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# 2018 Minerals Yearbook

## SLAG—IRON AND STEEL [ADVANCE RELEASE]

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# Slag—Iron and Steel

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Total sales of iron and steel slags in 2018 increased by 4% to an estimated 16.8 million metric tons (Mt) from the revised total of 16.2 Mt in 2017 (table 1). In 2018, slag sales increased by 11% to $444 million.

Iron and steel slags are silicate melts created by adding agents and fluxes, such as dolomite, lime, limestone, or silica sand, to blast furnaces, steel furnaces, or associated ladles. This process removes impurities from iron ore, crude iron, direct-reduced iron, steel scrap, and other ferrous feeds. Molten slag floats on top of molten crude iron or steel and is tapped from the furnace or ladle separately from the liquid metal. After cooling to solid form, the slag is processed and either sold, stockpiled for eventual sale, or returned to the furnace. Processed slags have much lower unit values than do iron and steel metal; accordingly, the iron and steel companies generally contract with outside slag-processing companies to cool and remove the slag. Typically, the processing company receives the slag for free, cools and crushes the slag, screens and magnetically separates the slag from entrained metal and sells the slag on the open market, and may pay a small percentage of the sales revenues to the steel company. Some companies return some slag to the furnace as a flux and supplemental source of iron. This return flow is not always included in the reported sales tonnages. The value of entrained metal typically exceeds the value of the slag itself and the entrained metal can be sold back to the furnace operator.

A listing of slag processors, processing sites, slag types, and steel companies serviced is provided in table 4. Some sites may appear more than once because of the transfer of processing contracts to other companies during the year and iron or steel plants with multiple processing contracts for the same or different types of slag.

## Legislation and Government Programs

Most slag is sold to the construction sector, and its market is influenced by Federal and State programs that affect construction spending, especially those that allow and encourage the use of "alternative" raw materials in construction or that restrict the use of natural construction materials. Slags can substitute for raw materials in some construction applications, such as substituting for natural stone aggregates in concrete and raw materials in cement manufacture. Ground granulated blast furnace slag (GGBFS) is a supplementary cementitious material (SCM), which can partially substitute for clinker in finished cement or for some of the portland cement in concrete. Substituting slags for raw materials in the manufacture of clinker can reduce fuel consumption and the amount of limestone in the kiln, which can reduce emissions, including carbon dioxide. Use of GGBFS or unground granulated blast furnace slag (GBFS) in the cement plant's finish mill produces more cement from the same amount of clinker.

The National Emissions Standards for Hazardous Air Pollutants (NESHAP), which took effect in September 2015, set very low limits for cement plant emissions of mercury, total hydrocarbons, hydrochloric acid, and particulates (U.S. Environmental Protection Agency, 2015). The NESHAP limits have resulted in some, generally older, cement plants being idled or closed. This reduction in cement capacity has the potential to increase demand for SCMs, such as GGBFS and fly ash.

## Production

The amount of slag tapped from a furnace is not routinely measured, and not all slag is tapped in a heat; thus, data on annual production of slag are usually unavailable. Production of slag can be broadly estimated based on typical slag-to-metal ratios, which are related to the chemistry of the ferrous feeds to the furnace. For typical iron ore grades (60% to 66%), a blast furnace will normally produce 0.25 to 0.30 metric ton (t) of slag per metric ton of crude or pig iron produced. Lower-than-average ore grades will produce more slag, in some cases as much as 1.0 to 1.2 t of slag per metric ton of crude iron. Steel furnaces typically produce about 0.1 to 0.15 t of marketable steel furnace slag (SFS) per metric ton of crude steel. Using these ratios and data for U.S. and world iron and steel production from the World Steel Association (2019, p. 9, 18), domestic blast furnace slag production in 2018 was estimated to be between 6 and 7 Mt, with world production between 312 to 374 Mt. SFS production by U.S. furnaces was estimated to be in the range of 9 to 13 Mt, with world production of SFS from 181 to 271 Mt.

The commercial uses of ferrous slag depend on the method by which the slag is cooled. Blast furnace slag (BFS) can be cooled to three main product types—air-cooled, granulated, and pelletized (or expanded). Air-cooled BFS is made by slowly cooling molten slag under ambient conditions, and final cooling can be accelerated with water spray. Air-cooled slag is especially suitable for use as a construction aggregate. GBFS is made by quenching molten slag in water to form sand-sized granules of glass. When finely ground into GGBFS, the glass has moderate cementitious properties. These properties become strong if the GGBFS has access to free lime, such as when it is included in a concrete mix and the portland cement is hydrated. GGBFS concretes are generally slower to develop strength than concretes with only portland cement, but have similar or even superior long-term strength, release less heat during hydration, exhibit improved resistance to chemical attack, and have reduced permeability. Pelletized (expanded) slag is cooled by a water jet, generating steam and developing vesicles, which reduces the slag's overall density and allows for good mechanical binding with hydraulic cement paste. Very finely ground, pelletized slag is commonly used as a lightweight aggregate and can have cementitious properties similar to those

of GGBFS. BFS, generally air-cooled, can be made into mineral wool. Mineral wool is made by remelting slag, pouring it through a gaseous stream or passing through a fast spinning perforated disc to make molten droplets, which elongate into long fibers that are collected and layered and used for thermal insulation.

SFS is cooled similarly to air-cooled BFS, has similar properties to BFS, and is used for some of the same purposes. SFSs, especially those commingled with ladle slags, contain large amounts of dicalcium silicate, are prone to expansion, and commonly are cured in piles for several months to allow for this expansion and for leaching out of lime.

Iron and steel slags are also used in environmental applications, such as water filtration, although the data on such uses are incomplete.

## Consumption

The data in this report are based on an annual U.S. Geological Survey (USGS) canvass of slag processors and importers and pertain only to sales of processed slag. In 2018, canvasses were sent to 28 companies, and at least partial data were received for 123 of the 133 processing and (or) importation sites (table 4). This data accounted for 90% of total slag tonnages, including 91% of total GBFS tonnages. Data on pelletized BFS have been withheld to avoid disclosing company proprietary data. Sales for GBFS and GGBFS miss some material sold by a few importers who as yet do not take part in the USGS canvass. Data in table 1 do not include free metal recovered from slag, which is sold separately.

Slag sales and production commonly bear little resemblance in a given year because of several factors, such as imports, returns of slag to the furnaces, changes in processing protocols affecting slag marketability, and because slag sales are from stockpiles, including old slag banks from iron and steel plants long-since closed. In 2018, domestic production of crude iron increased by 7.6% and that of crude steel increased by 6.1% (World Steel Association, 2019, p. 9, 18); by comparison, sales of BFS increased slightly and sales of SFS increased by 6.5% (table 1).

Because of transportation costs, long-term sales contracts, restricted geographic availability, and processors stockpiling slag to allow bidding on large contracts, trends in sales volumes for slag can differ from those of competing natural aggregates and those of portland and blended cement. In 2018, the increase in overall sales of ferrous slags was slightly higher than the increase in domestic cement sales. About 80% of total slag sales in 2018 were of air-cooled BFS and SFS (table 1). Both slag types are mainly used as construction aggregates. Because of their low unit values (table 2), these slags generally only compete with natural aggregates in market regions near active iron and steel furnaces or slag banks, which avoids long-distance transportation charges.

Expansion problems with SFS, especially ladle slags or commingled ladle and SFS, reduce its usage for maintenance of a fixed volume, such as ready-mixed concrete. Air-cooled BFS and SFS can be used for the manufacture of clinker for cement, but SFS is most suitable. Changes in slag sales by type of use are difficult to evaluate because of data estimates, and consolidation of plant-level data into the dominate use of the slag or into the "Other" category on the canvass, leaving the minor use categories understated. The usage breakouts in table 3 appear to be broadly similar for both years shown.

In 2018, GBFS, reported as GGBFS, sales increased by 0.3 Mt to 3.4 Mt, accounting for 40% of BFS sales tonnages and 20% of total iron and steel slag sales tonnages. GGBFS total value increased by $39 million to $345 million, accounting for 88% of BFS sales value and 78% of total iron and steel slag sales value. Actual GGBFS sales have been higher in some years than have been previously stated because of some imports that were missed by the USGS canvass; however, this is not believed to be the case in 2018 (table 1). Material consumption data from USGS canvasses of cement producers continue to indicate that the major component of GGBFS sales are to the concrete industry, though this is not distinguished on the USGS slag survey. An alternative source of data for sales of GGBFS, under the designation "slag cement," is the Slag Cement Association (SCA), whose members account for much of the country's GGBFS production and sales. The SCA's reported slag cement shipment sales of 3.4 Mt in 2018 excluded the content of GGBFS in blended hydraulic cements (Slag Cement Association, 2019) and was thus not strictly comparable to the data in table 1.

## Prices

As in previous years, in 2018, many slag canvasses returned to the USGS lacked price data or included only an average price for total tons sold. Accordingly, data in table 2 include many estimates but have been left unrounded to better show the range of reported values. Small unit differences of less than $1 per metric ton are likely of no statistical significance, commonly reflecting modest changes in tonnages sold or the amount of detail provided in the use breakouts. The average prices did not change significantly for air-cooled BFS or SFS but increased by 3% for GGBFS, in-line with the price increase for portland cement, for which GGBFS is a partial substitute (table 2).

As noted above, air-cooled BFS and SFS have many similar uses, mainly as aggregates. The prices of these two slag types are affected by competition from natural aggregates, level of construction activity, particularly for roads, and long-term supply contracts. Air-cooled BFS and SFS sold for uses other than aggregates can command higher prices than slags sold as aggregates. Pelletized slag, not shown in tables 1, 2, or 3, can sell for prices well above those for air-cooled slag.

## Foreign Trade

A majority of the iron and steel slag imported into the United States is GBFS or GGBFS, which are covered under the Harmonized Tariff Schedule of the United States (HTS) code 2618.00. Import data under this HTS code commonly contain entries that are other slags, such as copper slag, or non-slag materials, such as silica fume, fly ash or its cenospheres, other industrial residues, or metal concentrates. Granulated slag imports in 2018, under HTS code 2618.00, were reported to be 2.59 Mt by the U.S. Census Bureau; however, only 2.18 Mt of this appeared to be GBFS or GGBFS, based on unit values. HTS code 2619.00 includes some granulated slag imports, though

this amount was negligible in 2018. By comparison, import data from Trade Mining, LLC's trade database showed totals similar to the U.S. Census data, with likely granulated slag imports of 2.5 Mt (Trade Mining, LLC, 2019). In 2018, granulated slag imports were mostly supplied by, in descending order, Brazil, Italy, Japan, Canada, and China. Exports of granulated slag were reported to be around 24,000 t by the U.S. Census Bureau.

### Outlook

Most ferrous slag will continue to be used in the United States as construction aggregate. Ferrous slags have significant growth potential in more specialized uses, such as raw materials for manufacturing clinker and glass. Two previously idle blast furnaces resumed production in 2018, but the domestic supply of BFS remains limited with only 19 blast furnaces operating (Iron & Steel Technology, 2019) and with only 2 equipped with granulation cooling. Demand for GGBFS and other SCMs will likely increase because SCMs reduce the clinker content of hydraulic cement and concrete, limit the emissions of carbon dioxide from concrete construction, and improve concrete quality.

Basic oxygen furnace (BOF) SFS has the same supply constraints as BFS because the BOFs are located at the same plants and mostly rely on the crude iron feed supplied by the blast furnaces. Domestic electric arc steel furnace (EAF) slag likely does not face the same supply constraints because the EAFs are numerous and rely on scrap for most of their ferrous feed.

Ferrous slags, especially SFS, can substitute for some of the limestone in portland cement production, thereby reducing carbon dioxide emissions. Fly ash and bottom ash are also substitutes, and thus commonly compete with ferrous slags. To meet NESHAP limits on mercury emissions, the cement industry may turn from fly ash to ferrous slags, especially if the industry is unable to substitute bottom ash for the fly ash. Demand for ferrous slag also may increase owing to closure of U.S. coal-fired powerplants, or their conversion to natural gas, which may constrain the supply of coal combustion ashes, including fly ash.

### References Cited


Iron & Steel Technology, 2019, 2019 AIST North American blast furnace roundup: Iron & Steel Technology, v. 16, no. 3, p. 260–261.

Slag Cement Association, 2019, Shipments: Farmington Hills, MI, Slag Cement Association. (Accessed September 13, 2019, at https://www.slagcement.org/resources/shipments.aspx.)

Trade Mining, LLC, 2019, Trade Mining—Import trade data: Dearborn, MI, Trade Mining, LLC. (Accessed August 21, 2019, via https://www.trademining.com/index.jsp.)

U.S. Environmental Protection Agency, 2015, 40 CFR Parts 60 and 63—National emissions standards for hazardous air pollutants from the portland cement manufacturing industry and standards of performance for portland cement plants: Federal Register, v. 80, no. 143, July 27, p. 44772–44793.

World Steel Association, 2019, World Steel in figures 2019: Brussels, Belgium, World Steel Association, 32 p. (Accessed September 13, 2019, at https://www.worldsteel.org/en/dam/jcr:96d7a585-e6b2-4d63-b943-4cd9ab621a91/World%2520Steel%2520in%2520Figures%25202019.pdf.)


## GENERAL SOURCES OF INFORMATION

### U.S. Geological Survey Publications

Historical Statistics for Mineral and Material Commodities in the United States. Data Series 140.

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

### Other

National Slag Association.

Portland Cement Association.

Slag Cement Association.

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

(Million metric tons and million dollars)

| | 2017 | | | | | 2018 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Blast furnace slag[2] | | | Steel | Total iron | Blast furnace slag[2] | | | Steel | Total iron |
| | Air-cooled | Granulated | Total | furnace slag | and steel slag | Air-cooled | Granulated | Total | furnace slag | and steel slag |
| Quantity | 5.4 r | 3.1 | 8.5 r | 7.7 | 16.2 r | 5.2 | 3.4 | 8.6 | 8.2 | 16.8 |
| Value | 45 r | 306 | 352 r | 47 r | 399 r | 46 | 345 | 392 | 52 | 444 |

rRevised.

[1]Table includes data available through March 31, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Excludes expanded (pelletized) slag to protect company proprietary data. The quantities are very small (about 0.1 unit or less).

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

(Dollars per metric ton)

| Slag type | 2017 | | 2018 | |
|---|---|---|---|---|
| | Range | Average | Range | Average |
| Blast furnace slag: | | | | |
| Air-cooled | 3.31–24.20 r | 8.42 r | 3.46–24.80 | 8.89 |
| Granulated[2] | 82.03–113.67 r | 98.84 r | 75.79–115.74 | 102.14 |
| Steel furnace slag | 0.62–22.96 r | 6.12 r | 1.10–22.57 | 6.33 |

rRevised.

[1]Table includes data available through March 31, 2020. Data, although unrounded, contain a large component of estimates, and some respondents provided 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.

[2]Values are for material reported for use as a cementitious additive in cement or concrete manufacture.

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

(Percentage of total tons sold)

| Use | 2017 | | | 2018 | | |
|---|---|---|---|---|---|---|
| | Blast furnace slag[2] | | Steel furnace slag | Blast furnace slag[2] | | Steel furnace slag |
| | Air-cooled | Granulated | | Air-cooled | Granulated | |
| Ready-mixed concrete | 21.0 r | -- | -- | 18.6 | -- | -- |
| Concrete products | 1.7 | -- | 0.4 | 1.1 | -- | -- |
| Asphaltic concrete | 13.2 | -- | 14.9 r | 13.4 | -- | 12.3 |
| Road bases and surfaces | 48.4 r | -- | 42.2 r | 51.1 | -- | 44.5 |
| Fill | 3.5 | -- | 14.8 | 2.0 | -- | 13.7 |
| Cementitious material | -- | 99.8 | -- | -- | 99.8 | -- |
| Clinker raw material | -- | -- | 2.4 | -- | -- | 3.1 |
| Miscellaneous[3] | 8.8 r | 0.2 | 4.8 r | 8.5 | 0.2 | 5.9 |
| Other or unspecified[4] | 3.4 r | -- | 20.5 r | 5.3 | -- | 20.5 |

rRevised. -- Zero.

[1]Table includes data available through March 31, 2020. A number of respondents provided 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; precision is probably no more than two significant digits.

[2]Excludes expanded or pelletized slag; this material is generally sold as a lightweight aggregate.

[3]Used for railroad ballast, roofing, mineral wool, or as a soil conditioner.

[4]Including returns to furnaces (likely underreported) and other uses.

TABLE 4
PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2018

| Slag-processing company | Plant location | Steel company serviced[1, 2] | Slag and furnace types[3] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Blast furnace slag | | | Steel furnace slag | | |
| | | | AC | GG | Exp | BOF | OHF | EAF |
| Alexander Mill Services Inc. | Hollsopple, PA | North American Höganäs, Inc. | | | | | | X |
| Argos USA Corp. | Tampa, FL | Foreign | | X | | | | |
| Ash Grove Cement Co. | Portland, OR | do. | | X | | | | |
| Barfield Enterprises, Inc. | LaPlace, LA | Bayou Steel Group | | | | | | X |
| BDM Warren Recycling LLC | Warren, OH | Slag pile (former RG Steel LLC) | X | | | X | | |
| Beaver Valley Slag, Inc. | Aliquippa, PA | Old slag pile site | X | | | X | X | |
| Beelman Truck Co. | Granite City, IL[4] | United States Steel Corp. | X | | | | | |
| Beemsterboer Slag Corp. | East Chicago, IN | ArcelorMittal USA ("East side") | X | | | | | |
| Do. | Gary, IN | United States Steel Corp. | X | | | X | | |
| Blackheart Slag, LLC | Muscatine (Montpelier), IA | SSAB Americas | | | | | | X |
| CEMEX, Inc. | Miami, FL | Foreign | | X | | | | |
| City Slag LLC | Sharon (Hermitage), PA | Old slag pile site | | | | | X | |
| Commercial Metals Co. | Jacksonville, FL | CMC Steel Florida | | | | | | X |
| Diproinduca (USA) Ltd. | Sparrows Point, MD | Slag pile (former RG Steel LLC) | | | | X | | |
| Dragon Products Co., Inc. | Thomaston, ME | Domestic and foreign | | X | | | | |
| Edw. C. Levy Co. | Butler, IN | Steel Dynamics, Inc. | | | | | | X |
| Do. | Columbia City, IN | do. | | | | | | X |
| Do. | Crawfordsville, IN | Nucor Corp. | | | | | | X |
| Do. | Detroit (Dearborn), MI | AK Steel Corp. | X | | | X | | |
| Do. | Detroit (Ecorse), MI | United States Steel Corp. | X | | | X | | |
| Do. | Columbus, MS | Steel Dynamics, Inc. | | | | | | X |
| Do. | Canton, OH | The Timken Co. | | | | | | X |
| Do. | Delta, OH | North Star BlueScope Steel Ltd. | | | | | | X |
| Do. | Huger, SC | Nucor Corp. | | | | | | X |
| Do. | Memphis, TN | do. | | | | | | X |
| Do. | Seattle, WA | do. | | | | | | X |
| Fritz Enterprises, Inc. | Fairfield, AL | United States Steel Corp. | X | | | X | | |
| Harsco Metals & Minerals | Blytheville (Armorel), AR | Nucor-Yamato Steel Co. | | | | | | X |
| Do. | Newport, AR | Arkansas Steel Associates, LLC | | | | | | X |
| Do. | Pueblo, CO | Evraz Inc. NA | | | | | | X |
| Do. | Wilton (Muscatine), IA | SSAB Americas | | | | | | X |
| Do. | Pittsboro, IN | Steel Dynamics, Inc. | | | | | | X |
| Do. | Ahoskie (Cofield), NC | Nucor Corp. | | | | | | X |
| Do. | Brackenridge, PA | Allegheny Technologies Inc. (ATI) | | | | | | X |
| Do. | Butler, PA | AK Steel Corp. | | | | | | X |
| Do. | Koppel, PA | TMK IPSCO | | | | | | X |
| Do. | Latrobe (Natrona Heights), PA | Allegheny Technologies Inc. (ATI) | | | | | | X |
| Do. | Steelton, PA | ArcelorMittal USA | | | | | | X |
| Do. | Midlothian, TX | Gerdau Long Steel North America | | | | | | X |
| Do. | Geneva (Provo), UT | Old slag pile site | X | | | | | |
| LafargeHolcim Ltd. | South Chicago, IL | ArcelorMittal USA | | X | | | | |
| Do. | East Chicago (Indiana Harbor), IN[5] | do. | | X | X | | | |
| Do. | Sparrows Point, MD | Domestic and foreign | | X | | | | |
| Do. | Detroit, MI | do. | | X | | | | |
| Do. | Cleveland (Cuyahoga Co.), OH[4] | ArcelorMittal USA | X | | | | | |
| Do. | Lordstown, OH | Old slag pile site | | | | | X | |
| Do. | West Mifflin (Duquesne), PA | United States Steel Corp. (ET Works) | X | | | | | |
| Do. | Seattle, WA | Foreign | | X | | | | |
| Lehigh Hanson, Inc. | San Francisco, CA | do. | | X | | | | |
| Do. | Cape Canaveral, FL | do. | | X | | | | |
| Do. | Camden, NJ | do. | | X | | | | |
| Do. | Cementon, NY | do. | | X | | | | |
| Do. | Middlebranch, OH | Domestic and foreign | | X | | | | |
| Do. | Evansville, PA | Foreign | | X | | | | |
| LoMc LLC | Mingo Junction, OH | Slag pile (former RG Steel LLC) | X | | | X | | X |
| Mountain Materials, Inc. | Ashland, KY | Old slag pile site | X | | | | | |
| Ozinga Cement, Inc. | Chicago, IL | Foreign | | X | | | | |

See footnotes at end of table.

TABLE 4—Continued
PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2018

| Slag-processing company | Plant location | Steel company serviced[1, 2] | Slag and furnace types[3] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Blast furnace slag | | | Steel furnace slag | | |
| | | | AC | GG | Exp | BOF | OHF | EAF |
| Phoenix Services, LLC | Blytheville, AR | Nucor Corp. | | | | | | X |
| Do. | Rancho Cucamonga, CA | CMC Steel California | | | | | | X |
| Do. | Wilton, IA | Gerdau Long Steel North America | | | | | | X |
| Do. | Riverdale, IL | ArcelorMittal USA | | | | X | | |
| Do. | Burns Harbor, IN | do. | X | | | X | | |
| Do. | Indiana Harbor, East Chicago, IN | ArcelorMittal USA (“E” and “W” sides) | X | | | X | | |
| Do. | Ghent, KY | Nucor Corp. | | | | | | X |
| Do. | do. | North American Stainless | | | | | | X |
| Do. | Cool Springs/Steubenville, OH | Old slag pile site | | | | X | | |
| Do. | Marion, OH | Nucor Corp. | | | | | | X |
| Do. | Johnstown, PA | Old slag pile site | X | | | | | |
| Do. | Latrobe, PA | Latrobe Specialty Steel Co. | | | | | | X |
| Do. | Roanoke, VA | Steel Dynamics, Inc. | | | | | | X |
| Do. | Weirton, WV | Old slag pile site | | | | | X | |
| Skyway Cement Co. (Eagle Materials Inc.) | Chicago, IL, and Gary, IN | United States Steel Corp. | | X | | | | |
| St. Marys Cement Inc. | Detroit, MI | Domestic and foreign | | X | | | | |
| Do. | Milwaukee, WI | do. | | X | | | | |
| Stein, Inc. | Decatur (Trinity), AL | Nucor Corp. | | | | | | X |
| Do. | Alton, IL | Alton Steel Inc. | | | | | | X |
| Do. | Granite City, IL[4] | United States Steel Corp. | X | | | X | | |
| Do. | Sterling, IL | Sterling Steel Co., LLC | | | | | | X |
| Do. | Ashland, KY[4] | Old slag pile site | X | | | X | | |
| Do. | Canton, OH | Republic Engineered Products, Inc. | | | | | | X |
| Do. | Cleveland, OH[4] | ArcelorMittal USA | X | | | X | | |
| Do. | Lorain, OH | Republic Engineered Products, Inc. | X | | | X | | X |
| Do. | Mansfield, OH | AK Steel Corp. | | | | | | X |
| Do. | Middletown, OH | do. | X | | | X | | |
| Do. | Durant, OK | CMC Steel Oklahoma | | | | | | X |
| Do. | Coatesville, PA | ArcelorMittal USA | | | | | | X |
| TMS International Corp. (Tube City IMS) | Axis, AL | SSAB North America | | | | | | X |
| Do. | Birmingham, AL | Nucor Corp. | | | | | | X |
| Do. | Calvert, AL | Outokumpu Stainless USA, LLC | | | | | | X |
| Do. | Tuscaloosa, AL | Nucor Corp. | | | | | | X |
| Do. | Fort Smith, AR | Gerdau Special Steel North America | | | | | | X |
| Do. | Osceola, AR | Big River Steel LLC | | | | | | X |
| Do. | Mesa, AZ | CMC Steel Arizona | | | | | | X |
| Do. | Cartersville, GA | Gerdau Long Steel North America | | | | | | 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 | | | | | | X |
| Do. | Jackson, MI | Gerdau Special Steel North America | | | | | | X |
| Do. | Monroe, MI | do. | | | | | | X |
| Do. | St. Paul, MN | do. | | | | | | X |
| Do. | Jackson, MS | Nucor Corp. | | | | | | X |
| Do. | Charlotte, NC | Gerdau Long Steel North America | | | | | | X |
| Do. | Norfolk, NE | Nucor Corp. | | | | | | X |
| Do. | Sayreville, NJ | CMC Steel New Jersey | | | | | | X |
| Do. | Auburn, NY | Nucor Corp. | | | | | | X |
| Do. | Cleveland, OH | Charter Steel | | | | | | X |
| Do. | Youngstown, OH | Vallourec Star, LP | | | | | | X |
| Do. | McMinnville, OR | Cascade Steel Rolling Mills, Inc. | | | | | | X |
| Do. | Braddock, PA | United States Steel Corp. | | | | X | | |
| Do. | Bridgeville, PA | Universal Stainless & Alloy Products, Inc. | | | | | | X |
| Do. | Burnham, PA | Standard Steel, LLC | | | | | | X |
| Do. | New Castle, PA | Ellwood Quality Steels Co. | | | | | | X |
| Do. | Park Hill (Johnstown), PA | Old slag pile site | X | | | | X | |

See footnotes at end of table.

TABLE 4—Continued
PROCESSORS OF IRON AND STEEL SLAG IN THE UNITED STATES IN 2018

| Slag-processing company | Plant location | Steel company serviced[1, 2] | Slag and furnace types[3] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Blast furnace slag | | | Steel furnace slag | | |
| | | | AC | GG | Exp | BOF | OHF | EAF |
| TMS International Corp. (Tube City IMS)—Continued | | | | | | | | |
| Do. | Reading, PA | Carpenter Technology Corp. | | | | | | X |
| Do. | Cayce, SC | CMC Steel South Carolina | | | | | | X |
| Do. | Darlington, SC | Nucor Corp. | | | | | | X |
| Do. | Gallatin, TN | Hoeganaes Corp. | | | | | | X |
| Do. | Jackson, TN | Gerdau Long Steel North America | | | | | | X |
| Do. | Knoxville, TN | CMC Steel Tennessee | | | | | | X |
| Do. | Beaumont, TX | Optimus Steel, LLC | | | | | | X |
| Do. | Jewett, TX | Nucor Corp. | | | | | | X |
| Do. | Lone Star, TX | United States Steel Corp. | | | | | | X |
| Do. | Longview, TX | Nucor Corp. | | | | | | X |
| Do. | Seguin, TX | CMC Steel Texas | | | | | | X |
| Do. | Plymouth, UT | Nucor Corp. | | | | | | X |
| Do. | Petersburg, VA | Gerdau Long Steel North America | | | | | | X |
| Do. | Saukville, WI | Charter Steel | | | | | | X |
| Vinton Steel, LLC | Vinton (El Paso), TX | Vinton Steel, LLC | | | | | | X |

Do., do. Ditto.

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

[2]"Foreign" refers to the fact that the facility imports unground granulated blast furnace slag and grinds it on site to make ground granulated blast furnace slag, commonly referred to as "slag cement." "Domestic" implies grinding of slag sourced from the domestic market, not a service contract.

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

[4]For air-cooled slag, Stein, Inc. was responsible for the cooling, but the processing and marketing were handled by Beelman Truck Co. (Granite City, IL) and Lafarge North America Inc. (Cleveland, OH).

[5]LafargeHolcim Ltd. ground some of the granulated slag from East Chicago, IN, at some of its cement plants located elsewhere.