



# 2007 Minerals Yearbook

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RECYCLING—METALS [ADVANCE RELEASE]

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# RECYCLING—METALS

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In 2007, the United States recycled 72 million metric tons (Mt) of selected metals, an amount equivalent to 52% of the apparent supply of those metals (table 1). The United States exported 23.1 Mt of scrap metal and imported 5.4 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 economic processes for the recovery from the Earth (the primary source of metal) and from secondary sources (recycled from the use/process stream). 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.

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 (USGS) Minerals Yearbook, volume I, Metals and Minerals.

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).

## Reference Cited

Sibley, S.F., ed., 2004, Flow studies for recycling metal commodities in the United States: U.S. Geological Survey Circular 1196–A–M, 210 p.

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

Year	Quantity of metal (metric tons)				Percentage recycled <sup>6</sup>	Value of metal (thousands)			
	Recycled from new scrap <sup>2</sup>	Recycled from old scrap <sup>3</sup>	Recycled <sup>4</sup>	Apparent supply <sup>5</sup>		Recycled from new scrap <sup>2</sup>	Recycled from old scrap <sup>3</sup>	Recycled <sup>4</sup>	Apparent supply <sup>7</sup>
<b>Aluminum:</b> <sup>8</sup>									
2003	1,750,000	1,070,000	2,820,000	8,870,000 <sup>r</sup>	32 <sup>r</sup>	\$2,620,000	\$1,610,000	\$4,230,000	\$13,300,000 <sup>r</sup>
2004	1,870,000	1,160,000	3,030,000	9,080,000 <sup>r</sup>	33 <sup>r</sup>	3,460,000	2,140,000	5,600,000	16,800,000 <sup>r</sup>
2005	1,950,000	1,080,000	3,030,000	9,220,000 <sup>r</sup>	33 <sup>r</sup>	3,910,000	2,160,000 <sup>r</sup>	6,070,000 <sup>r</sup>	18,500,000 <sup>r</sup>
2006	2,300,000 <sup>r</sup>	1,260,000 <sup>r</sup>	3,560,000 <sup>r</sup>	9,010,000 <sup>r</sup>	39 <sup>r</sup>	6,140,000 <sup>r</sup>	3,370,000 <sup>r</sup>	9,520,000 <sup>r</sup>	24,100,000 <sup>r</sup>
2007	2,250,000	1,600,000	3,850,000	8,660,000	45	6,070,000	4,320,000	10,400,000	23,300,000
<b>Chromium:</b> <sup>9</sup>									
2003	NA	NA	180,000 <sup>r</sup>	548,000 <sup>r</sup>	33 <sup>r</sup>	NA	NA	139,000 <sup>r</sup>	429,000 <sup>r</sup>
2004	NA	NA	177,000 <sup>r</sup>	591,000 <sup>r</sup>	30 <sup>r</sup>	NA	NA	217,000 <sup>r</sup>	692,000 <sup>r</sup>
2005	NA	NA	174,000 <sup>r</sup>	548,000 <sup>r</sup>	32 <sup>r</sup>	NA	NA	227,000 <sup>r</sup>	783,000 <sup>r</sup>
2006	NA	NA	179,000 <sup>r</sup>	589,000 <sup>r</sup>	30 <sup>r</sup>	NA	NA	213,000 <sup>r</sup>	745,000 <sup>r</sup>
2007	NA	NA	162,000	493,000	33	NA	NA	297,000	1,090,000
<b>Copper:</b> <sup>10</sup>									
2003	738,000	206,000	944,000	3,170,000	29.8	1,390,000	387,000	1,770,000	5,950,000
2004	774,000	191,000	965,000	3,330,000	28.9	2,290,000	565,000	2,850,000	9,830,000
2005	769,000	183,000	953,000	3,170,000	30.0	2,940,000	698,000	3,640,000	12,100,000
2006	819,000	150,000	968,000	3,000,000	32.3	5,680,000	1,040,000	6,720,000	20,800,000
2007	768,000	157,000	925,000	3,040,000	30.5	5,550,000	1,090,000	6,690,000	22,000,000
<b>Iron and steel:</b> <sup>11</sup>									
2003	NA	NA	65,000,000 <sup>r</sup>	117,000,000	55 <sup>r</sup>	NA	NA	7,860,000 <sup>r</sup>	13,200,000
2004	NA	NA	66,600,000 <sup>r</sup>	132,000,000	51	NA	NA	14,000,000 <sup>r</sup>	24,900,000
2005	NA	NA	65,600,000 <sup>r</sup>	121,000,000	54	NA	NA	12,600,000	21,900,000
2006	NA	NA	65,300,000 <sup>r</sup>	137,000,000 <sup>r</sup>	48	NA	NA	14,300,000 <sup>r</sup>	25,300,000 <sup>r</sup>
2007	NA	NA	65,000,000	123,000,000	53	NA	NA	16,400,000	29,200,000
<b>Lead:</b> <sup>12</sup>									
2003	19,300	1,120,000	1,140,000	1,520,000	77.4	18,600	1,080,000	1,100,000	1,470,000
2004	12,900	1,110,000	1,130,000	1,460,000	77.3	15,600	1,350,000	1,370,000	1,440,000
2005	20,300 <sup>r</sup>	1,130,000	1,150,000 <sup>r</sup>	1,430,000 <sup>r</sup>	80.1 <sup>r</sup>	27,300 <sup>r</sup>	1,530,000 <sup>r</sup>	1,550,000 <sup>r</sup>	1,920,000 <sup>r</sup>
2006	19,600 <sup>r</sup>	1,140,000	1,160,000 <sup>r</sup>	1,470,000 <sup>r</sup>	78.9 <sup>r</sup>	33,500 <sup>r</sup>	1,950,000 <sup>r</sup>	1,980,000 <sup>r</sup>	2,510,000 <sup>r</sup>
2007	24,100	1,160,000	1,180,000	1,480,000	79.6	65,700	3,150,000	3,220,000	4,050,000
<b>Magnesium:</b> <sup>13</sup>									
2003	44,700	25,400	70,100	152,000	46	107,000	60,900	168,000	366,000
2004	51,500	20,500	72,000	179,000	40	167,000	66,400	233,000	582,000
2005	53,500	19,400	72,900	168,000	43	172,000	62,400	235,000	541,000
2006 <sup>r</sup>	60,500	21,700	82,200	165,000	50	155,000	55,400	210,000	421,000
2007	60,300	23,800	84,000	161,000	52	228,000	90,200	319,000	611,000
<b>Nickel:</b> <sup>14</sup>									
2003	NA	NA	101,000	218,000	46	NA	NA	971,000	2,100,000
2004	NA	NA	103,000	232,000	45	NA	NA	1,430,000	3,200,000
2005	NA	NA	101,000	237,000 <sup>r</sup>	43	NA	NA	1,490,000 <sup>r</sup>	3,490,000 <sup>r</sup>
2006	NA	NA	103,000 <sup>r</sup>	247,000 <sup>r</sup>	43	NA	NA	2,500,000 <sup>r</sup>	5,990,000 <sup>r</sup>
2007	NA	NA	93,700	208,000	45	NA	NA	3,490,000	7,730,000
<b>Tin:</b> <sup>15</sup>									
2003	3,570	5,500	9,070	41,500	22	26,800	41,200	68,000	311,000
2004	3,590	5,240	8,830	53,800	16	43,300	63,200	107,000	649,000
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 <sup>r</sup>	27 <sup>r</sup>	29,100 <sup>r</sup>	145,000 <sup>r</sup>	174,000 <sup>r</sup>	642,000 <sup>r</sup>
2007	2,860	11,900	14,800	44,200	34	56,700	236,000	293,000	876,000

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>	Recycled <sup>4</sup>	Apparent supply <sup>5</sup>	Percentage recycled <sup>6</sup>	Recycled from new scrap <sup>2</sup>	Recycled from old scrap <sup>3</sup>	Recycled <sup>4</sup>	Apparent supply <sup>7</sup>	
<b>Titanium:</b> <sup>16</sup>										
2003	NA	NA	14,300	W	46	NA	NA	\$37,500 <sup>e</sup>	NA	
2004	NA	NA	18,300	W	46	NA	NA	110,000 <sup>e</sup>	NA	
2005	NA	NA	25,700	W	50	NA	NA	302,000 <sup>e</sup>	NA	
2006	NA	NA	25,000	W	47	NA	NA	253,000 <sup>e</sup>	NA	
2007	NA	NA	23,800	W	41	NA	NA	167,000 <sup>e</sup>	NA	
<b>Zinc:</b> <sup>17</sup>										
2003	295,000	50,300	345,000	1,390,000	25	\$264,000	\$45,100	309,000	\$1,250,000	
2004	302,000	47,100	349,000	1,430,000	24	349,000	54,500	404,000	1,650,000	
2005	303,000	50,700	354,000	1,290,000	27	448,000	75,000	524,000	1,910,000	
2006	294,000	47,900 <sup>r</sup>	342,000 <sup>r</sup>	1,400,000 <sup>r</sup>	24 <sup>r</sup>	1,030,000	168,000 <sup>r</sup>	1,200,000 <sup>r</sup>	4,900,000 <sup>r</sup>	
2007	207,000	30,100	237,000	1,170,000	20	705,000	102,000	807,000	3,980,000	

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

<sup>1</sup>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 excludes 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>Metal recovered from new plus old scrap.

<sup>5</sup>Apparent 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.

<sup>6</sup>Also referred to as recycling rate.

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

<sup>8</sup>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.

<sup>9</sup>Chromium 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.

<sup>10</sup>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.

<sup>11</sup>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 used to calculate values of recycled scrap and apparent supply of scrap.

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

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

<sup>14</sup>Nickel 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.

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.

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

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<sup>15</sup>Monetary value based on Platts Metals Week composite price for tin.

<sup>16</sup>Percentage recycled based on titanium scrap consumed divided by primary sponge and scrap consumption.

<sup>17</sup>Monetary 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 METALS<sup>1</sup>

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)	
<b>Aluminum:</b>						
2003	577,000	NA	\$633,000	440,000	NA	\$496,000
2004	660,000	NA	773,000	535,000	NA	655,000
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
<b>Chromium:<sup>2</sup></b>						
2003	505,000	85,900	386,000	89,400	15,400	71,700
2004 <sup>r</sup>	478,000	81,400	551,000	146,000	25,000	161,000
2005 <sup>r</sup>	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
<b>Copper:<sup>3</sup></b>						
2003	689,000	558,000	664,000	90,600	70,700	121,000
2004	714,000	578,000	882,000	102,000	79,800	183,000
2005	658,000	556,000	1,060,000	114,000	90,300	270,000
2006	803,000	662,000	2,350,000 <sup>r</sup>	118,000	91,600	474,000 <sup>r</sup>
2007	907,000	704,000	2,840,000	133,000	112,000	665,000
<b>Iron and steel:</b>						
2003	10,900,000	10,900,000	1,960,000	3,690,000	3,690,000	556,000
2004	11,800,000	11,800,000	2,930,000	4,790,000	4,790,000	1,280,000
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	3,980,000	3,780,000	3,780,000	1,080,000
<b>Lead:</b>						
2003	92,800	92,800	23,300	4,970	4,150 <sup>r</sup>	1,740 <sup>r</sup>
2004	56,300	56,300	14,800	5,320	4,780 <sup>r</sup>	3,510
2005	67,300	67,300	21,600	3,840	3,340	2,880
2006	121,000	121,000	37,200	1,800	1,560	1,650
2007	129,000	129,000	55,400	1,590	2,430	2,740
<b>Magnesium:</b>						
2003	5,040	5,040	11,800	16,200	16,200	22,000
2004	4,790	4,790	11,300	11,700	11,700	17,600
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
<b>Nickel:<sup>4</sup></b>						
2003	1,410,000	50,900	704,000	230,000	12,000	138,000
2004	2,240,000	55,200	995,000	453,000	20,000	328,000
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
<b>Tin:</b>						
2003	5,040	5,040	8,630	921	921	686
2004	9,310	9,310	13,200	1,950	1,950	1,700
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

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 (thousands)
	Gross weight (metric tons)	Contained weight (metric tons)		Gross weight (metric tons)	Contained weight (metric tons)	
<b>Titanium:</b> <sup>5</sup>						
2003	5,320	NA	\$29,200	5,550	NA	\$19,700
2004	9,760	NA	56,000	8,830	NA	53,600
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
<b>Zinc:</b>						
2003	32,300	NA	23,300	10,300	NA	5,740
2004	40,300	NA	39,400	10,800	NA	7,740
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

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

<sup>1</sup>Contained weight based upon 100% of gross, unless otherwise specified.

<sup>2</sup>Includes 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.

<sup>3</sup>For 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, 7404.00.65, and 7404.00.6090 contained weight for import quantity is 72%.

<sup>4</sup>Contained weight for import and export quantities is 0.4% of gross weight for HTS code 7204.29.000, 50% for HTS code 7503.00.00, and 7.5% for HTS code 7204.21.0000.

<sup>5</sup>Includes titanium waste and scrap HTS code 8108.30.0000.