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IRON AND STEEL SLAG

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Slag—Iron and Steel

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In 2005, sales of iron and steel slags in the United States totaled about 21.6 million metric tons (Mt), an increase of almost 2% from sales in 2004; the overall value of sales in 2005 was about $372 million, up by about 13% (table 1). Ferrous slags are formed through the addition of slagging agents (chiefly limestone or dolomite) and/or fluxing materials to blast furnaces and steel furnaces to strip the impurities from iron ore, steel scrap, and other iron or steel feeds. The slag forms as 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 cooling to solid form, the slag is processed and may then be sold.

Most slags have very low unit values compared to iron and steel products. For this reason, iron and steel companies consider slag to be a nuisance and thus generally contract with outside slag-processing companies to remove it; commonly, the slag-processing company is also responsible for cooling the slag. 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 (this 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. Also, slag may be returned to the furnaces for use as flux and as a supplemental source of iron; this return of slag is typically not reported as a sale.

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

Legislation and Government Programs

Demand for slag in the construction sector is influenced by Federal and State programs that affect construction spending levels. The main Federal funding program in recent years relating to construction has been the Transportation Equity Act for the 21st Century (TEA–21) and temporary funding continuations following its formal expiration in September 2003. Negotiations to reauthorize TEA–21 culminated with the August 10, 2005, signing into law of its replacement, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA–LU). This Act authorized Federal funding of surface transportation projects for the period 2005–09 at a total guaranteed minimum funding level of $244.1 billion for the period. In federally funded and other construction projects, slags are promoted as "sustainable" construction materials, mainly on the basis that slags substitute directly or indirectly for virgin raw materials (for example, natural stone aggregates in various applications, and natural raw materials for cement manufacture) or, in the specific case of ground granulated blast furnace slag (GGBFS), can partially substitute for portland cement in concrete.

Production

Data are generally unavailable from plants on the actual output of iron and steel slags for an extended series of production cycles (heats). This generally is because not all of the slag is tapped during a heat, and the amount of slag tapped is not routinely measured. Accordingly, there are no data on U.S. production of ferrous slags and few, if any, data on foreign production, although both can be 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 will normally produce about 0.25 to 0.30 metric tons (t) of slag per ton of crude iron. For ore grades lower than average, the slag output will be higher—sometimes 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 is generally recovered during slag processing and returned to the furnace. The amount of marketable slag remaining after entrained steel 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 (2005, p. 121-126), it was estimated that U.S. blast furnace slag production in 2005 was in the range of about 9 to 11 Mt, and world output was in the range of 196 to 237 Mt. Likewise, U.S. output of steel slag (after metal removal) in 2005 was estimated to be 10 to 14 Mt, and world output, 113 to 170 Mt.

Blast furnace slags, as sold, 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. The cooled material is hard and dense, although it can have a vesicular texture with closed pores. After crushing and screening, air-cooled slag is used mainly as an aggregate for various purposes (table 3). Granulated blast furnace slag is formed by quenching molten slag in water to form sand-sized particles of glass. The disordered structure of this glass gives the material moderate hydraulic cementitious properties when very finely ground. However, if this GGBFS can access free lime during hydration, the GGBFS develops strong hydraulic cementitious properties and is valued as a partial substitute for portland cement. 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 vesicular texture reduces the overall density of

the slag and allows for good mechanical binding with hydraulic cement paste. Blast furnace slag (generally air-cooled) also can be made into mineral wool. Slag for this purpose 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.

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

Consumption

Data in this report are based on an annual U.S. Geological Survey (USGS) canvass of slag processors and relate to sales of processed slag rather than to the amount of slag processed by the same firms or to the actual production of slag by iron and steel companies. Processed slag is sold from stockpiles, and although most of the material is a byproduct of current or recent iron and steel production or is of imported material, some is material mined from old slag piles (slag banks) and reflects iron and steel production from plants now closed. In 2005, canvasses were sent to 27 companies, covering 131 processing sites, and at least partial data were received for 127 sites. By comparison, in 2004, canvasses were sent to 28 processing companies, covering 130 processing sites, and at least partial data were received for 126 sites. For both 2004 and 2005, the reported data account for about 98% of the gross tonnages listed in table 1. 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. Prior to 2002, data for pelletized slag were presented combined with granulated slag under the term "Expanded slag."

In terms of tonnage, U.S. slag sales in 2005 continued to be dominantly of air-cooled blast furnace slag and steel slag (table 1). Air-cooled blast furnace slag sales totaled about 8.4 Mt in 2005, up by about 4% from the amount sold in 2004. In contrast, steel furnace slag sales declined by about 3% in 2005 to about 8.7 Mt. For all years, the sales data for air-cooled and steel furnace slags largely exclude material returned to the furnaces (and likewise exclude the weight of free metal recovered from the slag and returned to the furnace); data on these returns are very incomplete.

Air-cooled and steel furnace slags have a similar set of uses—mostly as aggregates for various applications (table 3). Because of potential expansion problems, steel slags find little use in applications requiring maintenance of a fixed volume (for example, concrete). Steel slags that contain a lot of free lime may be used as a soil conditioner. Most slags can be used as raw material for cement (clinker) manufacture (the slag contributes aluminum, calcium, iron, and silicon oxides) but steel slags have proven to be especially suitable for this use. Much of the use of steel slag as a raw material for clinker continued to be through the CemStar process, developed and patented by Texas Industries, Inc. (TXI) after researching higher valued uses for the slag produced by its subsidiary company Chaparral Steel Co. In December 2004, following the spinoff of Chaparral from TXI, it was announced that the CemStar patents and marketing rights had been sold to Edward C. Levy Co., a major steel furnace slag processing company (Edward C. Levy Co., 2005).

Even though the sales price data for air-cooled and steel slags contain a large component of estimates, it appears that the average selling prices of air-cooled and steel slag were essentially unchanged in 2005, although the upper end of the steel slag price range increased (table 2). Typically, the major factors affecting the sales volumes and prices of these slags include local competition from natural aggregates, the overall level of construction activity (particularly that for roads), and the existence of some long-term supply contracts. Because of generally low unit sales values, slags for aggregate applications cannot sustain long-distance transportation costs. Slag converted to mineral wool is mainly used for thermal insulation. Pelletized slag is primarily used for lightweight concrete aggregate; however, when finely ground, pelletized slag can be used as a supplementary cementitious material similar to GGBFS.

In terms of sales value, the slag market in the United States in 2005 remained dominated by granulated blast furnace slag, particularly GGBFS. In 2005, granulated slag accounted for almost 83% of the value of total blast furnace slag sales and 74% of total ferrous slag sales (table 1). The tonnage of granulated slag sold in 2005 increased by almost 10% to 4.5 Mt, of which about 3.8 Mt was GGBFS, and the rest was unground material. The value dominance of granulated slag reflects its high unit value relative to the other slag types (table 2), and this, in turn, reflects the ready market for GGBFS as a partial substitute for portland cement in ready-mixed concrete or mixed with portland cement to make finished blended cement (also for use in concrete). The unit value for granulated slag rose by more than 7% in 2005 and yet continued to sell at a 20% to 25% discount to portland cement. 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 containing 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. A small fraction of the unground granulated slag on the market has been sourced from old slag piles and lacks cementitious properties as a result of weathering; this material still has use in concrete (as a fine grain aggregate), but sells for much lower prices than those indicated for the cementitious material in table 2.

The USGS slag survey does not distinguish between granulated slag sold directly to cement companies and that sold directly to concrete companies, but data collected by the 2005 USGS cement survey indicate that cement producers themselves consumed about 15% of the total granulated slag sales (up from 8% in 2004). Sales in the United States of GGBFS under the designation "slag cement" are promoted by the Slag Cement Association (SCA), whose members accounted for much of the country's GGBFS output. The SCA reported sales by its members of 3.50 Mt of GGBFS in 2005, which is in close

agreement with the USGS data (Slag Cement Association, 2006§[1]).

Foreign Trade

Imports of ferrous slags (excluding iron scales) totaled about 1.6 Mt in 2005, up by almost 63% from the 1.0 Mt imported in 2004. Granulated slag (mostly as unground material) imports totaled almost 1.1 Mt in 2005, compared with 0.76 Mt in 2004. For 2005, the average unit value (customs value) for imported granulated slag was $35.29 per metric ton, slightly lower than the $36.93 per ton average in 2004. By comparison, the cost, insurance, and freight (c.i.f.) value was $47.90 per ton in 2005 compared with $49.89 per ton in 2004. The difference in the c.i.f. values for the 2 years includes a modest ($0.35 per ton) decline in average shipping charges in 2005 compared with a $3.35 per metric ton shipping charge increase in 2004. Of the seven countries that supplied granulated slag in 2005, the leading sources were Italy (33%), Canada (24%), France (19%), and Japan (14%).

Outlook

Growth in consumption of ferrous slags as aggregate is expected to parallel growth trends for natural aggregates and is thus dependent on overall construction spending levels, especially spending in the public sector. Factors affecting increased use of slags relative to natural aggregates include the promotional efforts by the slag industry itself and slag availability. The generally declining trend in the U.S. output of iron and steel augurs for future supply constraints, especially as existing stockpiles get drawn down. The long-term availability of air-cooled slag is especially problematic given the continuing decline in the number of operating blast furnaces. Steel slag supplies are more assured, although an increasing fraction of this material will be from electric arc rather than basic oxygen furnaces.

[1]A reference that includes a section mark (§) is found in the Internet Reference Cited section.

The market for GGBFS is expected to continue to grow, in line with its performance advantages for concrete and efforts to reduce the environmental impacts of cement and concrete manufacture. Domestic output of granulated slag is limited by the fact that granulation cooling is currently installed at only five blast furnaces in the country, and one of these (at Weirton, WV) was shut down in mid-2005 following the purchase of the steel mill earlier in the year by Mittal Steel USA. Unless granulators are installed at other blast furnaces, future domestic growth of GGBFS production will be by grinding plants that rely on imported feed. Production of GGBFS at an import-fed grinding plant in Louisiana ceased in late August owing to damage sustained by the facility during Hurricane Katrina; repairs were continuing as of yearend and production was expected to resume in early 2006.

References Cited

American Iron and Steel Institute, 2005, Annual statistical report: Washington, DC, American Iron and Steel Institute, 126 p.
Edward C. Levy Co., 2005, Levy acquires CemStarSM: Detroit, MI, Edward C. Levy Co. press release, February, 1 p.

Internet Reference Cited

Slag Cement Association, 2006, Surge in blended cement pushes total slag cement to new record levels: Factsheet, accessed October 25, 2006, via.URL http://www.slagcement.org.

GENERAL SOURCES OF INFORMATION

U.S. GEOLOGICAL SURVEY PUBLICATIONS

Iron and Steel Slag. Ch. in Mineral Commodities 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)

	2004					2005				
	Blast furnace slag[1]			Steel	Total iron	Blast furnace slag[1]			Steel	Total iron
	Air-cooled	Granulated	Total[2]	furnace slag	and steel slag[2]	Air-cooled	Granulated	Total[2]	furnace slag	and steel slag[2]
Quantity[3]	8.1	4.1	12.2	9.0	21.2	8.4	4.5	12.9	8.7	21.6
Value[e, 4]	53	236	289	39	328	56	277	333	39	372

[e]Estimated.
[1]Excludes expanded (pelletized) slag to avoid disclosing company proprietary data. The quantities are very small (less than 0.1 unit).
[2]Data may not add to totals shown because of independent rounding.
[3]Quantities are rounded to reflect inclusion of some estimated data and to reflect inherent accuracy limitations of reported data.
[4]Values are rounded because of the inclusion of a large estimated component.

TABLE 2
SELLING PRICES FOR IRON AND STEEL SLAG IN THE UNITED STATES[1]

(Dollars per metric ton)

	2004		2005	
Slag type	Range	Average	Range	Average
Blast furnace slag:				
Air-cooled	1.54-17.35	6.58	2.76-17.50	6.57
Granulated[2]	22.05-71.65	61.49	17.63-88.18	66.04
Steel slag	0.22-7.89	4.32	0.22-12.85	4.45

[1]Underlying data contain a large component of estimates.
[2]Range shown is for material reported for use as a cementious additive in cement or concrete manufacture. Material at or near the low end of the range was sold in unground form.

TABLE 3
SALES OF FERROUS SLAGS IN THE UNITED STATES , BY USE[1]

(Percentage of total tons sold)

	2004			2005		
	Blast furnace slag[2]		Steel	Blast furnace slag[2]		Steel
Use	Air-cooled	Granulated	slag[3]	Air-cooled	Granulated	slag[3]
Ready-mixed concrete	20.4	--	--	16.1	--	--
Concrete products	3.5	--	--	5.2	--	--
Asphaltic concrete	20.4	--	12.9	16.7	--	15.6
Road bases and surfaces	32.3	--	63.5	34.0	--	53.0
Fill	4.9	--	9.6	11.1	--	10.5
Cementitious material	--	91.1	--	--	90.5	--
Clinker raw material	1.9	--	5.5	4.4	--	6.9
Miscellaneous[4]	4.2	--	2.9	9.0	--	2.3
Other or unspecified	12.4	8.9	5.6	3.5	9.5	11.7

-- Zero.
[1]Data contain a large component of estimates and are reliable to no more than two significant digits.
[2]Excludes expanded or pelletized slag; this material is generally sold as a lightweight aggregate.
[3]Steel slag use is based on the 77% of total tonnage sold in 2004 and the100% of total tonnage sold in 2005 (table 1) for which usage data were provided.
[4]Reported as used for railroad ballast, roofing, mineral wool, or soil conditioner.

TABLE 4
PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2005

Slag processing company	Plant location	Steel company serviced[1]	Slag and furnace types[2]					
			Blast furnace slag			Steel furnace slag		
			AC	GG	Exp	BOF	OHF	EAF
AMSI, Inc.	Holsopple, PA	North American Höganäs, Inc.						X
Barfield Enterprises, Inc.	La Place, LA	Bayou Steel Corp.						X
Do.	Lone Star, TX	Lone Star Steel Corp.						X
Beaver Valley Slag	Aliquippa, PA	Old slag pile site	X				X	
Do. (Thor Mill Services)	Roanoke, VA	Roanoke Electric Steel, Inc.						X
Beelman Truck Co.	Granite City, IL	U.S. Steel LLC	X					
Blackheart Slag Co.	Muscatine (Montpelier), IA	IPSCO Steel, Inc.						X
Border Steel, Inc.	El Paso, TX	Border Steel, Inc.						X
Buffalo Crushed Stone, Inc.	Woodlawn, NY	Old slag pile site	X					
Buzzi Unicem USA, Inc.	New Orleans, LA	Foreign[3]		X				
Civil & Marine, Inc.	Cape Canaveral, FL	do.		X				
Edward C. Levy Co.	Decatur (Trinity), AL	Nucor Steel Corp.						X
Do.	Butler, IN	Steel Dynamics Inc.						X
Do.	Columbia City, IN	do.						X
Do.	Crawfordsville, IN	Nucor Steel Corp.						X
Do.	Detroit, MI	Severstal North America, Inc.	X			X		
Do.	do.	U.S. Steel LLC	X			X		
Do.	Delta, OH	North Star-Bluescope Steel Inc.						X
Do.	Canton, OH	The Timken Co.						X
Do.	Huger, SC	Nucor Steel Corp.						X
Essroc Corp.	Middlebranch, OH	Miscellaneous domestic and foreign[3]		X				
Florida Rock Industries, Inc.	Tampa, FL	Foreign[3]		X				
Fritz Enterprises, Inc.	Fairfield, AL	U.S. Steel LLC	X			X		
Gerdau Ameristeel Corp.	Jacksonville, FL	Gerdau Ameristeel Corp.						X
Do.	Charlotte, NC	do.						X
Glens Falls-Lehigh Cement Co.	Cementon, NY	Foreign[3]		X				
Holcim (US) Inc.	Birmingham (Fairfield), AL	U.S. Steel LLC		X				
Do.	Gary, IN	do.		X				
Do.	Weirton, WV	Weirton Steel Corp.		X				
Lafarge North America Inc.	Joppa, IL	Mittal Steel USA		X				
Do.	South Chicago, IL	do.		X				
Do.	East Chicago, IN	do.		X	X			
Do.	Sparrows Point, MD	do.		X				
Do.	Cleveland (Cuyahoga Co.), OH[4]	do.	X					
Do.	Lordstown, OH	Old slag pile site		X				
Do.	McDonald, OH	do.	X					
Do.	Salt Springs (Youngstown), OH	do.	X					
Do.	Warren, OH	WCI Steel Inc.	X					
Do.	West Mifflin (Duquesne), PA	U.S. Steel LLC (ET Works)	X					
Do.	West Mifflin (Brown Reserve), PA	Old slag pile site	X					
Do.	Whitehall, PA	Foreign[3]		X				
Do.	Seattle, WA	do.		X				
Do.	Weirton, WV	Mittal Steel USA	X					
Lehigh Cement Co.	Evansville, PA	Foreign[3]		X				
Levy Co., Inc., The	Burns Harbor, IN	Mittal Steel USA	X			X		
Do.	East Chicago, IN	do.	X					
Do.	Gary, IN	U.S. Steel LLC	X	X				
Mountain Enterprises, Inc.	Ashland, KY[4]	AK Steel Corp.	X					
MultiServ	Birmingham, AL	Structural Metals Corp.						X
Do.	Blytheville, AR	Nucor Steel Corp.						X
Do.	Blytheville (Armorel), AR	Nucor-Yamato Steel Co.						X
Do.	Pueblo, CO	Rocky Mountain Steel Mills						X
Do.	Wilton (Muscatine), IA	IPSCO Steel, Inc.						X
Do.	Riverdale, IL	Mittal Steel USA				X		
Do.	East Chicago, IN	do.				X		
Do.	Indiana Harbor, IN	do.				X		
Do.	Pittsboro, IN	Steel Dynamics Inc.						X
Do.	Ghent, KY	Gallatin Steel Co.						X
Do.	do.	North American Stainless LP						X
Do.	Sparrows Point, MD	Mittal Steel USA	X			X		

See footnotes at end of table

TABLE 4—Continued
PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2005

Slag processing company	Plant location	Steel company serviced[1]	Slag and furnace types[2]					
			Blast furnace slag			Steel furnace slag		
			AC	GG	Exp	BOF	OHF	EAF
MultiServ—Continued:	Ahoskie (Cofield), NC	Nucor Steel Corp.						X
Do.	Canton, OH	Republic Engineered Products LLC						X
Do.	Mansfield, OH	AK Steel Corp.				X		
Do.	Warren, OH	WCI Steel Inc.				X		
Do.	Brackenridge, PA	Allegheny Ludlum Corp.						X
Do.	Braddock (Mon Valley), PA[5]	U.S. Steel LLC				X		
Do.	Butler, PA	AK Steel Corp.						X
Do.	Coatesville. PA	Mittal Steel USA						X
Do.	Koppel, PA	Koppel Steel Co. (NS Group, Inc.)						X
Do.	Latrobe, PA	Allegheny Ludlum Corp.						X
Do.	Natrona Heights, PA	do.						X
Do.	Steelton, PA	Mittal Steel USA						X
Do.	Midlothian, TX	Chaparral Steel Co.						X
Do.	Geneva (Provo), UT	Old slag pile site	X			X		
Do.	Seattle, WA	Nucor Steel Corp.						X
Recmix of PA, Inc.	Ghent, KY	North American Stainless, LP						X
Do.	Sarver (Brackenridge), PA	Allegheny Ludlum Corp.						X
Rinker Materials Corp.	Miami, FL	Foreign[3]		X				
St. Lawrence Cement, Inc.	Camden, NJ	do.		X				
St. Marys Cement, Inc.	Detroit, MI	do.		X				
Stein, Inc.	Alton, IL	Alton Steel Co.						X
Do.	Granite City, IL	U.S. Steel LLC				X		
Do.	Sterling, IL	Sterling Steel, Inc.						X
Do.	Ashland, KY[4]	AK Steel Corp.				X		
Do.	Cleveland, OH[4]	Mittal Steel USA				X		
Do.	Loraine, OH	Republic Engineered Products LLC	X			X		
Do.	Georgetown, SC	Georgetown Steel Corp.						X
Tube City-IMS, IMS Division	Axis, AL	IPSCO Steel, Inc.						X
Do.	Birmingham, AL	Nucor Steel Corp.						X
Do.	Tuscaloosa, AL	do.						X
Do.	Fort Smith, AR	MACSTEEL						X
Do.	Rancho Cucamonga, CA	TAMCO						X
Do.	Claymont, DE	CitiSteel USA, Inc.						X
Do.	Cartersville, GA	Gerdau Ameristeel Corp.						X
Do.	Wilton (Muscatine), IA	do.						X
Do.	Kankakee, IL	Nucor Steel Corp.						X
Do.	Peoria, IL	Keystone Steel & Wire Co.						X
Do.	Gary, IN	U.S. Steel LLC				X		
Do.	Portage, IN	Beta Steel Corp						X
Do.	Ashland, KY	Kentuckey Electric Steel LLC						X
Do.	Jackson, MI	MACSTEEL						X
Do.	Monroe, MI	Macsteel (Quanex, Corp.)						X
Do.	St. Paul, MN	Gerdau Ameristeel Corp.						X
Do.	Jackson, MS	Nucor Steel Corp.						X
Do.	Norfolk, NE	do.						X
Do.	Perth Amboy, NJ	Gerdau Ameristeel Corp.						X
Do.	Sayreville, NJ	do.						X
Do.	Auburn, NY	Nucor Steel Corp.						X
Do.	Marion, OH	Marion Steel Co.						X
Do.	McMinnville, OR	Cascade Steel Rolling Mills, Inc.						X
Do.	Middletown, OH	AK Steel Corp.	X			X		
Do.	Mingo Junction, OH	Wheeling Pittsburgh Steel Corp.	X			X		
Do.	Youngstown, OH	V&M Star						X
Do.	Sand Springs, OK	Sheffield Steel Corp.						X
Do.	Bethlehem, PA	Old slag pile site	X			X		
Do.	Braddock, PA[5]	U.S. Steel LLC				X		
Do.	Bridgeville, PA	Universal Stainless & Alloy Products Inc.						X
Do.	Midland, PA	Allegheny Ludlum Corp.						X
Do.	New Castle, PA	Ellwood Quality Steels Co.						X

See footnotes at end of table

TABLE 4—Continued
PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2005

Slag processing company	Plant location	Steel company serviced[1]	Slag and furnace types[2]					
			Blast furnace slag			Steel furnace slag		
			AC	GG	Exp	BOF	OHF	EAF
Tube City-IMS, IMS Division—Continued:	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 Steel Corp.						X
Do.	Jackson, TN	Gerdau Ameristeel Corp.						X
Do.	Knoxville, TN	do.						X
Do.	Beaumont, TX	do.						X
Do.	Jewett, TX	Nucor Steel Corp.						X
Do.	Longview, TX	LeTourneau Steel Group						X
Do.	Seguin, TX	SMI/CMC Steel Group						X
Do.	Plymouth, UT	Nucor Steel Corp.						X
Do.	Petersburg, VA	Chaparral Steel Co.						X
Do.	Saukville, WI	Charter Steel						X
Do.	Weirton, WV	Mittal Steel USA				X		
Uniserve LLC	Newport, AR	Arkansas Steel Association						X

[1]Currently operating iron and/or steel company. Company is not shown for old slag pile sites.

[2]Blast furnace slag type abbreviations: AC, air-cooled; GG, granulated; Exp, expanded. Steel furnace slag types: BOF, basic oxygen furnace; OHF, open hearth furnace; EAF, electric arc furnace.

[3]"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."

[4]For the air-cooled slag, Stein was responsible for the cooling, but the processing and marketing were handled by Lafarge North America Inc. (Cleveland, OH) and Mountain Enterprises, Inc. (Ashland, KY), respectively.

[5]Contract was transferred to Tube City IMS Corp. in mid-2005.