Contained weight (metric tons)	
Aluminum:						
2005	1,090,000	NA	\$1,370,000	482,000	NA	\$658,000
2006	1,480,000	NA	2,550,000	527,000	NA	930,000
2007	1,550,000	NA	3,050,000	471,000	NA	803,000
2008	1,980,000	NA	3,420,000	494,000	NA	853,000
2009	1,660,000	NA	22,100,000	433,000	NA	503,000
Chromium:²						
2005	585,000	99,600	675,000	111,000	19,000	124,000
2006	506,000	86,300	720,000	180,000	30,600	210,000
2007	882,000	150,000	1,620,000	118,000	20,400	200,000
2008	1,000,000	170,000	1,190,000	140,000	24,300	220,000
2009	1,130,000	192,000	778,000	124,000	21,200	138,000
Copper:³						
2005	658,000	556,000	1,060,000	114,000	90,300	270,000
2006	803,000	662,000	2,350,000	118,000	91,600	474,000
2007	907,000	704,000	2,840,000	133,000	112,000	665,000
2008	908,000	688,000	2,960,000	106,000	85,700	480,000 ^r
2009	843,000	633,000	2,010,000	71,800	56,300	234,000
Iron and steel:						
2005	13,000,000	13,000,000	3,460,000	4,000,000	4,000,000	972,000
2006	14,100,000	14,100,000	4,270,000	5,000,000	5,000,000	1,310,000
2007	16,700,000	16,700,000	6,980,000	3,780,000	3,780,000	1,080,000
2008 ^f	21,500,000	21,500,000	10,400,000	3,600,000	3,600,000	1,450,000
2009	22,400,000	22,400,000	7,120,000	2,990,000	2,990,000	814,000
Lead:⁴						
2005	67,300	67,300	21,600	3,840	3,340	2,880
2006	121,000	121,000	37,200	1,800	1,510	1,650
2007	129,000	129,000	55,400	1,590	1,400	2,740
2008	175,000	175,000	92,800	1,470	1,290	2,040
2009	140,000	140,000	72,000	1,600	1,310	2,620
Magnesium:						
2005	5,630	5,630	13,100	14,700	14,700	22,700
2006	3,680	3,680	8,410	17,200	17,200	23,700
2007	1,800	1,800	4,000	21,200	21,200	35,500
2008	2,600	2,600	5,420	24,100	24,100	58,800
2009	2,280	2,280	5,200	20,900	20,900	40,300

See footnotes at end of table.

TABLE 2—Continued
SALIENT U.S. RECYCLING TRADE STATISTICS FOR SELECTED METALS¹

Year	Exports			Imports for consumption		
	Quantity		Value (thousands)	Quantity		Value (thousands)
	Gross weight (metric tons)	Contained weight (metric tons)		Gross weight (metric tons)	Contained weight (metric tons)	
Nickel: ⁵						
2005	2,170,000	61,900	1,190,000	550,000	17,200	304,000
2006	2,890,000	68,600	1,730,000	717,000	22,400	416,000
2007	2,800,000	110,000	3,110,000	826,000	19,000	488,000
2008	2,720,000	101,000	2,670,000	788,000	22,600	613,000
2009	2,420,000	95,100	1,710,000	699,000	20,000	442,000
Tin:						
2005	10,600	10,600	12,100	3,530	3,530	2,010
2006	7,500	7,500	14,100	2,490	2,490	4,470
2007	9,930	9,930	26,900	10,200	10,200	7,430
2008	10,300	10,300	26,600	23,300	23,300	17,700
2009	9,430	9,430	25,600	80,600	80,600	16,200
Titanium: ⁶						
2005	20,600	NA	\$91,400	12,400	NA	\$162,000
2006	10,800	NA	110,000	12,800	NA	200,000
2007	9,510	NA	67,300	12,200	NA	133,000
2008	8,180	NA	52,000	10,400	NA	68,900
2009	4,200	NA	14,000	4,770	NA	17,600
Zinc:						
2005	46,800	NA	55,000	9,580	NA	8,820
2006	83,800	NA	95,800	14,200	NA	18,700
2007	102,000	NA	103,000	21,800	NA	32,500
2008	91,000	NA	99,100	17,000	NA	20,300
2009	47,100	NA	54,300	9,100	NA	8,800

¹Revised. NA Not available.

²Contained weight based upon 100% of gross, unless otherwise specified.

³Includes stainless steel scrap and chromium metal waste and scrap. Contained weight for import and export quantities of Harmonized Tariff Schedule of the United States (HTS) code 7204.21.000 is 17% of gross weight; 8112.22.0000 is 100% of gross weight.

⁴For HTS codes 7404.00.0045, 7404.00.0062, and 7404.00.0080 contained weight for import quantity is 65% of gross weight. 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 weight for import quantity is 72%.

⁵Lead content of waste and scrap obtained from lead acid batteries (HTS 7802.00.0030) included in exports but excludes from imports.

⁶Contained weight for import and export quantities is 0.4% of gross weight for HTS code 7204.29.0000, 50% for HTS code 7503.00.0000, and 7.5% for HTS code 7204.21.0000.

⁷Includes titanium waste and scrap HTS code 8108.30.0000.