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# 2008 Minerals Yearbook

## RECYCLING—METALS [ADVANCE RELEASE]

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# RECYCLING—METALS

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In 2008, the United States recycled 72 million metric tons (Mt) of selected metals, an amount equivalent to 59% of the apparent supply of those metals (table 1). The United States exported 28.5 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 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 U.S. Geological Survey (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., 2004, Flow studies for recycling metal commodities in the United States: U.S. Geological Survey Circular 1196–A—Q, T—X, Z. (Accessed July 7, 2010, via http://minerals.usgs.gov/minerals/pubs/commodity/recycle/.)

TABLE 1

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

| 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] |
| Aluminum:[8] | | | | | | | | | |
| 2004 | 1,870,000 | 1,160,000 | 3,030,000 | 9,080,000 | 33 | $3,460,000 | $2,140,000 | $5,600,000 | $16,800,000 |
| 2005 | 1,950,000 | 1,080,000 | 3,030,000 | 9,220,000 | 33 | 3,910,000 | 2,160,000 | 6,070,000 | 18,500,000 |
| 2006 | 2,290,000 r | 1,260,000 | 3,540,000 r | 8,190,000 r | 39 | 6,160,000 r | 3,380,000 r | 9,540,000 r | 22,000,000 r |
| 2007 | 2,250,000 | 1,540,000 r | 3,790,000 r | 7,990,000 r | 47 r | 6,110,000 r | 4,170,000 r | 10,300,000 r | 21,700,000 r |
| 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 |
| Chromium:[9] | | | | | | | | | |
| 2004 | NA | NA | 177,000 | 591,000 | 30 | NA | NA | 217,000 | 1,500,000 r |
| 2005 | NA | NA | 174,000 | 548,000 | 32 | NA | NA | 227,000 | 1,530,000 r |
| 2006 | NA | NA | 179,000 | 589,000 | 30 | NA | NA | 213,000 | 1,870,000 r |
| 2007 | NA | NA | 162,000 | 493,000 | 33 | NA | NA | 297,000 | 1,860,000 r |
| 2008 | NA | NA | 146,000 | 432,000 | 34 | NA | NA | 180,000 | 2,600,000 |
| Copper:[10] | | | | | | | | | |
| 2004 | 774,000 | 191,000 | 965,000 | 3,330,000 | 29.0 r | 2,290,000 | 565,000 | 2,850,000 | 9,830,000 |
| 2005 | 769,000 | 183,000 | 953,000 | 3,190,000 r | 30.0 | 2,940,000 | 701,000 r | 3,640,000 | 12,200,000 r |
| 2006 | 819,000 | 150,000 | 968,000 | 3,010,000 r | 32.1 r | 5,680,000 | 1,040,000 | 6,720,000 | 20,900,000 r |
| 2007 | 767,000 r | 158,000 r | 925,000 | 3,040,000 | 30.5 | 5,550,000 | 1,140,000 r | 6,690,000 | 22,000,000 |
| 2008 | 697,000 | 155,000 | 851,000 | 2,700,000 | 31.5 | 4,900,000 | 1,090,000 | 5,990,000 | 19,000,000 |
| Iron and steel:[11] | | | | | | | | | |
| 2004 | NA | NA | 66,600,000 | 132,000,000 | 51 | NA | NA | 14,000,000 | 24,900,000 |
| 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 | 25,300,000 |
| 2007 | NA | NA | 64,000,000 r | 119,000,000 r | 54 r | NA | NA | 24,200,000 r | 41,800,000 r |
| 2008 | NA | NA | 66,000,000 | 109,000,000 | 61 | NA | NA | 48,400,000 | 73,300,000 |
| Lead:[12] | | | | | | | | | |
| 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 | 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 r | 76.7 r | 65,700 | 3,150,000 | 3,220,000 | 4,200,000 r |
| 2008 | 20,100 | 1,130,000 | 1,150,000 | 1,490,000 | 77.0 | 53,600 | 2,960,000 | 3,010,000 | 3,950,000 |
| Magnesium:[13] | | | | | | | | | |
| 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 | 60,500 | 21,700 | 82,200 | 165,000 | 50 | 155,000 | 55,400 | 210,000 | 421,000 |
| 2007 | 59,900 r | 23,500 r | 83,300 r | 160,000 r | 52 | 227,000 r | 89,000 r | 316,000 r | 608,000 r |
| 2008 | 53,400 | 22,300 | 75,700 | 163,000 | 53 | 394,000 | 165,000 | 559,000 | 1,200,000 |
| Nickel:[14] | | | | | | | | | |
| 2004 | NA | NA | 99,700 r | 228,000 r | 44 r | NA | NA | 1,380,000 r | 3,150,000 r |
| 2005 | NA | NA | 98,500 r | 234,000 r | 42 r | NA | NA | 1,450,000 r | 3,440,000 r |
| 2006 | NA | NA | 103,000 | 247,000 | 42 r | NA | NA | 2,510,000 r | 5,980,000 r |
| 2007 | NA | NA | 98,900 r | 211,000 r | 47 r | NA | NA | 3,680,000 r | 7,870,000 r |
| 2008 | NA | NA | 85,200 | 200,000 | 43 | NA | NA | 1,800,000 | 4,230,000 |
| Tin:[15] | | | | | | | | | |
| 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 | 27 | 29,100 | 145,000 | 174,000 | 642,000 |
| 2007 | 2,860 | 12,200 r | 15,100 r | 44,500 r | 31 r | 56,700 | 242,000 r | 298,000 r | 882,000 r |
| 2008 | 2,100 | 11,500 | 13,600 | 37,600 | 34 | 41,600 | 228,000 | 269,000 | 784,000 |

See footnotes at end of table.

TABLE 1—Continued

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

| 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] | | | | | | | | | |
| 2004 | NA | NA | 18,300 | W | 46 | NA | NA | $110,000 e | NA |
| 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 |
| Zinc:[17] | | | | | | | | | |
| 2004 | 302,000 | 47,100 | 349,000 | 1,190,000 r | 29 r | $349,000 | $54,500 | 404,000 | $1,380,000 r |
| 2005 | 303,000 | 50,700 | 354,000 | 1,080,000 r | 33 r | 448,000 | 75,000 | 524,000 | 1,600,000 r |
| 2006 | 294,000 | 47,900 | 342,000 | 1,190,000 r | 29 r | 1,030,000 | 168,000 | 1,200,000 | 4,170,000 r |
| 2007 | 207,000 | 26,700 r | 234,000 r | 1,040,000 r | 23 r | 705,000 | 90,900 r | 796,000 r | 3,540,000 r |
| 2008 | 205,000 | 92,200 | 297,000 | 1,000,000 | 30 | 402,000 | 181,000 | 582,000 | 1,960,000 |

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

[1]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 excludes 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 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.

[6]Also referred to as recycling rate.

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

[8]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.

[9]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.

[10]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.

[11]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.

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

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

[14]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[1]

[15]Monetary value based on Platts Metals Week composite price for tin.

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

[17]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[1]

| | Exports | | | Imports for consumption | | |
|---|---|---|---|---|---|---|
| | Quantity | | | Quantity | | |
| Year | Gross weight (metric tons) | Contained weight (metric tons) | Value (thousands) | Gross weight (metric tons) | Contained weight (metric tons) | Value (thousands) |
| Aluminum: | | | | | | |
| 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 |
| 2008 | 1,980,000 | NA | 3,420,000 | 494,000 | NA | 853,000 |
| Chromium:[2] | | | | | | |
| 2004 | 478,000 | 81,400 | 551,000 | 146,000 | 25,000 | 161,000 |
| 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 |
| Copper:[3] | | | | | | |
| 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 | 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 | 485,000 |
| Iron and steel: | | | | | | |
| 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 | 6,980,000 r | 3,780,000 | 3,780,000 | 1,080,000 |
| 2008 | 21,600,000 | 21,600,000 | 10,400,000 | 3,750,000 | 3,750,000 | 1,530,000 |
| Lead: | | | | | | |
| 2004 | 56,300 | 56,300 | 14,800 | 5,320 | 4,770 r | 3,510 |
| 2005 | 67,300 | 67,300 | 21,600 | 3,840 | 3,340 | 2,880 |
| 2006 | 121,000 | 121,000 | 37,200 | 1,800 | 1,510 r | 1,650 |
| 2007 | 129,000 | 129,000 | 55,400 | 1,590 | 1,400 r | 2,740 |
| 2008 | 175,000 | 175,000 | 92,800 | 1,770 | 1,290 | 2,040 |
| Magnesium: | | | | | | |
| 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 |
| 2008 | 2,600 | 2,600 | 5,420 | 24,100 | 24,100 | 58,800 |
| Nickel:[4] | | | | | | |
| 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 |
| 2008 | 2,720,000 | 101,000 | 2,670,000 | 788,000 | 22,600 | 613,000 |

See footnotes at end of table.

TABLE 2—Continued

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

| | Exports | | | Imports for consumption | | |
|---|---|---|---|---|---|---|
| | Quantity | | | Quantity | | |
| Year | Gross weight (metric tons) | Contained weight (metric tons) | Value (thousands) | Gross weight (metric tons) | Contained weight (metric tons) | Value (thousands) |
| Tin: | | | | | | |
| 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 |
| 2008 | 10,300 | 10,300 | 26,600 | 23,300 | 23,300 | 17,700 |
| Titanium:[5] | | | | | | |
| 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 |
| 2008 | 8,180 | NA | 52,000 | 10,400 | NA | 68,900 |
| Zinc: | | | | | | |
| 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 |
| 2008 | 91,000 | NA | 99,100 | 17,000 | NA | 20,300 |

[r]Revised. NA Not available.

[1]Contained weight based upon 100% of gross, unless otherwise specified.

[2]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.

[3]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, 7404.00.6065, and 7404.00.6090 contained weight for import quantity is 72%.

[4]Contained 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.

[5]Includes titanium waste and scrap HTS code 8108.30.0000.