



# 2010 Minerals Yearbook

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## SLAG, IRON AND STEEL

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# SLAG—IRON AND STEEL

By Hendrik G. van Oss

Sales of iron and steel slag in the United States in 2010 totaled about 15.7 million metric tons (Mt), up by about 26% from total sales in 2009 (table 1). The value of slag sales increased by 13% to \$266 million overall.

Iron and steel slags are formed by the addition of slagging agents and fluxes (chiefly limestone or dolomite and silica sand) to blast furnaces and steel furnaces to strip impurities from iron ore, steel scrap, and other ferrous feeds. The slag is a silicate melt that floats on top of the molten crude iron or steel and is tapped from the furnace separately from the liquid metal. After being cooled by various means to solid form, the slag is processed and may then be sold and (or) returned to the furnace. Most forms of processed slag have much lower unit values than do iron and steel (metal) and, for this reason, iron and steel companies generally contract with outside slag-processing companies to cool the slag and to remove it. Although the financial arrangements vary, typically the processing company receives the slag for free, crushes it to various marketable sizes, uses screens and magnetic separators to recover entrained metal from the slag (metal to be returned to the furnace for a low charge), sells the slag on the open market, and pays a small percentage of the net slag sales revenues or profits to the iron or steel company. Slag can be returned to the furnaces for use as flux and as a supplemental source of iron, but despite having a value, this return flow is not always included in the tonnages of slag reported as sold.

A listing of slag processors, processing sites, and the iron and steel companies serviced is provided in table 4. Apparent duplication at some sites is because processing contracts may have been transferred to other companies during the year, and it is common for integrated iron and steel plants to have processing and (or) marketing contracts with different companies for different slag types produced at the plant. In some cases, the slag is cooled by one company but is then further processed and (or) marketed by another company or at another site.

## Legislation and Government Programs

Consumption of slag for construction is influenced by Federal and State programs that affect construction spending levels, encourage the use of “alternative” materials, and that may affect the availability of competing “alternative” or natural materials. Slags are considered to be “sustainable” raw materials mainly because they can substitute directly or indirectly for virgin raw materials (for example, for natural stone aggregates in concrete and for natural raw materials in cement manufacture), or, in the specific case of ground granulated blast furnace slag (GGBFS), can partially substitute for clinker in finished cement or for portland cement in concrete. With respect to clinker manufacture, substitution of slags for natural raw materials can reduce the unit consumption of fuel and limestone in the kiln, which then reduces the overall and unit emissions of certain

pollutants, most notably carbon dioxide. Use of granulated blast furnace slag [GGBFS, or unground (GBFS)] in the finish mill allows more finished cement to be made from the same amount of clinker.

In September 2010, following the release of a proposed ruling in May 2009, the U.S. Environmental Protection Agency (EPA) issued a final rule, within the National Emissions Standards for Hazardous Air Pollutants (NESHAP), for the U.S. cement industry (U.S. Environmental Protection Agency, 2009; 2010). The NESHAP sets very low limits for cement plant emissions of mercury, total hydrocarbons, hydrochloric acid, and particulates, and has the potential, through the closure of plants unable to meet the new limits, to reduce the supply of domestically produced cement on the U.S. market. Although imports of cement would probably make up for some of the reductions in domestic cement supply, the NESHAP has the potential to increase demand for alternative or supplementary cementitious materials (SCM) such as GGBFS and fly ash. Also, the NESHAP likely would make fly ash (typically relatively high in mercury) unattractive as an alternative raw material for clinker manufacture and thus might increase demand for slag for this purpose. The EPA continued to evaluate the reclassification of coal combustion byproducts, including fly ash, as hazardous waste for landfill disposal purposes (but not for beneficial use purposes). Were even a limited designation as hazardous waste to stigmatize fly ash, construction market demand for this material might fall significantly. It remained unclear if the supply of GGBFS and other SCM would be adequate to fill the fly ash void, and this availability issue might work against efforts to promote increased use of these materials.

## Production

Data on annual production of slag are generally unavailable because the amount of slag tapped is not routinely measured; also, not all of the slag formed is tapped during a heat. However, U.S. and world production of ferrous slags can be broadly estimated based on typical slag to metal production ratios, which in turn are related to the chemistry of the ferrous feeds to the furnaces. For typical iron ore grades (60% to 66% iron), a blast furnace normally will produce about 0.25 to 0.30 metric tons (t) of slag per metric ton of crude or pig iron produced. For ores of lower than average grade, the slag output will be higher, in some cases as much as 1.0 to 1.2 t of slag per ton of crude iron. Steel furnaces typically produce about 0.2 t of slag per ton of crude steel, but up to 50% of this slag is entrained metal, most of which would be expected to be recovered during slag processing and to be returned to the furnace. The amount of marketable steel slag remaining after entrained metal removal is thus usually equivalent to about 10% to 15% of the crude steel output. Using these ratios and data for U.S. and world iron and steel production from the American Iron and Steel Institute (2010, p. 121–126), U.S. blast furnace slag production in 2010

was estimated to be in the range of about 7 to 8 Mt, and world output, 260 to 310 Mt. Similarly, U.S. output of steel slag (after metal removal) in 2010 was estimated to be 8 to 12 Mt, and world output, 140 to 210 Mt. Apparent production of slag commonly will differ from the sales of slag (table 1) because of a combination of undocumented returns of slag to the furnaces, stockpiling of slag by the processors, and sales from stockpiles; the latter include old slag banks from iron and steel plants long-since closed.

The uses for ferrous slag are determined mainly by how the slag is cooled. Marketed blast furnace slags are of three main types—air-cooled, granulated, and pelletized (or expanded). Air-cooled blast furnace slag is formed by allowing the molten slag to cool relatively slowly under ambient conditions; final cooling can be accelerated with a water spray. Although it can have a vesicular texture with closed pores, the air-cooled slag is hard and dense and is especially suitable for use as construction aggregates. Formation of GBFS is by quenching molten slag in water to form sand-sized particles of glass. The disordered structure of this glass gives the material inherent moderate hydraulic cementitious properties when the slag is very finely ground (GGBFS), and the cementitious properties become strong if the material accesses free lime during hydration. In concrete containing a proportion of GGBFS, hydration of portland cement releases the lime needed to fully activate the slag. Concretes incorporating GGBFS generally develop strength more slowly than concretes that contain only portland cement but can have similar or even superior long-term strength, release less heat during hydration, have reduced permeability, and generally exhibit improved resistance to chemical attack. Pelletized or expanded slag is cooled through a water jet, which leads to rapid steam generation and the development of innumerable vesicles within the slag. The vesicles reduce the overall density of the slag and allows for good mechanical binding with hydraulic cement paste. This slag type is most commonly used as a lightweight aggregate, but if very finely ground, it can have cementitious properties similar to those of GGBFS. Blast furnace slag (generally air-cooled) also can be made into mineral wool. For this purpose, slag is remelted and then poured through an air stream or jet of steam or other gas to produce a spray of molten droplets; alternatively, the droplets can be formed by passing the melt through a perforated or fast spinning disc. The droplets elongate into long fibers that are collected and layered, and this material is suitable for use as thermal insulation.

Steel furnace slag is cooled similarly to air-cooled blast furnace slag, has similar properties to it, and is used for some of the same purposes. Steel slags containing large amounts of dicalcium silicate are prone to expansion and commonly are cured in piles for several months to allow for the expansion and for leaching out of lime.

## Consumption

Data in this report are from an annual U.S. Geological Survey (USGS) canvass of slag processors and importers and pertain to sales of processed slag, not the amount of slag produced or processed during the year. Processed slag is sold from stockpiles and although most of the material is a byproduct of current or

recent iron and steel output or is of imported material, some slag sales are of material mined from old slag piles (slag banks) produced by iron and steel plants now closed. In 2010, canvasses were sent to 24 companies, covering 138 processing and (or) importation sites, and at least partial data (some as consolidated responses) were received for 132 sites; the reported data accounted for slightly more than 98% of the total iron and steel slag tonnage in table 1. In 2009, canvasses were sent to 22 companies, covering 137 sites, and at least partial data were received for 130 sites, accounting for slightly more than 96% of the gross tonnage listed for the year. Because of the wide range in the level detail in the data reported to the USGS, and the need to estimate activities of survey nonrespondents, the data in table 1 have been heavily rounded. For both years, data on pelletized blast furnace slag have been withheld to avoid disclosing company proprietary data, but the quantities sold were very small. Sales data for granulated slag in both years exclude material sold by importers who as yet do not take part in the USGS canvass.

Sales data for slag exclude much of the ferrous slag returned to the furnaces, although more respondents provided data on this flow in 2010 than in previous years. The sales data also exclude the free metal recovered from the slag. Total slag sales increased by almost 26% in 2010 (table 1), owing significantly to improved slag availability resulting from a return to service of a number of previously idle iron and steel furnaces during the year. This appears to have been especially true for steel slag, but the 44% increase in sales tonnage noted in table 1 partially reflects the increased reporting, as sales, of slag returns to the furnaces. As in 2009, more than 80% of slag sales in 2010 were of air-cooled blast furnace slag and of steel slag. Both of these slag types are used as aggregates in general construction. However, because their market areas tend to be somewhat restricted geographically relative to natural construction materials, and because sales commonly are based upon long-term contracts, trends in slag consumption commonly differ, at least in terms of relative percentage changes, from sales trends for competing materials, and for cement. For example, total crushed stone sales in 2010 were unchanged from those in 2009, sand and gravel sales were down by 6%, and cement sales (which are a useful proxy for concrete sales) declined slightly (0.4%).

As noted above, air-cooled blast furnace and steel furnace slags are used primarily for a variety of aggregate applications (table 3). Because of potential expansion problems, steel slag finds little use in applications requiring maintenance of a fixed volume (for example, concrete). Both slag types also are used as a raw material for cement (clinker) manufacture (the slag contributes several major oxides), but steel slag has proven to be especially suitable for this use. Differences evident in table 3 among the usage breakout percentages for these two slag types continue to be difficult to evaluate because the data incorporate estimates and much of the plant-level data reported in recent years have revealed only the dominant use(s) for the slag and thus the less common uses are likely understated. For example, although the percentage decline in the use of air-cooled slag for ready-mixed concrete is in some agreement with the apparent decline in concrete sales in 2010, the magnitude of the decline for slag is questionable given the large increase in the proportion

of sales reported for miscellaneous or unspecified uses. Steel slag sales in 2010 appear to show significant declines in use for road construction and paving, but an increase in use for fill purposes. For the other usage categories in table 3, the differences for the 2 years shown do not appear to be significant.

Notwithstanding higher sales volumes, unit prices for air-cooled and steel slags were substantially unchanged in 2010 (tables 1, 2); the base data contain estimates and few breakout details and thus small changes are likely to be of no statistical significance. Because of generally low unit sales values, slag sold for aggregate generally cannot be economically transported over long distances, particularly overland. Thus, the major factors affecting the sales volumes and prices of these two slag types are dominated by local competition from natural aggregates, the overall level of construction activity (particularly that for roads), and the existence of long-term supply contracts. Air-cooled and steel furnace slags sold for uses other than aggregates can command higher prices than slags sold as aggregates. Pelletized slag (not revealed in tables 1–3) can sell for prices well above those for air-cooled slag.

Sales of GBFS in 2010 increased by 18% to 2.6 Mt. Although this represented just 17% of total slag sales, GBFS has a comparatively high unit value (table 2) and accounted for 70% of total slag sales value and 84% of total blast furnace slag sales value (table 1). Actual sales of GBFS in some years have been higher than those shown in table 1 because of some imports being missed by the USGS canvass; however, it is unclear if this was the case in 2009–10. About 92% of total reported GBFS sales in 2009–10 were of GGBFS and the rest was unground material. The high unit sales value of GBFS reflects the dominant use of GGBFS as a partial substitute for portland cement in blended cements and in concrete. Despite its relatively high unit price, GGBFS has in most years sold at a 20% to 25% discount to portland cement. The discount was about 17% in 2010, however, owing to a significant decline in the price of portland cement. Overall sales of GBFS and GGBFS for cementitious uses totaled 2.5 Mt in 2010, up by 19%. A small fraction of the unground GBFS on the market has been sourced from old slag piles and lacks cementitious character as a result of weathering; this material still has use as a fine grained aggregate in concrete, but sells for much lower prices than those indicated for the cementitious material in table 2.

The USGS slag survey does not distinguish between GBFS sold directly to cement companies and that sold directly to concrete companies, but data from recent USGS cement surveys indicate that cement producers consume only about 15% of the total granulated slag sold, including that used to make blended cement and that used as a grinding aid to make portland cement. Sales in the United States of GGBFS under the designation “slag cement” are promoted by the Slag Cement Association (SCA), whose members account for much of the country’s GGBFS output. The SCA reported sales by its members of 2.0 Mt of GGBFS in 2010, a decline of 2.5% (Slag Cement Association, unpub. data, September 2011).

## Foreign Trade

Actual ferrous slag imports are almost entirely of GBFS or GGBFS, but the data within the appropriate tariff code commonly contain entries that, because of unreasonably high or low unit dollar values, are likely either slags of other metallurgical industries or are unrelated materials entirely (such as silica fume, cenospheres from fly ash, other industrial residues, or metal concentrates). For example, data from the U.S. Census Bureau list imports of granulated slag totaling about 1.38 Mt in 2010, up by about 7% from levels in 2009, but the 2010 total includes 0.03 Mt of imports from Italy at a listed average cost-insurance-freight (c.i.f) valuation of \$251.85 per metric ton and 0.24 Mt of material from South Africa at \$354.36 per ton—these values, if accurate, appear to be too high to be GGBFS. Accordingly, the true tonnage of granulated slag imports is unclear. Taken as listed by the Census Bureau, the leading import sources of GBFS tonnages in 2010 were Japan (41%), Canada (29%), South Africa (18%), and France (6%). Comparison of the Census Bureau import data for slag with data from the United Business Media Ltd.’s Port Import Export Reporting Service (PIERS) has generally revealed higher totals for PIERS in recent years, suggesting that the Census Bureau data were incomplete. In 2010, the PIERS total was 1.46 Mt.

## Outlook

Future slag demand will reflect trends in overall construction spending, especially for public sector projects; it is expected that it will take some years for slag sales to return to the levels of about 20 Mt per year experienced during the boom construction years of 2004 through 2006. Slag sales are expected to benefit from Government programs to promote the use of recovered mineral components in public sector construction projects but may not be able to capture a large share of this market because of limited slag availability. The declining number of operating blast furnaces in the United States makes the future supply of air-cooled blast furnace slag highly vulnerable to even temporary closure of integrated iron and steel complexes, such as were experienced in 2009. Steel slag supplied from basic oxygen furnaces is also vulnerable to closures, but slag availability from electric arc furnaces is more assured. An increasing constraint on steel slag availability for construction projects is a recent tendency for steel plants to retain more slag for return to the furnaces at times of high prices for iron ore and scrap. In terms of actual sales volumes, however, the effects of these increased returns to the furnace are hard to quantify because of the tendency of slag processors to stockpile slag so as to be able to bid on large projects. Slags are useful alternative raw materials for clinker production, and such use can reduce a cement plant’s fuel consumption and overall emissions of carbon dioxide. Availability of sufficient slag near cement plants will continue to be a major determinant of demand for this purpose, as will the slag’s chemical suitability.

The cement and concrete industries have increasingly accepted GGBFS as a cementitious component and this should ensure a steady or growing market share for this slag type. The supply of GBFS from domestic blast furnaces, however, will remain severely constrained by the fact that granulation cooling is currently installed at only four blast furnaces in the United States. Installation of granulators at other blast furnaces is possible but unlikely; it is expensive and would depend upon the perception of the specific furnace's future viability, and not all blast furnaces produce a slag that is chemically suitable for GGBFS. Thus, increases in GGBFS sales will likely depend on the availability of imported GGBFS or GGBFS ground from imported granules.

Current proposed changes in environmental rules governing the manufacture of portland cement and the characterization of fly ash have the potential of increasing the demand for slag as an alternative raw material for clinker manufacture and as an SCM.

### References Cited

American Iron and Steel Institute, 2010, Annual statistical report: Washington, DC, American Iron and Steel Institute, 126 p.

U.S. Environmental Protection Agency, 2009, National emissions standards for hazardous air pollutants from the portland cement manufacturing industry: proposed rule: Federal Register, 40 CFR Parts 60 and 63, v. 74, no. 86, May 6, p. 21136–21192.  
 U.S. Environmental Protection Agency, 2010, National emissions standards for hazardous air pollutants from the portland cement manufacturing industry and standards of performance for portland cement plants: Federal Register, 40 CFR Parts 60 and 63, v. 75, no. 174, September 9, p. 54970–55066.

### GENERAL SOURCES OF INFORMATION

#### U.S. Geological Survey Publication

Iron and Steel Slag. Ch. in Mineral Commodity Summaries, annual.

#### Other

National Slag Association.  
 Portland Cement Association.  
 Slag Cement Association.

TABLE 1  
 IRON AND STEEL SLAG SOLD OR USED IN THE UNITED STATES

(Million metric tons and million dollars)

	2009					2010				
	Blast furnace slag <sup>1</sup>		Steel furnace slag	Total iron and steel slag <sup>2</sup>	Total	Blast furnace slag <sup>1</sup>		Steel furnace slag	Total iron and steel slag <sup>2</sup>	Total
	Air-cooled	Granulated				Air-cooled	Granulated			
Quantity	4.6	2.2	6.8	5.7	12.5	4.9	2.6	7.5	8.2	15.7
Value <sup>c</sup>	33	172	205	30	235	37	186	222	44	266

<sup>c</sup>Estimated.

<sup>1</sup>Excludes expanded (pelletized) slag to protect company proprietary data. The quantities are very small (about 0.1 unit or less).

<sup>2</sup>Data may not add to totals shown because of independent rounding.

TABLE 2  
SELLING PRICES FOR IRON AND STEEL SLAG IN THE UNITED STATES<sup>1</sup>

(Dollars per metric ton)

Slag type	2009		2010	
	Range	Average	Range	Average
Blast furnace slag:				
Air-cooled	3.31 – 19.84	7.35	3.34 – 18.40	7.48
Granulated <sup>2</sup>	20.00 – 100.00	81.37	16.53 – 102.69	74.51
Steel furnace slag	0.19 – 14.66	5.28	0.02 – 24.25	5.37

<sup>1</sup>Data contain a large component of estimates, and some respondents provide values only on their total sales of a slag type, not value by type of use. Thus, the value ranges shown are likely too restrictive.

<sup>2</sup>Values are for material reported for use as a cementitious additive in cement or concrete manufacture. Material at or near the low end of the range was sold in unground form. Sales other than for cementitious use were generally at unit values below the ranges shown.

TABLE 3  
SALES OF FERROUS SLAGS IN THE UNITED STATES, BY USE<sup>1</sup>

(Percentage of total tons sold)

Use	2009			2010		
	Blast furnace slag <sup>2</sup>		Steel slag	Blast furnace slag <sup>2</sup>		Steel slag
	Air-cooled	Granulated		Air-cooled	Granulated	
Ready-mixed concrete	16.4 <sup>r</sup>	--	--	13.4	--	--
Concrete products	4.0 <sup>r</sup>	--	--	4.3	--	--
Asphaltic concrete	16.3 <sup>r</sup>	--	8.1 <sup>r</sup>	17.6	--	3.1
Road bases and surfaces	39.6 <sup>r</sup>	4.1 <sup>r</sup>	59.3 <sup>r</sup>	37.6	4.4	42.8
Fill	9.1 <sup>r</sup>	--	12.6 <sup>r</sup>	4.7	--	32.5
Cementitious material	--	94.6 <sup>r</sup>	--	--	95.1	--
Clinker raw material	1.1 <sup>r</sup>	0.9 <sup>r</sup>	2.3 <sup>r</sup>	0.4	(3)	2.5
Miscellaneous <sup>4</sup>	12.1 <sup>r</sup>	0.4 <sup>r</sup>	0.5	12.0	0.5	0.3
Other or unspecified <sup>5</sup>	1.4	--	17.2 <sup>r</sup>	10.0	--	18.8

<sup>r</sup>Revised. -- Zero.

<sup>1</sup>A number of respondents provide breakouts that represent only the dominant use(s) of their slag; accordingly, the minor use categories are likely underreported. The data also incorporate some estimates and thus should be viewed as accurate to no more than two significant figures.

<sup>2</sup>Excludes expanded or pelletized slag; this material is generally sold as a lightweight aggregate.

<sup>3</sup>Less than 0.1%.

<sup>4</sup>Reported as used for railroad ballast, roofing, mineral wool, or soil conditioner.

<sup>5</sup>Including return to furnaces (likely underreported) and other uses.







TABLE 4—Continued  
PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2010

Slag processing company	Plant location	Steel company serviced <sup>2, 3</sup>	Blast furnace slag			Slag and furnace types <sup>1</sup>		
			Exp			Steel furnace slag		
			AC	GG	Exp	BOF	OHF	EAF
Phoenix Services LLC—Continued:	Johnstown, PA	Old slag pile site	X					
Do.	Latrobe, PA	Latrobe Speciality Steel Co.						X
Do.	Vinton (El Paso), TX	ArcelorMittal USA						X
Do.	Roanoke, VA	Steel Dynamics, Inc.						X
Do.	Weirton, WV	Old slag pile site						X
Recmix of PA, Inc.	Ghent, KY	North American Stainless						X
Do.	Sarver (Brackenkridge), PA	Allegheny Ludlum Corp.						X
Rinker Materials Corp.	Miami, FL	Foreign		X				
St. Marys Cement Inc.	Detroit, MI	do.		X				
Do.	Milwaukee, WI	Domestic and foreign		X				
Stein, Inc.	Alton, IL	Alton Steel Inc.						X
Do.	Granite City, IL <sup>4</sup>	United States Steel Corp.	X				X	
Do.	Sterling, IL	Sterling Steel Co., LLC						X
Do.	Ashland, KY <sup>4</sup>	AK Steel Corp.	X				X	
Do.	Canton, OH	Republic Engineered Products, Inc.						X
Do.	Cleveland, OH <sup>4</sup>	ArcelorMittal USA	X				X	
Do.	Loraine, OH	Republic Engineered Products, Inc.	X				X	
Do.	Mansfield, OH <sup>6</sup>	AK Steel Corp.					X	
Do.	Coatesville, PA <sup>6</sup>	ArcelorMittal USA						X
Do.	Georgetown, SC	Georgetown Steel Corp.						X
Tube City IMS, LLC	Axis, AL	SSAB North America						X
Do.	Birmingham, AL	Nucor Corp.						X
Do.	Tuscaloosa, AL	do.						X
Do.	Fort Smith, AR	GerdauMACSTEEL						X
Do.	Rancho Cucamonga, CA	TAMCO Steel						X
Do.	Claymont, DE	Evrax Inc. NA						X
Do.	Cartersville, GA	Gerdau Ameristeel Corp.						X
Do.	Kankakee, IL	Nucor Corp.						X
Do.	Peoria, IL	Keystone Steel & Wire Co.						X
Do.	Gary, IN	United States Steel Corp.					X	
Do.	Portage, IN	NLMK Indiana (Beta Steel Corp.)						X
Do.	Ashland, KY	Kentucky Electric Steel LLC						X
Do.	Jackson, MI	GerdauMACSTEEL						X
Do.	Monroe, MI	do.						X

See footnotes at end of table.

TABLE 4—Continued  
PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2010

Slag processing company	Plant location	Steel company serviced <sup>2,3</sup>	Slag and furnace types <sup>1</sup>									
			Blast furnace slag		Steel furnace slag							
			AC	GG	Exp	BOF	OHF	EAF				
Tube City IMS, LLC—Continued:	St. Paul, MN	Gerdau Ameristeel Corp.										
Do.	Jackson, MS	Nucor Corp.										
Do.	Norfolk, NE	do.										
Do.	Perth Amboy, NJ	Gerdau Ameristeel Corp.										
Do.	Sayreville, NJ	do.										
Do.	Auburn, NY	Nucor Corp.										
Do.	Marion, OH	do.										
Do.	Middletown, OH	AK Steel Corp.	X				X					
Do.	Mingo Junction, OH	Severstal North America, Inc.	X				X					
Do.	Youngstown, OH	V&M Star										
Do.	Sand Springs, OK <sup>12</sup>	Gerdau Ameristeel Corp.										
Do.	McMinnville, OR	Cascade Steel Rolling Mills, Inc.										
Do.	Braddock, PA	United States Steel Corp.						X				
Do.	Bridgeville, PA	Universal Stainless & Alloy Products, Inc.										
Do.	New Castle, PA	Ellwood Quality Steels Co.										
Do.	Park Hill (Johnstown), PA	Old slag pile site	X						X			
Do.	Pricedale, PA	do.							X			
Do.	Reading, PA	Carpenter Technology Corp.										X
Do.	Cayce, SC	SMI/CMC Steel Group										X
Do.	Darlington, SC	Nucor Corp.										X
Do.	Jackson, TN	Gerdau Ameristeel Corp.										X
Do.	Knoxville, TN	do.										X
Do.	Beaumont, TX	do.										X
Do.	Jewett, TX	Nucor Corp.										X
Do.	Lone Star, TX	Lone Star Steel Co.										X
Do.	Longview, TX	LeTourneau Technologies Steel Products										X
Do.	Seguin, TX	SMI/CMC Steel Group										X
Do.	Plymouth, UT	Nucor Corp.										X
Do.	Petersburg, VA	Gerdau Ameristeel Corp.										X
Do.	Saukville, WI	Charter Steel										X
Uniserve LLC	Newport, AR	Arkansas Steel Associates, LLC										X
Do.	Gallatin, TN	Hoeganaes Corp.										X
Vulcan Materials Co.	Tampa, FL	Foreign							X			
Do., do. Ditto.												

<sup>1</sup>Blast furnace slag type abbreviations: AC = air-cooled; GG = granulated; Exp = expanded; Steel furnace slag types: BOF = basic oxygen furnace; OHF = open hearth furnace;

TABLE 4—Continued  
 PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2010

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<sup>2</sup>“Foreign” refers to the fact that the facility imports unground granulated blast furnace slag and grinds it onsite to make ground granulated blast furnace slag—commonly now referred to as “slag cement.” “Domestic” implies grinding slag sourced from the domestic market, not a service contract.

<sup>3</sup>Currently operating iron and (or) steel company. Company is not shown for old slag pile sites.

<sup>4</sup>For the air-cooled slag, Stein Inc. was responsible for the cooling but the processing and marketing were handled by Beelman Trucking (Granite City, IL), Lafarge Corp. (Cleveland, OH), and Mountain Materials, Inc. (Ashland, KY), respectively.

<sup>5</sup>For granulated slag, Fritz Enterprises, Inc. operates the granulator but Holcim (US) Inc. owns the apparatus and markets the slag.

<sup>6</sup>The contracts for Miansfield, OH, and Coatesville, PA, were transferred to Stein, Inc. in mid-2010.

<sup>7</sup>The contract for Midland, PA, was captured by Harsco Metals Corp. at the end of 2009.

<sup>8</sup>Allegheny Ludlum Corp. closed the meltshop at Natrona Heights, PA, in July 2010.

<sup>9</sup>Lafarge grinds some of the granulated slag from East Chicago, IN, at several of its cement plants located elsewhere.

<sup>10</sup>The contract for Warren, OH, was captured by Phoenix Services LLC in October 2010.

<sup>11</sup>Both “east” and “west” sides.

<sup>12</sup>The Sand Springs, OK, plant closed in June 2010.