IRON AND STEEL SLAG

(Data in thousand metric tons, unless otherwise noted)

Domestic Production and Use: Ferrous slags are valuable coproducts of ironmaking and steelmaking. In 2003, about 19 million tons of domestic iron and steel slag, valued at about $300 million[1] (f.o.b.), were consumed. Iron or blast furnace slag accounted for about 60% of the tonnage sold and was worth about $270 million. Steel slag, produced from basic oxygen, electric arc, and open hearth furnaces[2] accounted for the remainder. There were 23 slag-processing companies servicing iron and/or steel companies, or reprocessing old slag piles, at about 125 locations: iron slag at about 40 sites in about 15 States and steel slag at about 90 sites in about 32 States. Included in these data are about a dozen facilities that grind and sell ground granulated blast furnace slag (GGBFS) based on imported unground feed.

The prices listed in the table below are the weighted average for a variety of ferrous slags. Actual prices per ton range from about $0.50 for steel slags in areas where natural aggregates are abundant to about $60 for GGBFS. The major uses of air-cooled iron slag and for steel slag were as aggregates for road bases, fill, and asphaltic paving. In contrast, because of its cementitious properties, GGBFS is mainly used as a partial substitute for portland cement in concrete mixes and in blended cements. Owing to the low unit value, most slag is shipped by truck and over short distances only (rail and waterborne transportation can be longer). Because it has a much higher unit value, GGBFS can be shipped over longer distances.

Salient Statistics—United States:	**1999**	**2000**	**2001**	**2002[3]**	**2003[e, 3]**
Production, marketed[4]	17,000	16,300	16,900	19,000	19,000
Imports for consumption	900	1,200	2,600	1,000	1,000
Exports	12	20	([5])	400	400
Consumption, apparent[6]	18,000	20,200	19,500	18,600	18,600
Price average value, dollars per ton, f.o.b. plant	8.80	8.60	8.05	[7]15.50	[7]15.50
Stocks, yearend	NA	NA	NA	NA	NA
Employment, number[e]	2,750	2,750	2,700	2,700	2,700
Net import reliance[8] as a percentage of apparent consumption	5	10	8	6	6

Recycling: Ferrous slags are viewed as valuable byproducts of ironmaking and steelmaking. Apart from the large outside markets for slag in the construction sector, some iron and steel slags are used in the furnaces as iron and flux feed. Entrained metal, particularly in steel slag, is routinely recovered during slag processing for return to the furnaces. However, data for such furnace feed uses are unavailable.

Import Sources (1999-2002): Most imports are of unground granulated blast furnace slag. In recent years, some import data for ferrous slags have shown discrepancies related to both tonnages and unit values. Principal suppliers in recent years have been Brazil, Canada, France, Italy, Japan, and South Africa. Principal sources, for 2002 only, were Italy, 40%; France, 26%; Japan, 7%; Canada, 6%; and other, 21%.

Tariff: Item	Number	Normal Trade Relations 12/31/03
Granulated slag	2618.00.0000	Free.
Basic slag	3103.20.0000	Free.
Ferrous scale	2619.00.9000	Free.
Slag, dross, scale, from manufacture of iron and steel	2619.00.3000	Free.

Depletion Allowance: Not applicable.

Government Stockpile: None.

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<u>Events, Trends, and Issues</u>: Air-cooled blast furnace slag is in declining domestic supply owing to depletion of old slag piles and the closure of many blast furnaces over the years for economic and/or environmental reasons. No new blast furnaces are under construction or are planned. Steel slag from integrated works is likewise in decline; slag from electric arc furnaces (largely fed with steel scrap), in contrast, remains abundant. Both of these slag types compete with natural aggregates. Demand is growing for GGBFS in concrete; spurred by this demand and the much higher unit sales price for GGBFS, two new granulators have been added in recent years to existing blast furnaces, and a number of grinding facilities at independent sites or at cement plants have been constructed to process imported granulated slag. Sales in 2003 of GGBFS were almost 20% of the total slag market. Overall, most of the demand for slag is in large-scale (mostly public-sector) construction projects and fluctuates with levels of construction spending. Local environmental opposition to the use of slag in public sector construction stems from some material, especially if improperly cured, yielding non-neutral-pH, metal-rich, leachate under certain weathering conditions. But use in construction, or locally as feed to cement kilns, is the most economic way to remove otherwise unsightly slag piles and restore the land underneath to its original contours.

<u>World Mine Production, Reserves, and Reserve Base</u>: Slag is not a mined material. Production data for the world are unavailable, but it is estimated that annual world iron and steel slag output is on the order of 240 to 415 million tons, based on typical ratios of slag to crude iron and steel output.

<u>World Resources</u>: Not applicable.

<u>Substitutes</u>: Crushed stone and sand and gravel are common aggregate substitutes in the construction sector. Certain rock types, as well as silica fume and, especially, fly ash, are alternative cementitious additives in blended cements and concrete. As a cement kiln feed, slags (especially steel slag) compete with some of the traditional limestone and other rock raw materials.

[e]Estimated. NA Not available.
[1]The data (obtained from annual survey of slag processors) pertain to the quantities of processed slag sold rather than that processed or produced during the year. The data exclude any entrained metal that may be recovered during slag processing and returned to iron and, especially, steel furnaces. Data for such recovered metal were unavailable.
[2]Sales of open hearth furnace steel slag were only from stockpiles; there was no domestic open hearth steel production in 2003.
[3]Owing to inclusion of new data (especially for granulated slag), data in 2002-3 are not strictly comparable to those of recent previous years.
[4]Data for actual production of marketable slag are unavailable, and the data shown are for sales, largely from stockpiles, and include sales (2002-3) of imported granulated blast furnace slag, either after domestic grinding or still unground. Overall, slag production may be estimated as equivalent to 25% to 30% of crude (pig) iron production and 10% to 15% of crude steel output.
[5]Less than ½ unit.
[6]Defined, for 1999-2001, as production (sales) + imports – exports and, for 2002-3, as total sales of slag (includes that from imported feed) – exports.
[7]The higher price in 2002-3 represents more complete data on sales of ground granulated blast furnace slag, which sold for almost $60 per ton, as opposed to air-cooled blast furnace and steel slags, which sold, on average, in the range of about $4 to $7 per ton.
[8]Defined as imports – exports for 1999-2001 and, for 2002-3, as total sales of import-based slag – exports of slag. Data are unavailable to allow adjustments for changes in stocks.